

CAPT. ECKERSLEY'S QUERY CORNER (See Page 197)

Popular Wireless

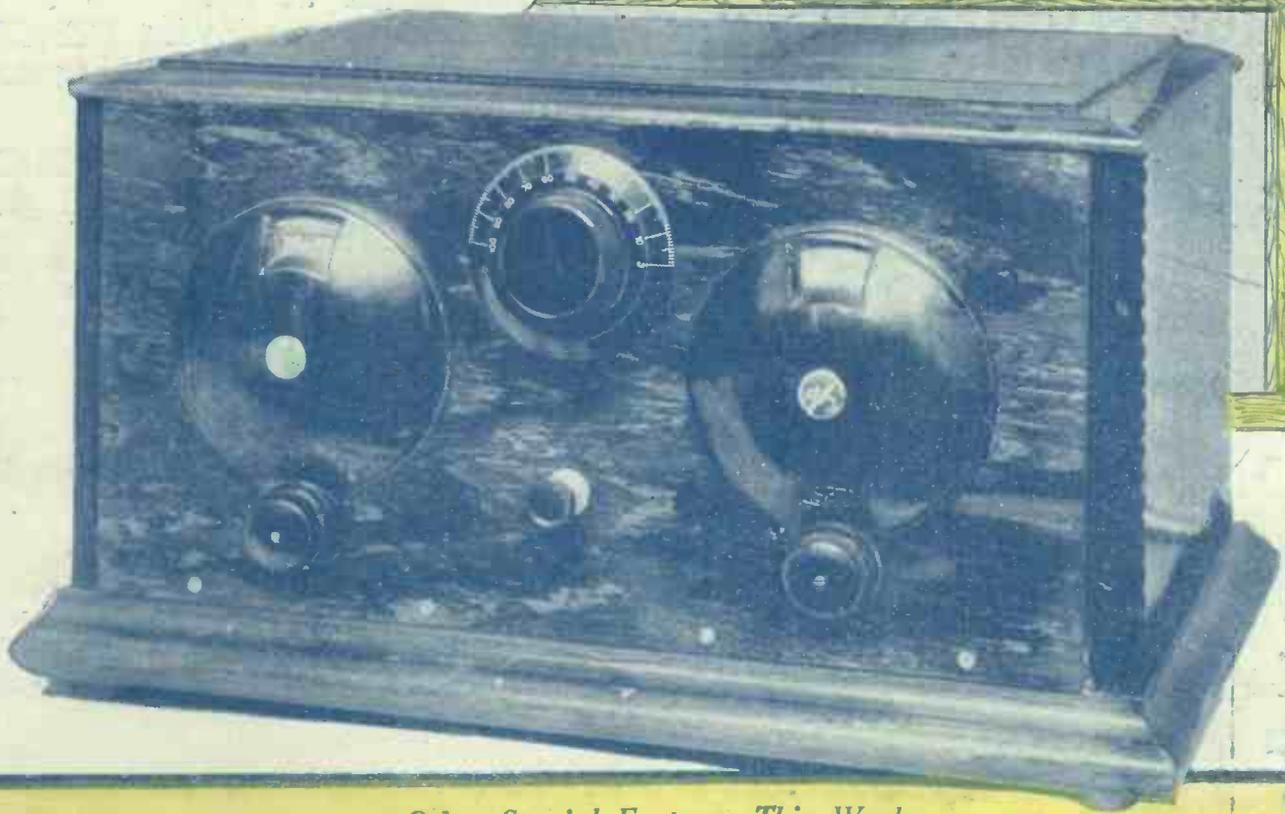
Every Thursday
PRICE
3d.

No. 383. Vol. XVI.

INCORPORATING "WIRELESS"

October 5th, 1929.

"THE VANGUARD" TWO



Other Special Features This Week

IMPROVING LOUD SPEAKERS. SIMPLE POLARITY INDICATORS
A CRITIQUE OF THE EXHIBITION
THREE DIALS. PARASITIC NOISES. JUNK-BOX COMPONENTS

£180 IN £3 NOTES GIVEN AWAY NEXT WEEK

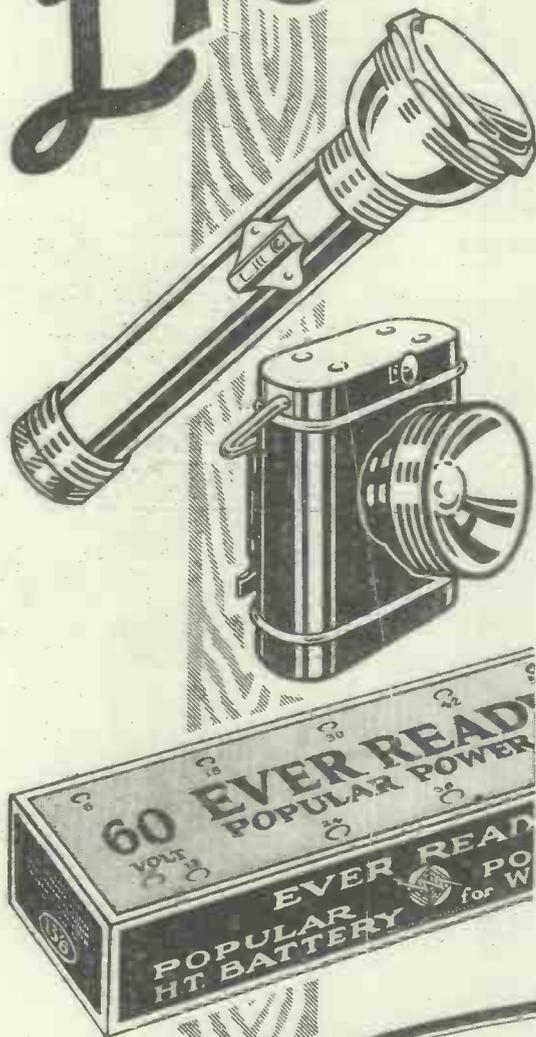
(October 7-12)

to purchasers of EVER READY Lamps and Batteries. The Ever Ready man will visit Hardware, Electrical, Photographic Stores and Garages, etc., where special displays of Ever Ready goods are made.

Brilliant illumination at the touch of a switch is provided by an EVER READY SPOTLIGHT, ready for every emergency in the dark Winter nights.

EVER READY WIRELESS BATTERIES ensure clear, powerful reception, and give the best service at least cost.

Buy an EVER READY Lamp or Battery, you may be one of the lucky ones and receive £3 notes.



PORTABLE SPOTLIGHTS

EVER READY

BRITAIN'S BEST BATTERIES

REGD TRADE MARK

To get a higher gain per stage in your screen grid receiver

Fit this new valve with its special CROSS-MESH screen

STILL longer range, greater clarity—these were the aims of the Marconi engineers in making this new screen grid valve. And already thousands of wireless owners are praising the wonderful results it brings them, the unrivalled efficiency, the faultless reproduction from even very distant stations.

The gain per stage is higher, the control easier, more stable. For the special cross-mesh construction makes a very notable improvement in the screening and lowers the inter-electrode capacity.

To get the very best out of your set fit Marconi screen grid valves—made by the famous engineers who design the great transmitting valves used in most of the chief broadcasting stations of the world.

Types S.215 for 2 volts, S.410 for 4 volts and S.610 for 6 volts cost 22/6 each. Type S Point 8 for A.C. mains operation costs 25/-. Ask any dealer for them. If you do not know of a dealer near you, write to the Marconiphone Company Limited, 210-212 Tottenham Court Road, London, W.1.

SEE THE MARCONIPHONE STANDS AT OLYMPIA, NOS. 79 to 84



SPECIFICATIONS

	S.215	S.410	S.610	S point 8
Filament volts	2.0 max.	4.0 max.	6.0 max.	0.8 max.
Filament current	0.15 amp.	0.1 amp.	0.1 amp.	0.8 amp.
Anode volts	100-150 max.	100-150 max.	150 max.	100-150 max.
Screen grid volts	60-90 max.	60-90 max.	60-90 max.	60-90 max.
*Amplification factor	170	180	210	160
*Impedance	200,000 ohms.	200,000 ohms.	200,000 ohms.	200,000 ohms.
*Normal slope	.85 Ma/v.	.9 Ma/v.	1.05 Ma/v.	0.8 Ma/v.

* At Anode Volts 120, Screen Grid Volts 80, Grid Volts 0 to -1

Longer range, easier control — improve your screen grid receiver by fitting this new valve



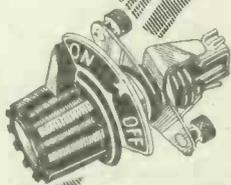
MARCONI Screen Grid VALVES

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-and they've got all the quality and finish you expect from a Benjamin product



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An attractive alternative to the usual Push and Pull type of Switch. All insulated, with indicating "On" and "Off" dial, pointer knob, double contact and suitable for use with panels up to $\frac{3}{8}$ in. thickness. Price each

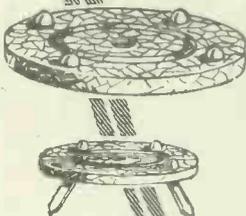
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5-PIN VALVEHOLDER

Designed for use with the new 5-pin A.C. valve with centre leg. The well-known Benjamin anti-microphonic feature is incorporated, and also patented contact, which ensures perfect contact when using either solid pin or split pin valves. Price each

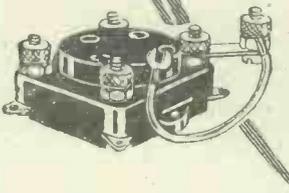
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TURNTABLE

Ball bearing Turntable, 9 in. in diameter, brown crystalline finish. Fitted with hinged and folding legs which enables the set to be used on uneven ground, while maintaining perfect level. For indoor use, the legs can be folded up, being equipped underneath with rubber buffers, to prevent damage to furniture, etc. Price each

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The famous Benjamin Clearer-Tone Valveholder equipped with small attachment enabling same to be used with the Pentode valve. Flexible connection is provided for attaching to the terminal on the cap of the Pentode valve. Price each
Pentode attachment only for use with existing Clearer-Tone Valveholders or Vibroliders, 3d. each.

2/3

**AND HERE ARE 3
TRIED AND TESTED FAVOURITES**

★ The original CLEARER-TONE VALVEHOLDER in face of considerable low price competition has more than held its own, and will be continued at 2s. each list.

★ The BENJAMIN VIBROLIDER was last season's most successful accessory, the self-aligning feature ensuring positive contact with all types of English 4-pin valves. Price 1/6d. each.

★ The popular Push and Pull double-contact Battery Switch. It's off when it's in. Price, with terminals 1/3d. each, without terminals 1s. each.

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LEWCOS Centre Tapped Coil

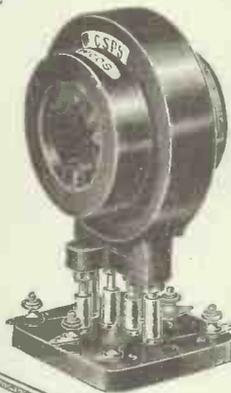
C.T. 25-75 3/6
C.T. 100-300 4/6



LEWCOS "X"
Coil

"X" 60-75 4/9
"X" 200-300 6/6

LEWCOS
Super Coil
(Patent No.
285,723)



between Transmitter & Super Reception

LEWCOS Components give Super Reception because of the Superior Materials and Workmanship used in their manufacture.

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Descriptive leaflets of the Centre Tapped "X" Coil and Super Coil will be sent on application.

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First Full Description in Next Week's "P.W."
with

1/- Full-Size Blue Print Free

This is THE Set of the Year

Do you want the Whole Wide World at your fireside?—Power and Purity,—Standard Components,—and a Tuning Range of 20 to 2,000 metres.

*Don't fail to get Next Week's
"P.W." and learn all about*

THE "MAGIC" THREE

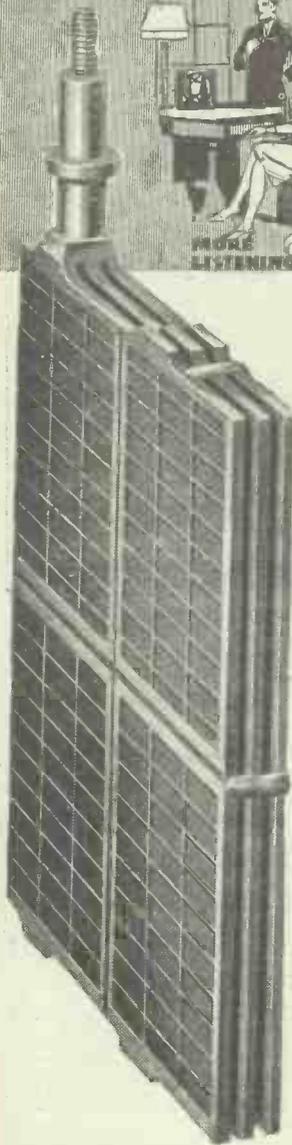
There are Programmes Everywhere—Why not get your Full Share?

The
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3 and
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See
Next
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Price
3d., as
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Cut the cost of working your Set. Use Oldham "Faithful Service" Accumulators. Their Triple Girder-built plates hold their charge for long periods even when not in use. And because of their massive construction they will not buckle. They give you more L.T. for the same money.

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They give more listening from every recharge. You save money. The Special Activation Process under which all Oldham Plates are made endows them with exceptionally long life. Sulphation is practically eliminated.

No other Accumulator possesses such wonderful advantages as the Oldham—Triple "Girder-built" plates—free all-metal carrier—seamless clear-glass non-leak container. Ask your dealer to show you an Oldham to-day.

O.V.D.
2-volt 10 amp.
hrs. (actual)

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2-volt 20 amp. hrs. (actual),
specially recommended for
the Cassor Melody Maker

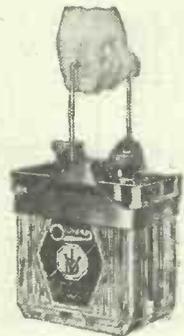
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All fitted with free all-metal carriers.



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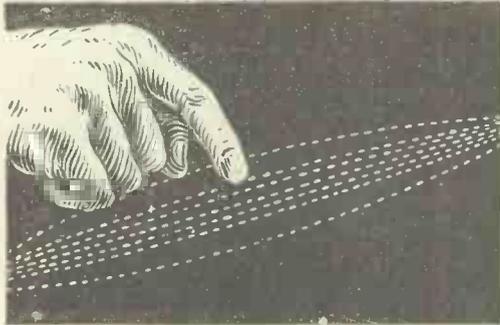


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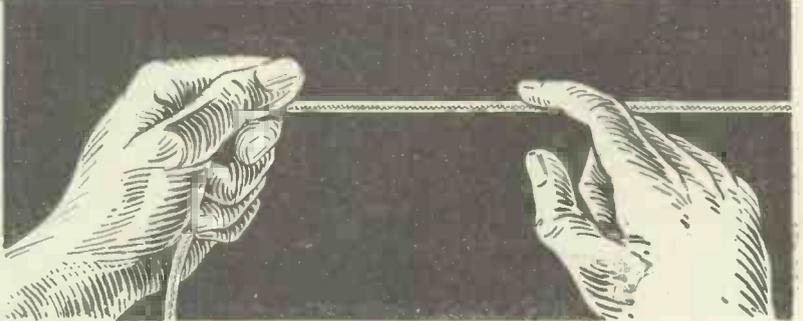
"TWANG" A TAUT WIRE



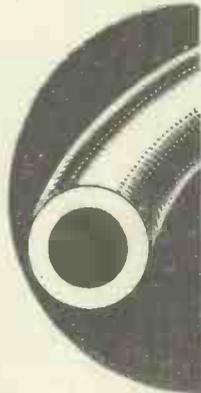
— THEN TRY TO
"TWANG" A RUBBER
COVERED CABLE

— YOU CAN'T!

MICROPHONIC
NOISES ARE
LARGELY DUE
TO FILAMENT
VIBRATION



On the right you see how the new Cossor filament would appear if viewed through a powerful microscope. Note the tungsten core and the thick coating which definitely damps out vibration. This wonderful new filament is tougher than steel yet as pliable as whipcord.



NEW COSSOR FILAMENT CAN'T VIBRATE——ITS COATING IS TOO THICK

Because of their wonderful tungsten core filament and their rigid construction, the NEW Cossor Valves are definitely non-microphonic—they give you 100% pure music. And because this new Cossor filament has a 28% greater emission the NEW Cossor Valves give greater volume, longer range and sweeter tone. No other filament has such enormous emission. Put new life into your Receiver—use the NEW Cossor—they make old Sets like new—they improve even the most up-to-date Receivers. Your dealer sells them.

NO NOISE
100% PURE
MUSIC WITH
THE NEW
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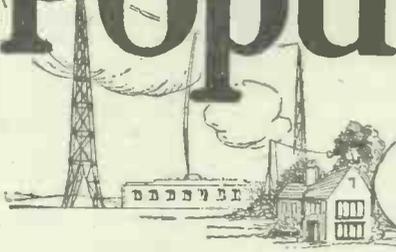
The NEW Cossor is available in a complete range of types, including, Screened Grid, H.F., Detector, L.F., R.C., Power, Super Power and Pentodes. Your Wireless dealer stocks them.



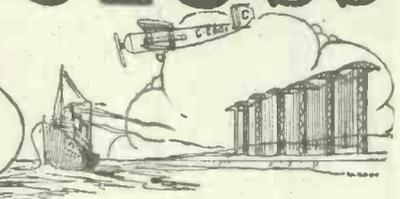
The NEW COSSOR

DEFINITELY NON-MICROPHONIC

Popular Wireless



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**MORE MAGIC.
 ON THE AIR.
 ICELAND'S STATION.
 JOURNEY'S END.**

RADIO NOTES & NEWS

**"P.W." AND "P.P."
 A FRIENDLY TIP,
 TOO MUCH OXFORD,
 WATCH YOUR ZEPP.**

More "Magic."

FOLLOWING on my sleuth-like tactics of last week, by dint of much careful keyhole listening and spying, I have learnt some more about this MAGIC business. It is absolutely the last word in three-valvers. I heard it being tested—without anyone knowing I was about—and the Research Department people were obviously delighted with the results.

Remarkable Results.

MANY stations were tuned in without any difficulty, while the selectivity appeared to be all that could be desired. Afterwards I told Mr. Kendall I had overheard the test, and, instead of rating me in his usual manner, he was so pleased at the results that he invited me to come and see the set.

Absolutely It!

SO I was admitted into the inner fastnesses of the research laboratory, and there, among a mass of meters and a galaxy of gadgets, I saw— Well, you wait till you see the photos and description next week. I think you will agree with me that the "Magic" Three is the last word. It is IT!

"On the Air."

THIS phrase, which I never thought very apt, certainly might be applied to the conversation which Mr. H. Bushmeyer held on August 12th at Roosevelt Field, New York. This plucky man jumped from an airplane 12,000 feet up and as he sailed down in his parachute, he talked by means of a short-wave set weighing 20 pounds with a station on the ground. It took him nine minutes to get down, talking all the time except from the moment when, 3,000 feet up, his legs became tangled in his aerial and broke it. This chap would not get much of a thrill out of a "Big Ben" re-broadcast!

The Radio Show.

I DON'T know how you found it at Olympia, but every time I turned into the Radio Show this year it fairly boomed. The booths for the demonstration of loud speakers were chock-a-block, and no wonder, for they were in effect twenty-five little theatres where twelve-hour programmes were given simultaneously. There were over 300 stands and the arrangements for dealing with the crowds were much improved.

Despite its difficulties, the radio trade appears to be a live and vigorous plant, good luck to it.

Yet Another Station.

ICELAND intends to broadcast its own "depressions." In order to celebrate the 999th anniversary of its discovery 1,000 years ago, it has ordered Marconi's to build a 15 kw. (in aerial) broadcasting station at Reykjavik. I understand that its wave-length will be about 1,200 metres, and that it will be used for telegraphic transmission as well as broadcasting.

Honegger Versus Beethoven.

AN American pianist, Madame Sonya Michell, says that the world is "fed up" with Beethoven's music, which ought to be neglected for at least two years. As I read this report I felt

"Journey's End."

AN opportunity to hear a broadcast version of that world-famous British war play, "Journey's End," by Mr. R. C. Sherriff, will be available to listeners on the evening of Armistice Day. It will be broadcast from 2 L O, 5 X X, and other stations, including 5 S W. Competent critics in America, whilst admitting the excellence of this work, have complained of its sentimentality, notably in regard to the man who talks about birds and flowers. Englishmen are sentimental—and a good thing, too, in proper proportion.

"P.W." and "P.P."

WHAT about it, eh? Did you see that Capt. Eckersley has joined us? You did! And was your reaction to that red or blue? It was purple! I knew it.

GOING ON THE AIR!



A real radio thrill was provided by this intrepid parachutist, who had a portable transmitter strapped to his body, and described to listeners his sensations during a 12,000-ft. plunge through space. In America, of course!

convinced that the lady is one of those who profess to enjoy Stravinsky, Honegger, etc., and, sure enough, she enjoys Honegger's "Pacific 231," one of the most hideous rows I have ever heard. Beethoven is, in parts, difficult to a middlebrow, but never flagrantly ridiculous or ugly. This cult of the discordant medley of sounds is simply "pose"; in my young days young men used to rave about Walt Whitman's "Poetry." Same sort of affectation!

Well, you can take it from me that this appointment is of considerable importance—to us and to you.

The B.B.C.'s ex-Chief Engineer is without doubt the best-known technical man in the broadcasting industry throughout the world, and his acceptance of the position of Radio Consultant-in-Chief to "P.W." shows what he, as critic and engineer, thinks of us. I doubt whether we shall

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

be able to cope with the demand for copies, but we'll try, even if it means working on Derby Day and between meals.

"These Furriners."

I HOPE that you have been amused from time to time with the little anecdotes about the adventures of our young helper in the domestic department at home with the small set I installed in the kitchen. Here is the latest. "Well, Jane," I said, "how goes the radio?" She replied: "I like some of the music when it isn't Queen's 'All, but there's a foreign chap comes on and gives French lessons, and I can't understand a word of it. Don't see why they can't teach it in English."

For DX Enthusiasts.

I EXPECT that the sit-up-late and get-up-early brigade are now beginning to feel that the pursuit of the nimble short wave makes a rigorous demand on their powers of endurance—of cold. So if it is any use to them, I present them with the knowledge that to keep the feet and legs warm there is nothing like newspaper. Years ago, when I was studying in "digs," too hard up for a fire, I used to swathe my legs in a well-known "daily," and kept as warm as toast. "The Times" was good, but I fancy that I got more calories out of the "Daily Telegraph."

Queries Without Answers.

A. W. M. (Middlesbro') asks what stations are "Grinco" and "Fie-fly." He has heard one calling t'other on 77 metres, telephony. Can't find them anywhere, friend. Do Woolworths run any stations? Then A. W. M. asks whether I will contribute to the series "My Radio Career." In the words of Grossmith's song, "They'll never believe me"! It's much too wonderful to print, the film rights alone being worth-censoring.

"Moose Jaw."

THE reference to Moose Jaw in "Short-Wave Notes" for September 14th brings yet another letter from A. W. M., who says that Moose Jaw is on 499.7 metres, and Winnipeg, C J R X, on 25.6 metres, the last-mentioned relaying Fleming, C J R W (499.7 metres). Our valued correspondent has received C J R M (Moose Jaw) more than once, and has shown us a letter of confirmation. Hefty work, lad. Have you heard 3 Z C, New Zealand?

News from Siam.

A LETTER from Phra Aram, of the Siamese Post and Telegraph Department, states that there is a station at Bangkok, 20 kw., 16.9 metres, call-sign H S P, which normally works telegraph traffic with Europe, but is sometimes used for telephony. The same station is used also as an experimental broadcaster, call-sign H S 1 P J; hours of broadcasting, every Sunday, 12.30 to 14.30, G.M.T. Mostly Siamese music.

There is another small experimental station, H S 4 P J, wave-length 37 metres, power 200 watts, transmitting on Tuesdays, 12.30 to 14.30 and 18.00 to 20.00 G.M.T., and on Fridays, 12.30 to 14.30 G.M.T.

A Friendly Tip.

PREPARATORY to the winter's work in your radio den you may be looking round for a job somewhat more ambitious in size than you have attempted hitherto, something to "bite on." Very good! In this month's "Wireless Constructor" you will find an unusually interesting article by Mr. P. W. Harris, describing the "Push-Pull" Five.

This receiver is a scientific job, carefully designed in every detail, at the cost of much preliminary laboratory work. Mr. Harris' articles are always good reading; he does not merely catalogue parts, he reasons with you like a father, and tells you "Why." I recommend you to look into this matter and judge whether or not I am right.

The Unofficial Nightingale.

THAT story of how P C J's announcer heard a nightingale squawking and promptly chased the thing with his microphone till he succeeded in broadcasting the row to all the unfortunate short-wavites is very interesting, but I

SHORT WAVES.

"Television to start from 2 L O." B.B. See?—"Star."

"The matrimonial affairs of an artist whose broadcasts are features of B.B.C. programmes, are to come before the courts," we read in "Reynolds' News."

Apparently the poor man hasn't yet found the right loud speaker.

A movement has been started, we understand, to revive the art of conversation. It is rumoured that the B.B.C. will be hearty supporters.

The failure to broadcast Mr. Arthur Henderson from Geneva, recently, came as a disappointment to many hundreds of listeners. We understand that the ultra-Red rays are suspected.

THE BOOKSHELF UP TO DATE.

Lydia: "I've often thought how romantic it would be to be cast away on a desert island."

Nydia: "What ten-valve set would you take with you?"—"Radio News."

We spend the evening jiggling
Upon our parlour floor;
We make much noise, you'd think that those
Below us would get sore.
But folks who live beneath us,
They can't get peeved, you know;
Because we get our music from
Their darned old radio!
"New York Times."

hope that it will not induce other announcers to break official programmes in order to broadcast odd "noises off" which may seem attractive to them.

We might get: "You will now hear the janitor snoring," or "Stand by for the charlady having a few words with the oboeist about her asthma."

My Sentiments.

AS I have so often railed at the B.B.C. about its education craze, I am warmed to find that so respected a periodical as the old-established "Electrician" is doing the same thing. Its contributor, "Horax," says that the B.B.C.'s highbrow policy is killing radio in this country.

"There is far too much desire to teach and to teach obviously. There is far too little of the popular mind in the direction of the B.B.C. Quasi-Governmental it may

be; but it cannot remain on Olympus and yet try to maintain hourly contact with its mass of subscribers."

Too Much "Oxford."

TOO much Oxford and too little Oxford Street! That is what is wrong at Savoy Hill. It may be fine to use public money to uplift the public—to hoist us up by our own suspenders, so to speak—but it is not cricket or even business, and until those responsible get their ears to the ground and hear the rumbling of the coming storm, there will be sorrow in the home of the "ordinary listener" and in the ranks of the radio trade. There is but one rule for those who serve the public—"Deliver the goods which are required."

And What of Canada?

A PART from interference by trolley lines, the Canadian listener has always seemed to me to be well nursed. What does he need that he does not get, and why has the Royal Commission recommended that broadcasting there should be nationalised? More "education" appears to be in store for the Canucks, judging from the Commission's report; I don't say they do not need it, but I'll bet they won't stand for it, especially as there is a large French-speaking public there. We shall watch events with mingled interest and sympathy.

"Watch Your Zepp!"

WHILST many readers had the pleasure of picking up the broadcast account of the landing of the Zeppelin in America, we have not heard much about the airship's own wireless. An Ilford reader (initials like a gridiron) tells me that he heard her wireless throughout practically the whole of her voyage round the globe. She transmitted on "tonic train." His achievement, which is really fine work, is a good example of the advantage to be derived from learning to read Morse.

The "Aberdare" Five.

E. J. (Aberdare) announces that he is sixteen years old and then discloses that since 1927 he has made no less than five models, each being apparently greedier than its predecessor. (All except the first.—Ed. "P.W.") Quate! As a result he has logged quite a pretty sprinkling of stations including 7 L O and 2 F C. I shake hands and trust that his voice is breaking nicely, but as to a Valve Bartship—sorry, Eric! Stick to it and tell us something really thrilling and then we'll put your name forward.

Is Electricity Doomed?

IT is reported that two New Zealand men have discovered a new force which is said to be ten times more powerful than electricity, whatever that may mean. The name given to this force is "Chromadyne," which suggests to me that the report may be "coloured"—by imagination. But this is a mere side issue; the force was found, it is said, during work which has led to a process by which certain elements can be changed into gold. That's more like the real stuff! Give me a gold brick every time! Still—think twice before buying your new accumulator. You may need a Chromadynamo soon!

ARIEL.



A CRITIQUE OF THE EXHIBITION

Here is a comprehensive survey of the show, written immediately after a visit to Olympia.

By OUR SPECIAL REPRESENTATIVE.

I TRAVELLED to Olympia on a 'bus. "Do you go to the Radio Exhibition?" I asked the conductor. "Every year, regular," he replied, with a grin. And the show virus had spread even to the 'bus-driver, for all the way he shouted badinage at pedestrians and policemen.

Of course, an exhibition, and particularly an exhibition of such a scientific nature as one devoted to radio, should be an extremely staid and dignified thing. And so it is—underneath a few thick layers of cheeriness. Show time for the radio world is a modern version of an old English bazaar-fair, except that there is no direct buying and selling.

And it is just that absence of money transactions that makes the whole business so free and easy. Visitors do not mind examining the gear closely and asking questions and engaging in friendly discussions with obliging demonstrators when they know that they are not expected to hand out cash or, alternately, be glared away as non-customers.

Blue and Gold.

Our 'bus stopped right outside Olympia with an "All change for the Radio Rodeo!" from the exuberant driver. Early in the evening though it was, a steady stream of people was squeezing through the barriers. A trifle of pushing from all sides, and then the Great Exhibition burst into view. My first impressions were of a mass of blue and gold flung everywhere above a teeming crowd. Coloured lights were splashed over the whole, and music of the clearest possible kind seemed to be coming from a huge band distributed over the entire building.

It was not for some minutes that one of the secrets of the show was revealed to me. The reason why the music was so well filling the hall was because loud speakers on dozens of stands were in operation. They were operated from a central amplifier, and, for the first time, visitors had the opportunity of hearing as well as seeing the various instruments at work.

A Wonderful Display.

It is said that there were three miles of stands crammed with over five million pounds' worth of gear. One can well believe it after having been there, for never has there been a radio show like it before. I well remember the first wireless exhibition held in this country. It was remarkably successful, but what a contrast! That first radio show was an assembly of scientific instruments arranged in a rather drab and quite small hall. This year's Exhibition was a mighty display of really artistic broadcasting furniture.

Vast credit is due to the people who planned and executed the Exhibition, for the whole structure of the massed display was wonderful. Blue and gold, blue and gold everywhere, with sufficient individuality in the stall fixtures to make every part, every corner, worth looking at for its colourfulness alone. In the centre an illuminated fountain played, and high above in the gallery was another burst of blue and gold.

Attracting Attention!

A great stairway has been erected in the centre of the hall, and by this one can leisurely reach the gallery via wide, easy steps without having to search out the old, cold, and ugly stone stairs.

How one can describe three hours of thoroughly enjoyable stand-to-stand pilgrimage I do not know. With all the pages of a whole issue of "P.W." at one's disposal it might be possible!

However, if it be the desire of an exhibitor to catch a visitor's eye, and I suppose this is very much the case, the Mullard people were very successful with me on at least two counts. Right before the main entrance I noticed the figures of a couple of old gentlemen sitting on pedestals reading papers.



An artistic and practical design of a Radio-Gramophone set which was shown by the Peto-Scott people. Note the record compartments.

I examined one closely. He was gently moving his hands, and every now and then he nodded his head. It was a nice problem as to whether or not these very similar-looking old chaps were clever effigies. I pinched the legs of one of them, and he said something very vulgar. The problem was solved. Later, I found some more old chaps sitting on pedestals reading papers. One or more may have been automatons, but I did not pursue my researches.

Mullards again had a bevy of beautiful young women (I heard it whispered that they were film people from Elstree), and somehow or other one was always catching sight of them. Perhaps it was that their astoundingly short skirts made them somewhat conspicuous!

Of course, I possessed myself of a brightly coloured catalogue-carrying bag from the Cossor stand. Everybody seemed to have one of these useful articles. I believe another firm was giving away similar things this year, but they hadn't got the striking Cossor colour to make them prominent.

A Popular Exhibit.

By the way, some indication of the tremendous popularity of the "Cossor Melody Maker" was given by the huge crowds that swayed backwards and forwards around the Cossor stand that was entirely devoted to the new version of this famous outfit. Similar congestion was noticeable around the other Cossor displays where, among other things, the New Process Valves were on view.

Not so far away young ladies in vividly-coloured, glitteringly-spangled dresses graced the large Marconiphone stands. Are such items, attractive though they be, out of place at a radio exhibition? That, of course, is a matter of opinion and, perhaps, of age; but, be it mentioned, there was some first-class radio gear in the Marconiphone display, and this by itself justified the crowds of admiring visitors.

The Largest Loud Speaker.

There was, for instance, a beautiful five-valver in a walnut cabinet that would have made a millionaire's mouth water and no doubt lightened his large purse by a modest trifle.

I have said that exhibitors were allowed to demonstrate their loud speakers at their stands by means of one official tune, as it were. The largest loud speaker I saw and heard in action was an Ultra Air-Chrome, with a diaphragm measuring some six by nine feet. This colossus threw out the

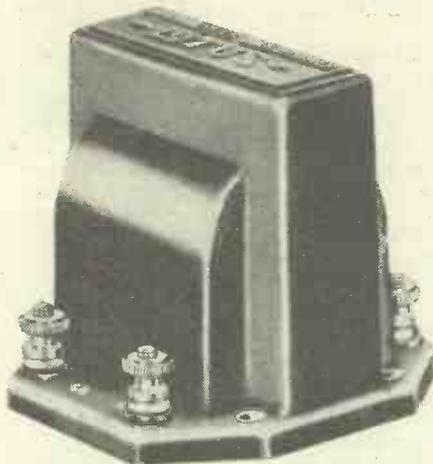
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A CRITIQUE OF THE EXHIBITION

(Continued from previous page.)

music in a remarkably effective way and occasioned a great deal of surprise. It proved that the Air-Chrome principle is scientific and confounded the critics.

One of the most restful stand arrangements was the one due to the Igranic people. They had some artistically coloured globe-lamps draped with artificial flowers to set



The Lotus L.F. transformer was a new line that attracted the attention of visitors.

off their fine show of components and complete sets.

The largest set I saw was the M.P.A. Radio-Exchange. A most ambitious instrument this. Worked entirely from the mains, it is a radio-gramophone outfit built into a large, finely finished console-type cabinet. You operate various buttons, and as you press them you directly tune in various stations, and the names of these jump out of the panel in illuminated lettering. No dialing or knob-twisting is necessary with this super-set.

More illumination, but this time of a different character, was in evidence at the Dubilier stands, where a lighted windmill was in action and a terrestrial globe slowly revolved. These devices fulfilled their purpose by drawing visitors, and the Dubilier products shown did their part by holding the attention of the crowd.

An Enthusiastic Managing Director.

Yet another lighting effect of another variety was due to Radio Instruments, at whose stands was a curve in neon tubing of the famous "Hypermu" L.F. transformer. I took the opportunity of having a few words with R.I.'s genial chief, Mr. J. Joseph, who is always in evidence at show times ready for friendly discussions on the subject of his firm's fine products with any visitor who is fortunate enough to button-hole him.

He was most enthusiastic about the Exhibition. "Undoubtedly an excellent show and one that is notable for the general excellence of its exhibits," he said. Then he went on to give me a detailed commentary. (At the conclusion of my visit I found that he had hit the nail on the head with his every point.)

R.I.'s had only one set on show, but there were a dozen samples to prove consistency in production. It was a mains set of quite an unique character and one that is sure to be well in the van this winter. The R.I. display was also notable in that it catered very largely for that important person, the home-constructor.

Clever Pictorial Settings.

The Ediswan display was at once artistic and comprehensive. Facing in the one direction was a clever pictorial setting of a home-constructor's domicile with appropriate fittings, and, in the other, a garden scene ornamented by a summerly (note the spelling!) clad young woman. Further along, one came to a veritable galaxy of gear in the way of B.T.H., Metro-Vick and Ediswan products. A strong combination this and one capable of equipping the most ambitious of listeners, as well as the constructor with the leanest purse, with apparatus for any radio purpose of the highest class.

Three hours was not a minute too long for my survey and I had to keep looking at my watch while I was at the Varley stands, for here was apparatus that I could have spent much more time examining than I could afford. I was particularly fascinated by the pick-up and correcting-carrier, although I have, of course, seen them oft-times before. But the instruments were arranged in a very clever way. Also there were all kinds of new mains components that one simply could not miss.

A Giant Variable.

The J.B. people struck a happy note by displaying a large model of one of their excellent variable condensers. I wished that this was not so far back and that I could twiddle its huge dial and see its great vanes swing backwards and forwards. I expect there were many other radio enthusiasts that had the same longing.

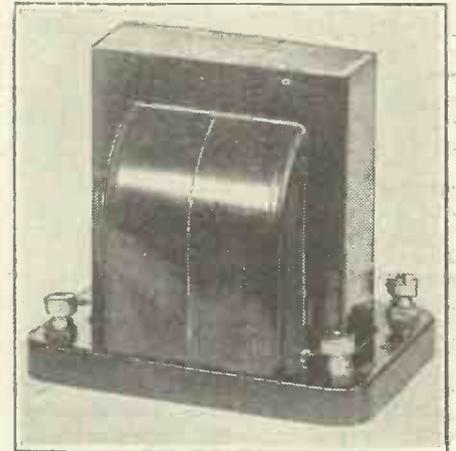
The Ever Ready stand was tucked away at the foot of the great new stairway. An excellent position, and one that must have given these well-known makers of batteries some considerable satisfaction, for every visitor had to pass it. Did I say pass it?



This power transformer figured among much other fine mains unit gear on the R.I. stands.

Then that was a mistake—I should have said that every visitor had to stop at it. Batteries are rather ordinary-looking things, but the Ever Ready people had theirs most artfully spread out, and as Ever Ready batteries are brightly encased I am sure that no visitor could have resisted their mute appeal.

And what a fine show our friends Lissen had. Only three stands they occupied, but they were big stands and so cunningly contrived that they seemed to be yards and yards longer than they really were. Although I knew beforehand that Lissen is now making everything in the way of radio gear from valves to variable condensers and from gramophone pick-ups to complete radio-gramophone sets, I was amazed at



The S. G. Brown L.F. transformer, an excellent example of first-class modern radio component design.

the variety of their show. It was undoubtedly an exhibition in itself. It was a display calculated to stagger foreign visitors. One can imagine an American going back to New York convinced that at last this "li'ole' country" is not only level with the U.S. in regard to its radio industry, but has much that is ahead of anything in the world.

If you have referred to a plan of Olympia whilst reading this critique, you will have gathered that my pilgrimage was no cut-and-dried one, and that I wandered hither and thither quite haphazardly. Of course, this was quite wrong. I should have worked to a very definite plan. But I was enjoying myself too much to do ought else but be pushed first this way and then that by my thousands of fellow-visitors. This was why I did not find myself pressed up against the stands of E. K. Cole earlier in the evening. Luckily, I am tall, otherwise I would have seen little of the excellent mains gear that was attracting so much eager attention.

Excellent Mains Devices.

I also had the pull over the crowd in that I knew every unit and every set with few exceptions and that, moreover, I had actually had the pleasure of using quite a few of the "Safe, Silent and Sound" products. Nevertheless, it was pleasant to browse over them in bulk as it were; if one can be said to browse with someone breathing down one's neck and with elbows and hats in close juxtaposition in every quarter!

The Westinghouse Brake and Saxby Signalling Co., Ltd. (Westinghouse for short!) were like the ether—they percolated

(Continued on next page.)

A CRITIQUE OF THE EXHIBITION.

(Continued from previous page.)

through everything. True, they had stands of their own, but were these necessary? I ask the question in all seriousness, for the famous Westinghouse Metal Rectifiers are used and could be seen in a vast percentage of the mains units and sets shown at Olympia.



Despite the progress of main units, accumulators are still very widely used. The Exide people had a fine show of batteries.

For instance, next door but one to the Westinghouse stands was the display of the Regent Radio Supply Co., which is one of the many firms that employs products of the well-known Westinghouse brand in its fine units. And the Regentone units are good and conform to the best standards of mains apparatus design.

An Enjoyable Tour.

At this juncture I must repeat that I cannot hope to give a complete description of all the exhibits, and, anyway, you have already had this in the previous stand-to-stand reviews. I can only hope to convey my impressions of an enjoyable tour as one of thousands of enthusiastic visitors.

However, I mustn't forget to mention that the Peto Scott Co., Ltd., had an



A really modern note is struck by this Marconi-phone two-valver, which has space for a mains unit in the back of the cabinet.

assembly of all kinds of sets, due to other leading makers as well as themselves, on their stands. The opportunity to see some of the best products of the modern radio industry side by side was eagerly taken by crowds of people.

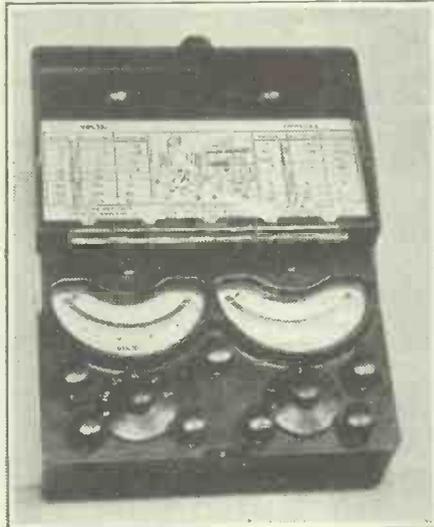
It was interesting to note the fascination cast by the wet H.T. battery over a large number of people. You could almost hear them weighing the pros and cons up in their minds as they stood before the products of the Standard Battery Co. This firm was also showing, for the first time, a three-in-one meter for panel mounting.

A Very Good Name!

The Philips people had a powerful attraction in their new mains sets. And they exploited the idea of "plug-in" to its very greatest advantage.

Mains-operated outfits were again in evidence on the Ferranti stands, where, also, the famous Ferranti L.F. transformers were seen and admired by the swaying crowds.

I remember some time before visiting Olympia mildly criticising in my own mind the name "Stork," as applied by the G.E.C. to their new loud speakers. But I must



This Ferranti test set drew admiration from experimenter visitors.

admit that their exhibition display made the fullest use of its advantages. Indeed, after having tarried awhile in the vicinity of the G.E.C. stands I came to the conclusion that "Stork" is a very good name, and one that is easily remembered! The instruments themselves are attractive devices, both in appearance and in operation.

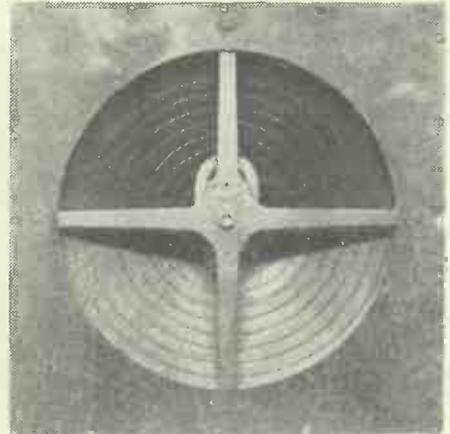
And what of the Burndept display. Briefly, it was one of the largest and most interesting. The seven-valve A.C. set using S.G.'s alone would have warranted exhibition space apart from a whole horde of other sets.

Of course, I did not make the mistake of not searching out the Amplion stands in order to examine the new Amplion radio sets and radio gramophones. Not that these stands wanted much searching out, for they were very excellently placed.

And the same applies to the

Igranic stands, although it so happened that these were among the last I came to on the ground floor. Here I was particularly interested in the new Igranic mains set, which embodies a non-directional frame aerial.

Celestions had a moving-coil loud speaker on show this year as well as all their loud speakers of established reputation. This



Constructors paid close attention to the shell-case Celestion loud speakers.

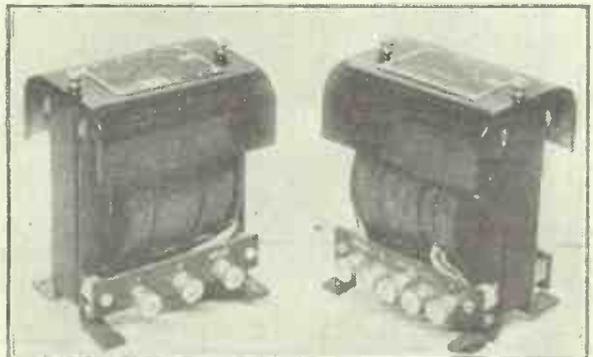
Celestion moving-coil instrument is known as the "Celestrola," and, having heard it in operation, I have no hesitation in saying that it jumps right into the front rank.

I thought the gallery was much more interesting this year than it has been hitherto. Up to quite recent years the gallery has been regarded by many Olympians as the home of the small people. This can no longer be said, for upstairs this year one met such stalwarts as S. G. Brown, Ltd., the B.B.C., the T.C.C. people, Eastick & Sons, Ward & Goldstone, Wright & Weaire, K.N., Eric J. Lever, Paroussi, etc.

The "Big Three."

And The Big Three in radio papers, POPULAR WIRELESS, "Modern Wireless," and "The Wireless Constructor," were to be found next door to the band in the balcony. And the crowd around these stands! I had spent an amusing half an hour on the way to Olympia working out a query that I was going to fire at one of the "P.W." experts. A query that I am sure would have made him scratch his head for a minute or so. But when I saw the mass attacks that were being made by legitimate seekers for advice, I gave up the idea. It would have been wasting valuable time.

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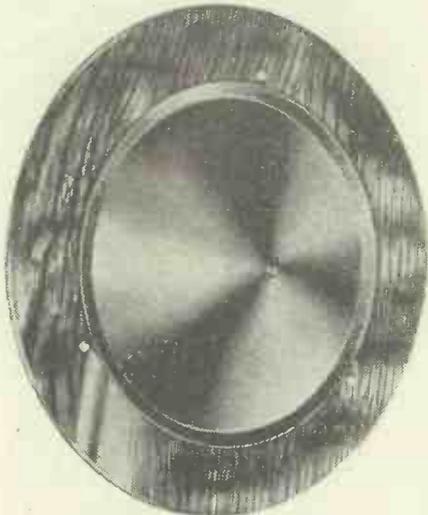


Two representatives of the Varley show—which was an excellent one

A CRITIQUE OF THE EXHIBITION.

(Continued from previous page.)

But the camaraderie and good fellowship! It was simply amazing. Radio was breaking down the Englishman's traditional aloofness all around. On the one side an enthusiastic "Titan" set owner was explain-



The G.E.C. Plaque Cone loud speaker.

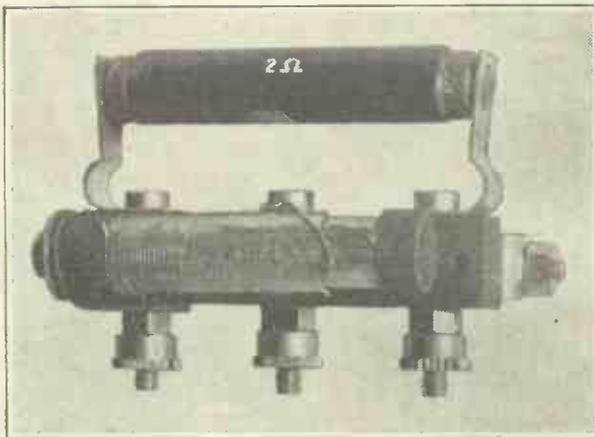
ing points to two or three of his neighbours, while somewhere else I overheard a visitor engaging in an argument as to the merits of some other "P.W." set versus those of yet a further "P.W." production.

The "P.W." sets that were on show were being studied by enthusiastic constructors, the famous "Titan" Three being the centre of most earnest mass scrutiny.

The Demonstration Room.

The importance of the gallery was still further increased by the presence of rows of demonstration rooms. Some of these were most comfortably arranged with expensive carpets and luxurious armchairs. Of course, I spent quite a time in these musical salons, and was most impressed by the general high standard of performance of the various sets.

Several times I have mentioned that I spent about three hours at Olympia on this



One of the vital components of the Osram "Music Magnet," which appeared in an improved form.

particular evening. I would have been there longer had it not so happened that the authorities politely informed me (and the rest of the throng) that it was closing time. However, I can honestly say that I did not miss a single stand, and that far from it being a duty not so to do, I was, even as the clock reached ten, on my second round.

That Olympia was a better show than ever, every newspaper has said already, but I would go further and say that in every respect it was as superior to the last exhibition as the last one was to the first two or three. It seemed to complete the most definite step forward that broadcasting in the home has yet made; that is, the complete change-over from the purely scientific to the quite domestic.

The Trade's Big Mistake.

"That knob to switch on, and that knob to select your programmes," was all that most of the stand attendants had to explain to the lady enquirers—and there were a large number of lady visitors this year.

But I do give it as my considered opinion that the trade is making one very big mistake, at least, that is judging by their exhibits. With very few exceptions they seemed to go all out for the complete set. The home-constructor has plenty of fine outfits to give him guidance in his set selection, but component parts were conspicuous either by their entire absence, or at best by but modest showing on a large proportion of the stands.

The sound design and excellent craftsmanship of the various exhibits were most noticeable, and I did not see anything of a shoddy character. There were one or two curious departures from the path of normal radio engineering practice, but, generally speaking, the industry seems to have eliminated nearly all of its duds.

Mains-operated sets were to be seen everywhere, while battery-operated alternatives were not always available.

Yes, it was a fine, interesting show, and one that gave one an immediate and clear insight into the modern tendencies of the radio industry I am writing of the Show in the past sense,

for it will all be over and done with by the time these words appear in print. Actually, at the time of writing, it has a few more days to run, so that I shall be able to pay another visit. I wouldn't be able to tell you anything more about it after a second or third visit, for I have seen everything that there is to be seen. But when I add that it was the first radio show that I wanted to visit several times, you will gather that it was of exceptional interest.

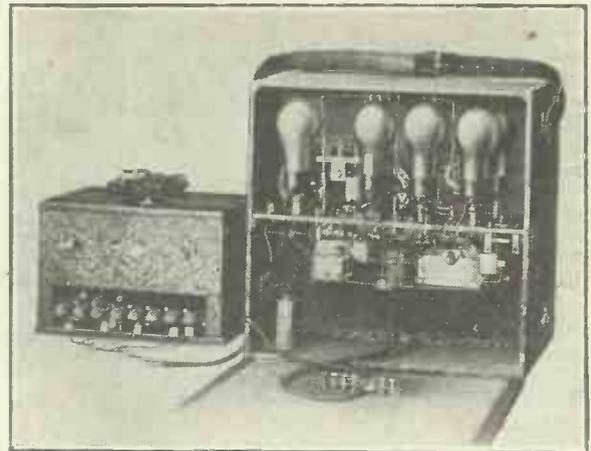
And my advice to "P.W." readers who didn't go is, on no account miss the next Show.



The Igranac Universal Five, with separate battery case underneath.

NOTE BOOK NOTIONS.

Generally speaking, when two different loud speakers are worked from the same set it is best to connect them in series, namely, positive of one to negative of the other, the remaining



An example of the magnificent apparatus shown by Metro-Vick Supplies, Ltd.

two leads going to the appropriate loud-speaker terminals on the set.

* * *

The local station is always capable of giving you good quality broadcasting and if the programme sounds distorted it is probably your own set or that of a neighbour which is responsible.

* * *

Long-distance reception upon simple sets is not so much a question of the circuit employed as of location, the skill of the operator, and of various other local conditions.

* * *

Reaction is indispensable for long-distance listening upon simple sets, but it is not necessary for local reception unless too small a set is being used.

* * *

If your set is fitted with a reaction control, but you are not quite sure how oscillation is produced, write to the B.B.C. for their free booklet entitled "Oscillation."

Capt ECKERSLEY'S QUERY CORNER



Below some varied and representative questions from "P.W." readers are answered in detail by Britain's greatest authority on broadcasting.

good earth and aerial system, try a variable aerial series condenser, which will effectively reduce the "pull" of the aerial on the circuit.

Two Aerial Wires or One?

L. W. B. (Newcastle-on-Tyne).—"I have got a single wire aerial about 80 ft. in length, and 35 ft. high at the far end. It is fixed to a chimney at the other. Should I get much better results by adding another wire?"

No.

Connecting a Volume Control.

L. H. B. (Clacton).—"I have been told that it is best to put a volume control be-

Under the above title, week by week, Capt. P. P. Eckersley, M.I.E.E., late Chief Engineer of the B.B.C., and now our Chief Radio Consultant, will comment upon radio queries submitted by "P.W." readers. But don't address your queries to Capt. Eckersley—a selection of those coming to the Query Department in the ordinary way will be dealt with by him.

tween my gramophone pick-up and the first amplifying valve, and not between this valve and the next, in order to prevent the pick-up from overloading the first valve. Is this a sound argument?"

It is theoretically best so to do, because obviously in the way recommended the valve chain has the least chance of being overloaded. It is practically possible if the amplifier circuits have a large factor of safety to put the volume control in the loud-speaker leads.

This has the advantage that one can put one's feet up on the mantelpiece and an idle hand dangling over the chair edge can delicately fade up or fade down the talk or music according to one's like without taking out more leads from the set than those for the loud speaker. But the volume control must be of special type for this.

Too Much Anode Current.

A. J. P. (Southampton).—"With correct H.T. and G.B. my power valve takes just twice the anode current it should according to the makers' curve. The makers have tested it and pronounced it O.K.

"Reproduction is rather muffled, and I notice that if I put my finger on the grid terminal of this valve the anode current drops to normal. What can be wrong?"

I suggest a low-frequency oscillation of very high frequency (and therefore unheard). There is some low-frequency reaction. Try a larger smoothing condenser, reversing transformer connections, moving positions of transformers, etc. etc.

Interference from an Oscillator.

M. G. (Colchester).—"Is there any method of determining the exact location of a neighbour causing oscillation interference? There are times when my results are absolutely spoiled by very loud oscillation squeals, and during these periods my signals, which normally are very pure, are dreadfully 'woolly' and rough."

Write to the B.B.C., who, with the Post Office, will do everything there is to be done.

Violins Like Flutes.

A. R. (Hanwell).—"Why does my moving-coil speaker make the higher violin notes sound more like flutes? There is little of the true string tone about them."

This is curious, because most moving coils give a very large significance to the higher harmonics and make flutes sound like violins! But they only do this because the paper cones of the diaphragms "break up," i.e. do not move as one with the coil.

If the cone referred to is made in some way that its break up is of a less extent or at a different frequency from that commonly experienced, it might cut off the higher harmonics and, in common with many loud speakers, "make violins sound like flutes." The moving-coil loud speaker is not typical, I feel, of the usual sort of moving-coil speaker I have heard.

P.S.—Is the writer sure that his amplifier or high-frequency circuits are not in themselves cutting off the higher frequencies? This would certainly make violins sound like flutes.

Try using less reaction on H.F. circuits, or using R.C. coupling if transformers are suspect, or—ask anyone knowledgeable about how to get a level input into the loud speaker.

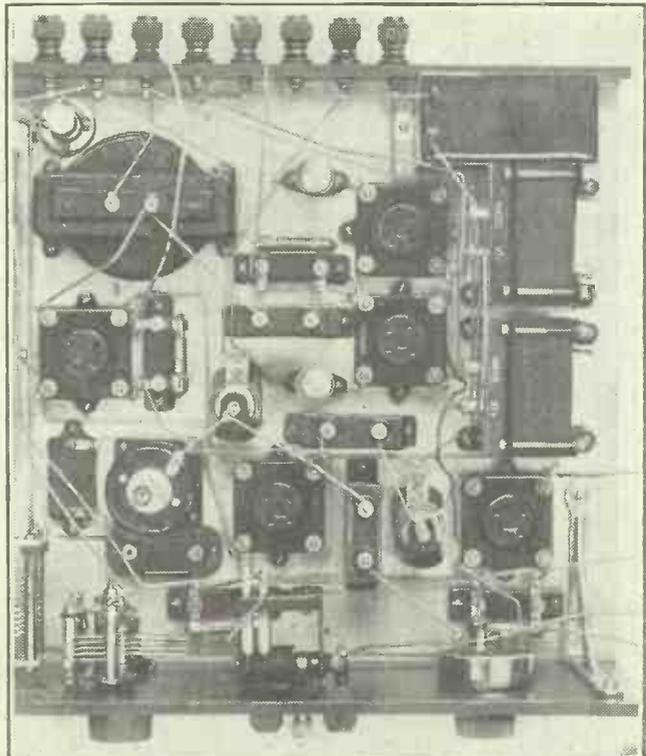
When The Set Grunts.

P. B. (Ipswich).—"I have a two-valve set, detector valve followed by a transformer coupled L.F. stage. When I attempt to make critical adjustments of reaction in order to tune in Continental stations I get a peculiar grunt, immediately after which the set begins to oscillate.

"I thus find that I cannot get the set at its most sensitive point just before oscillation, which I understand is necessary if good distant reception is to be obtained. I have tried a different size reaction coil, and also varying the H.T. voltage on the detector valve, but all to no avail. Can you help me?"

If I can assume that the whole circuit is of a conventional kind I suggest that the aerial circuit is of a rather high resistance, or that the reaction conditions are not ideal as regards values of H.T., grid leak (if used), etc.

As, however, you have tried varying circuit constants, I suggest that the aerial is "heavy." If you have got a reasonably



If you run a gramophone pick-up remember that there are alternative positions for the volume control (see Capt. Eckersley's remarks above).

LATEST BROADCASTING NEWS.

HALLÉ SEASON BEGINS.

RELIGION FROM A COLLIERY
—SOME IMPORTANT TALKS—
"WHILE LONDON SLEEPS"—
A "TALKIE" BURLESQUE, Etc.

LOVERS of good music will be pleased to learn that arrangements have been made to broadcast a number of the famous Hallé Concerts during the forthcoming season. The first will be heard on Thursday evening, October 17th, when the programme, conducted, of course, by Sir Hamilton Harty, and including Mozart's Divertimento No. 17 in D, and Brahms' Symphony No. 3 in F, will be relayed to listeners to 5GB as well as those of Manchester, the home of the Hallé Orchestra, and other stations in the Northern area. Alfred Barker, leader of the orchestra, will be the violin soloist.

Religion From a Colliery.

For nearly a hundred years—the exact period is not known—miners employed at the Mynydd Newydd Colliery, Fforestfach, Swansea, have assembled in the pit close to the underground stables, at 7 a.m. every Monday morning, to take part in a prayer meeting before the work of the week has begun.

The miners and local inhabitants express the firm belief that the comparative absence of fatal accidents in the colliery is due to the prayers of the men, and the service, now so firmly established and uninterrupted, is now historic. To it must be attributed the arrangement of a remarkable service in Welsh which the Cardiff and Swansea stations will relay from the same colliery at Swansea at 7 p.m. on Sunday, October 13th.

Some Important Talks.

Lord d'Abernon is visiting the London studio on Wednesday evening, October 16th, to speak on the Economic Mission to South America which has just concluded a most successful tour.

The talk is under the auspices of the Department of Overseas Trade, and will be of the greatest importance to British manufacturers at a time when our export trade is showing definite signs of a healthy revival.

The morning talk from 2 L O and 5 X X on the following day will be given by Mrs. H. A. L. Fisher, who will discuss "Colds and How to Prevent Them," in the third of her series of four talks on "Parents and Children."

"While London Sleeps."

Those who advocate brighter talks in the broadcast programmes should have no cause for complaint about one which is to be given in the London Studio at 7 p.m. on Tuesday, October 15th, by a Covent Garden porter. The talk is the first of a series of six, already referred to briefly in our columns, entitled "While London Sleeps," which are to be given fortnightly by night workers.

They should, unless the hand of the

B.B.C. censor is too rigorously applied, be extremely interesting. Much goes on in the great London fruit and vegetable market in the early hours of the morning about which most people know very little, and, provided this first talk is well done, we shall all look forward to others in the series, which include descriptions of their jobs by a coffee-stall man and a river policeman.

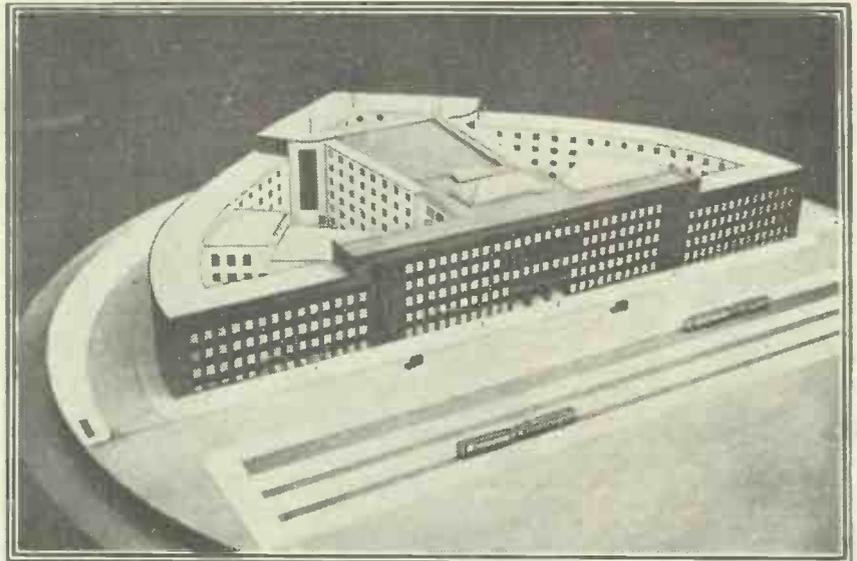
A "Talkie" Burlesque.

A burlesque on a talkie film will be included in the London programme on Saturday evening, November 2nd. Some people at Savoy Hill are disturbed by the progress of the talkies, which they regard as

inferior. It would not be surprising, therefore, if there is a good deal of "bite" in the forthcoming burlesque.

Between Life and Death.

Mr. Lance Sieveking, who has been responsible for the production of several somewhat unorthodox programmes at the London Station during the past two years, is to produce a drama entitled "The First Second," by Peter Godfrey, in the London Studio on Thursday evening, October 10th. The play, which portrays the beginning of the end of a man's life, has for its action the infinitely short time between life and death.

GIANT RADIO H.Q. FOR BERLIN.

This model of the new gigantic Berlin Radio House was exhibited at the recent German Radio Exhibition.

TECHNICAL NOTES.

By Dr. J. H. T. ROBERTS, F.Inst.P.

VARIATIONS IN GRAMOPHONE SPEED

THE BENDING PANEL—SPEED REGULATOR, Etc.

ONE of my readers has written describing a peculiar effect which he obtains with his gramophone, and as I have myself noticed the same effect more than once, especially with certain of the more popular-priced machines, I think it may be worth mentioning the matter in case any other readers may have had the same experience.

The particular trouble referred to is this: The gramophone speed varies considerably from time to time, even though the speed indicator has been untouched in the meantime: changes of speed will also be particularly noticeable if the motor is rewound whilst a record is playing.

At first sight these effects appear very remarkable and in particular it is difficult to see why the speed of the turntable should decrease when the motor is being wound up—at any rate, in the case of a "forward-wind" motor, which is the type in general use to-day.

The Bending Panel.

The explanation of these very curious

happenings is that the top table of the gramophone is of wood which is too thin or is too pliable, with the result that the slightest pressure upon the top of the gramophone, or the force introduced in the act of re-winding the motor, is sufficient to distort the top panel quite appreciably.

Now in practically all gramophones the speed regulator takes the form of a "quick thread" screw, which depresses the extremity of a long arm projecting from the motor frame and so varies the position of the stop which engages with the disc of the gramophone governor; the long arm is kept in contact with the speed regulator by a spring, as a rule.

Speed Regulator.

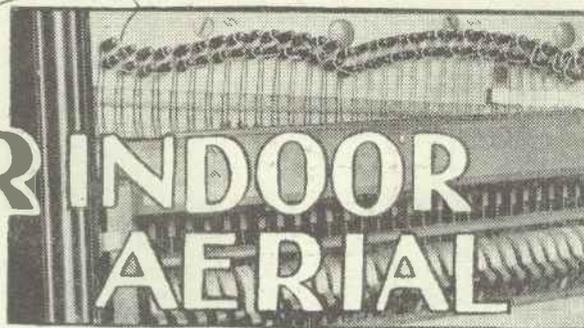
It is easy to see, since the speed-regulating screw is supported entirely in the top wooden panel of the gramophone, that any bending of the panel will cause a shift of the hinged arm in exactly the same way as if the speed regulator itself had actually been moved. In some cases the effect of a slight

(Continued on page 242.)

IMPROVING YOUR INDOOR AERIAL

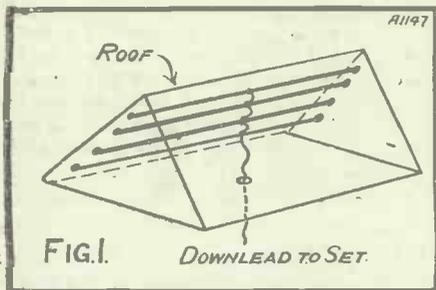
"The pick-up efficiency of the indoor aerial is by no means small, while it possesses several features making it particularly attractive for reception under modern conditions." An interesting and practical article

By J. F. CORRIGAN, M.Sc., A.I.C.



QUITE a considerable number of people are now using indoor aerials of various kinds, in the majority of cases because they cannot put up a decent outdoor aerial, and often because the indoor wire is more convenient and less unsightly. Under certain conditions, where, for instance, the receiver cannot be placed close to the aerial lead-in point, it often happens that an indoor aerial gives better results than an outdoor one, provided that it is properly designed and erected. Herein lies the secret of getting the most out of an indoor aerial, and in this short article I propose to run over the essential points to watch when arranging and erecting your aerial, with a few ideas for improving its efficiency.

Some amateurs with lofty outdoor aerials are apt to smile condescendingly when indoor aerials are mentioned, but, contrary



to general belief, the pick-up efficiency of this type of aerial is by no means small, while it possesses several features making it particularly attractive for reception under modern conditions. A well-designed indoor system of average dimensions has a smaller inductance than the outdoor aerial, and this results in sharper tuning and better selectivity, which is highly desirable with the Regional transmissions.

Moreover, its pick-up, although not quite so good as that of the outside wire, is certainly ample for present-day receivers, especially those incorporating a high-grade H.F. stage. For short-wave work, too, you will find the indoor aerial very useful; as an energy collector it has ample dimensions, yet it is small enough to give low aerial damping and fewer "blind spots" in tuning.

Low-loss Condenser

Of course, a badly erected aerial possesses none of these advantages. Unfortunately, a good many people do not take all the precautions and trouble that they should, with the consequence that the aerial is blamed for the poor results they obtain.

Now, in erecting an indoor aerial our main object is to construct what amounts to a low-loss condenser, one of the plates being the aerial wires and the other the

earth system. The capacity of this condenser has to be fairly considerable as we are restricted in the length of wire we can use. We get the required capacity by using several relatively short lengths of aerial wire all joined together, in conjunction with the best possible earth contact we can devise.

This is not all, however. The aerial wires in a loft, for example, are close to the roof and the down-lead near to walls, all of which provides a capacity to earth where it is least wanted. Also, the house itself forms the dielectric of our imaginary condenser which is far from ideal, so that on the whole we have more sources of loss to contend with than in erecting an outside aerial.

Taking every precaution to minimise these losses is the secret of efficiency when erecting your indoor aerial, and even if it means extra trouble over details, it is well worth while in the end.

As there are very many possible shapes and sizes for the indoor aerial, I shall only consider the more general types such as the loft aerial and wires across a ceiling or along an upper corridor. This should be quite sufficient to give you an insight into the efficiency requirements for all types.

Careful Insulation Required

In many cases there is not room for more than a 15-ft. length of wire, so that it is necessary to use several lengths in parallel, all separately insulated at the ends, the down-lead being joined to each wire either in the exact centre or at one end, whichever gives the shortest route to the receiver. The lengths of wire should total at least 30 ft., a greater length being preferable, up to a maximum of some 80 ft.

A loft aerial of the simplest type is depicted in Fig. 1, showing four parallel wires, each 15 ft. long. Whatever the dimensions of the loft try to arrange your wires at least 1 ft. from the roof sides, and well away from the top of the side walls, spacing the wires not more than 2 ft. apart.

The insulators at the end of each wire can be conveniently supported by short lengths of wire attached to nails or screw-eyes driven into the end beams or into the ends of short lengths of wood nailed at right angles to the side beams.

Although a loft aerial is to be preferred you may not be able to get under the rafters to put up your wires, in which case quite a serviceable system can be erected in an upper room, or across a landing, if this has generous dimensions. Usually several lengths of wire are stretched across from the two walls furthest apart. In this case each wire should be well insulated at every point of support and the side wires suspended at least 1 ft. away from the walls. As

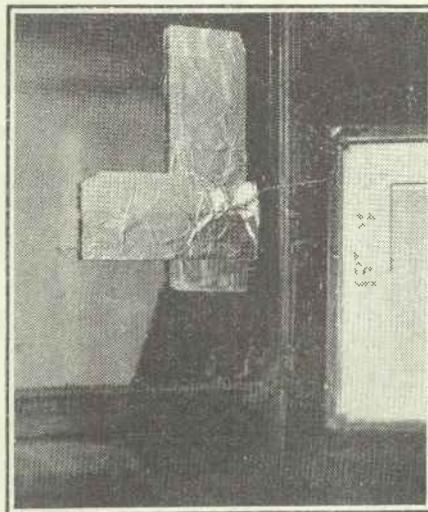
before, the common down-lead is joined at the ends or the centre, whichever gives the shortest route to the set.

The insulation of all wires of an indoor aerial is important, but as the effects of sun and rain are absent, dust being the only enemy, quite simple insulators are sufficient. Short lengths of ebonite with a hole bored in each end are very satisfactory, or you can use those small, egg-shaped ones. Great care is necessary with the insulation of the down-lead, and wherever this passes through a ceiling, wall, or door-frame, etc., the wire should be taken through an ebonite or glass tube.

Solder All Joints

One of the most important details in erection which I cannot emphasise too much is to solder all joints in the aerial wires. This is somewhat of a problem with a loft aerial, unless you possess an electric soldering iron. The simplest plan is to put up the wires temporarily, allowing sufficient length for the down-lead, clean up all wires to be joined, and twist them tightly together. The wires can then be taken downstairs, where you can do your soldering with the greatest of ease.

If your receiver is situated in a ground-floor room, the down-lead from the loft



An interesting form of aerial in which the metal surface of a mirror is capacitatively coupled to the receiver by means of the tin foil shown.

aerial, if brought through the house, will usually have to follow a somewhat tortuous path beset with losses all the way. In this case the ideal method of providing a direct route with the minimum of losses is to take the down-lead through the caves immediately above the room, down the

(Continued on next page)

IMPROVING YOUR INDOOR AERIAL.

(Continued from previous page.)

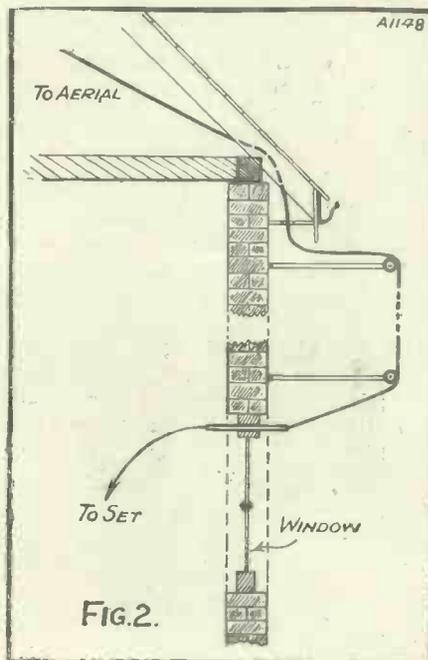
outside wall, and then in through an insulated tube in the window frame. This scheme is indicated roughly in Fig. 2, from which you will notice that the outside portion of the lead is supported some 2 or 3 ft. away from the wall by insulators on two lengths of wood.

If the receiver is in an upper room, then you may find it more convenient to take the aerial lead down through a small hole in the ceiling. This can be bored with an ordinary metal drill, without disfiguring the plaster, inserting a piece of glass tube in the hole for insulation purposes.

The Earth System.

There is just one other point about the down-lead. As far as possible avoid running the section from the aerial wires to the exit point from the loft parallel with the electric-light wiring, as this may in certain cases give rise to interference. Such wiring is usually visible in the floor of the loft.

Now, as regards the earth system you cannot be too particular about getting a good connection when using an indoor



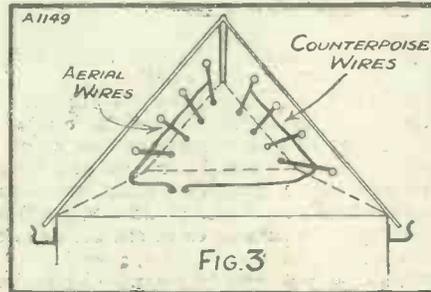
aerial. The usual main water-pipe contact or buried earth is quite satisfactory when the receiver is on the ground floor, provided you are careful to get a good "earth" contact.

Where the receiver is situated upstairs, however, this type of earth usually means a long earth-lead, which is not a very satisfactory state of affairs. Often a shorter lead can be arranged by taking another wire into the loft and making contact with the cold water supply pipe, where it enters the main cistern, if this is available.

Alternatively, another scheme which I have found to be particularly successful is to set up on the opposite side of the loft another group of wires similar to and parallel

with the aerial wires, and as far apart from the latter as space will permit (see Fig. 3). The down-lead from this second group is the "earth" wire, the additional wires forming a counterpoise of the required capacity. The pick-up of this arrangement is very satisfactory indeed, while aerial damping is still further reduced.

Because of the smaller dimensions of the average indoor aerial as compared with an



outdoor system a somewhat tighter aerial coupling can be used without unduly prejudicing selectivity. If the aerial coupling of your receiver is designed for use with an outdoor aerial, it is well worth while experimenting with a slightly larger aerial coil, or a higher aerial tapping where aperiodic or auto-coupling is incorporated.

FOR THE HOME CONSTRUCTOR.

The Reaction Condenser—Using a Pick-up.

WITH regard to reaction condensers, in some circuit arrangements these may have a large voltage—the whole voltage of the H.T. battery—across from one set of vanes to the other, and therefore, unless some safety device is included in circuit with the battery and the condenser, it is clear that serious damage may be caused by an accidental contact between a moving vane and a fixed vane.

Although variable condensers have been very much improved, an accidental contact of this kind is still by no means unknown. Consequently, it is a good plan, if you happen to be using an arrangement of this sort, to introduce some safety device into the H.T. supply to the condenser which is mounted on the metal panel.

Fuses.

A fuse is perhaps the simplest form of protection, and it has the advantage that, being of comparatively low resistance and free of inductance, it does not interfere with the other adjustments in the circuit. An alternative protection is a fixed condenser—which may be of the mica variety—introduced in series with the variable condenser.

Of course, this means that we are again dependent upon the insulation of the fixed condenser but generally the insulation of a good quality fixed mica condenser may be relied upon with much more certainty than that of a variable air condenser. In any case, reliance has to be placed upon fixed mica condensers in other parts of the circuit.

Adjustment of Circuit.

The introduction of the fixed condenser in series with the variable condenser means

that the setting of the variable condenser will be altered, and if the fixed condenser is of too small a capacity it may be that the desired resultant capacity is thrown outside the range of the variable condenser.

A capacity of .002 even up to .005 microfarad may be used for the fixed condenser, and it is important also that, in addition to an adequate capacity, this condenser should have mica insulation. If the condenser is not of appropriate capacity and quality the overall amplification will be reduced and sharpness of tuning will be lost.

USING A PICK-UP

Some experimenters prefer to use fibre needles with the electrical pick-up, possibly owing to the fact that they can still obtain sufficient volume for their requirements with this soft needle.

Personally I do not subscribe to this view, and I always think that the reproduction from the fibre needle is apt to be lacking in "character."

I think the original purpose of the fibre needle was to reduce wear-and-tear upon the record to a minimum. But in this connection you may be interested to know that some very careful tests were made some time ago upon the question of the wear of the record surface caused by steel needles as compared with that caused by fibre needles, and it was found that the fibre needles in many cases caused just as much wear as the steel, and in some cases actually more.

Owing to the non-conducting nature of the fibre needle, a good deal of extra heat is apparently produced at the point of contact with the record, or rather, the heat produced is unable to escape, and the result is that the fibre needle in time causes a curious roughening of the record surface which does not occur with steel needles.

Hard Needles.

To go to the other extreme, I am not a believer either in the so-called "permanent" needles. These are made from exceedingly hard metal or other substance and the very fact that they wear for a considerably longer time than the conventional steel needle is a proof of their very much superior hardness.

This means that the difference between the hardness of the needle and the hardness of the record is very much greater with the "permanent" needle than with the ordinary steel needle, and it is inevitable that the record must suffer more when engaging with an exceedingly hard needle than when a needle of medium hardness is used.

I am old-fashioned enough to believe in using an ordinary steel needle of "medium" tone, inserted as far as possible into the needle-holder of the soundbox or pick-up, and changing the needle after each rendering.

J. H.

Do not use frayed flex for L.T. leads, as this is dangerous, and easily fitted and efficient spade terminals are obtainable for a few pence.

If you are using dry battery H.T. ascertain from the makers of the battery the safe discharge rate for it, and make sure that this does not exceed the total plate current of your receiver, as given by the valve makers curves.

Do not destroy the instructions supplied with accumulators as it is important that these should be carefully followed if long life is desired.



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SHOULD THE B.B.C. CRITICISE?

Some remarks on the latest row at Savoy Hill, which has enlivened dramatic and literary circles, and the listening public.

By THE EDITOR.

IT was about time the B.B.C. got mixed up in a controversy again, and the alleged "attack" on a play by the B.B.C.'s Dramatic Critic, Mr. James Agate, has once again brought the B.B.C. into the limelight of publicity.

Well, from the publicity point of view, that is all to the good. In fact, the genius who controls the publicity destinies of the B.B.C. will probably very shortly receive an offer of £10,000 a year, or something like that, to join some big commercial undertaking. Surely there is no concern in London to-day which gets more publicity than the B.B.C. Very often, of course, it gets it without trying for it. But the fact remains that it gets it!

And we shouldn't be surprised if a good deal of the increase in licences lately has been due to some of the controversies which have had their origin at Savoy Hill.

This latest "row" is no less than a charge of injustice brought against the B.B.C. by Mr. Bertie Meyer, the theatrical manager. Mr. Meyer recently addressed a letter to Sir John Reith, the Director-General of the B.B.C., complaining that the criticism of his production, "The Flying Fool," now showing at the Prince's Theatre, was a scathing condemnation and "a warning to playgoers to keep away from the Prince's Theatre"!

"The Flying Fool."

Some of our readers, no doubt, listen to Mr. James Agate's broadcast talks on the drama and, no doubt, some don't. But the fact remains that Mr. Meyer is considerably annoyed with the B.B.C., and particularly with Mr. James Agate.

Mr. Meyer maintains that he does not object to general criticism, but when a critic, speaking to thousands of people of all classes, warns theatre-goers to abstain from going to his theatre, then he thinks that is going too far, especially when the majority of critics praised "The Flying Fool," and the play is proving popular.

Apart from the rights and wrongs of Mr. James Agate's criticism, Mr. Meyer's objection raises a very interesting point. It appears that theatre managers do not send the B.B.C. a ticket for a first night production inviting the B.B.C.'s critic to broadcast a review of the play.

As Mr. Meyer stated in an interview the other day: "Mr. Agate is a critic for the B.B.C., but I did not send a ticket to the B.B.C., and I did not solicit a B.B.C. criticism. If I had, I should have sent them an invitation. If I do not invite a newspaper to one of my productions it means that I do not want a criticism in that newspaper. I have never invited the B.B.C., and I cannot see by what right they seek to pass judgment on my production. I shall be obliged if they will refrain from doing so until I specifically invite them."

Now there's a pretty problem. Have the B.B.C. any right to criticise a play if they have not been officially invited to send a

dramatic critic? This is the B.B.C.'s answer, as given by a B.B.C. official:

"The B.B.C. employ established critics for the drama, the film, and for music. They attend public performances of these various entertainments, and they attend at Savoy Hill to express their opinions. I cannot enter into the question of specific invitations. All I can say is that our critic attends public performances, and we have confidence in his critical ability."

Good Play Doomed?

This seems to evade the point, although it has been stated in a newspaper that if a play invites public attendance, any member of the audience is entitled, if he wishes to do so, to criticise that play. Perhaps the B.B.C. would be technically correct if they

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purchased a ticket for a play and then gave their critic permission to broadcast his views on it!

Sir Gerald du Maurier, the actor-manager, stated to a reporter that the attitude of the B.B.C. is absolutely indefensible. Theatre managers and producers have never invited the B.B.C. to criticise plays. Sir Gerald continued:

"When I invite a newspaper critic, I am prepared to bear with the opinion he may express in his newspaper, but I cannot anticipate that he will seize the opportunity to broadcast another type of criticism which I do not invite. Perhaps the B.B.C. does not appreciate that a broadcast criticism is a totally different thing from a newspaper criticism. Theatre-goers alone read the newspaper criticisms for the most part, and are thus very shrewd critics of the critics, but the broadcasting of an adverse criticism may be thrust upon an unwilling or unsuspecting listener and, in a surprisingly short time, a good play may be utterly doomed by the voice of a single critic who may be out of harmony with his fellows."

Not Accurate.

Lastly, Mr. James Agate, in reply to Mr. Meyer's complaint to the B.B.C., said that he was astonished that Mr. Meyer should not take the trouble to find out what he

actually said before he (Mr. Meyer) made his complaint. As a matter of interest, the actual words in connection with "The Flying Fool" were as follow:

"In my view, 'The Flying Fool' is nonsense, but not good enough nonsense. The authors have simply not put enough work or enough contrivance into it. On the other hand, there may be, and probably are, a great number of people who like that sort of nonsense. Perhaps, as Charles Second said in another connection, 'the play's nonsense suits their nonsense.' Well, there you are. I don't think 'The Flying Fool' is a good thriller, but I would not deter people from seeing it who will not be as much affected by its shortcomings as I cannot help being."

In our opinion, that seems to "let Mr. Agate out," as the saying is. But it still does not clear up the interesting point as to whether the B.B.C. have any right at all to broadcast a criticism of a play when they have not been officially invited to send a dramatic critic.

Wastes Programme Time.

If the B.B.C. are going to set themselves up as critics of this, that, and everything, then there is no reason why they should not send somebody round criticising shop windows, stories, articles, buildings, the efficiency of navvies rebuilding the Strand, and a multitude of other things.

The chief trouble about this sort of thing is that it crowds the programmes out with matter which does not appeal to the majority of listeners, and, in fact, as in the case of the London theatre, has, when one considers the scattered population which enjoys wireless broadcasting, a very local interest for a comparatively limited number of people.

Still, it's a nice row—one of the most piquant, in fact, that Savoy Hill has supplied for nearly a month!

ITEMS OF INTEREST.

When using mains units remember that safety fuses are cheap and easily fitted, and that such apparatus should never be left at the mercy of inexperienced people or children.

Although the detector valve requires no grid bias it is often an advantage for H.F. valves, and for L.F. valves it can be regarded as being absolutely essential.

Do not expect a grid-bias battery to last more than six months.

In soldering, not only the faces of the iron itself but all the metals to be joined must be kept scrupulously clean.

Flux is used in soldering to exclude the air from the surface of the metal so that a little flux is just as efficient for this as a lot, and in practice a thin coat gives better results than a thick one.

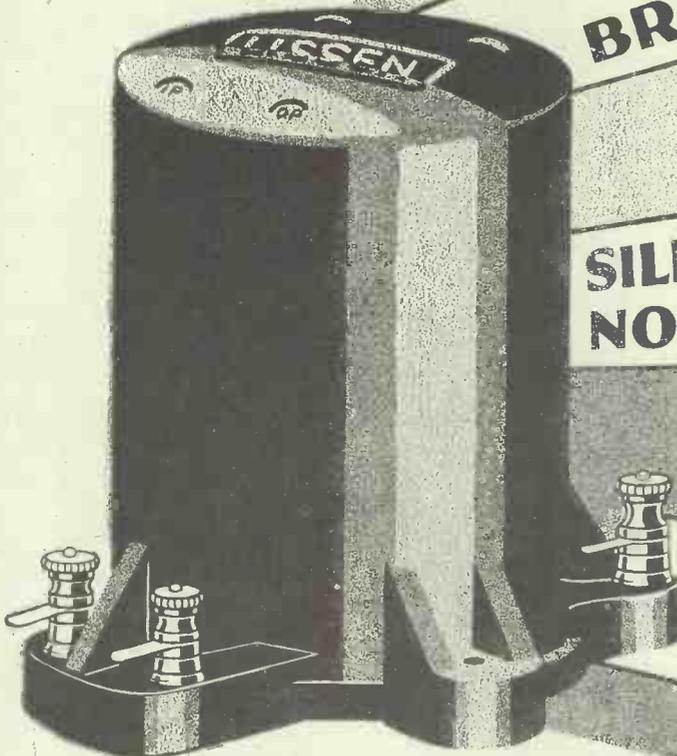
If you use a fire for heating the iron for soldering, get a clear fire if possible, and if not, try placing the head of the iron in a small, clean tin, placed in the centre of the fire to protect the end of the iron from dirt.

Never let inexperienced persons meddle with your set, for innocent curiosity has finished many a fine valve.

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THIS YEAR'S SHOW.

A Short Commentary on the Radio Exhibition.

By CAPT. P. P. ECKERSLEY, M.I.E.E.

ANOTHER show. Sometime about when the first daffodils are shivering in a March wind, I hear that Mr. Moody would like to see me. And I see Mr. Moody, and he asks what the B.B.C. are going to do about the show—a studio, a model, a demonstration—and we try and feel original in face of much discouragement. Then Mr. Moody goes away and someone does all the work, and just as the show comes I go abroad, every year, not by design, but just by coincidence—America twice, The Hague this time, Geneva another time, so I'm no authority.

I feel, however, that the trade are doing some really fine work these days, and every year perceptibly the quality of the receiver goes up and the price for a given performance goes down—which is all as it should be.

I have been to shows in other parts of the world, and I have studied receiving sets and their performance almost everywhere. I make in consequence one profound generalisation—transmitting conditions make receiving technique.

Little Imported Gear.

Why is it there is so little importation of foreign receiving gear, American or European? For two primary reasons: the American gear, as such, does not suit the conditions of wave-range, and most of the European sets I have seen do not satisfy the admirable fastidiousness for good quality reproduction which is demanded by the British listener.

Thus, no American set, unless specially adapted for the European market, will receive Daventry 5 X X and the other long-wave European stations; few other European sets give decent quality.

The British manufacturer has been forced by the long-wave policy on the one hand and the fastidiousness with which the B.B.C. have looked after quality on the other, to make a set substantially different and substantially better, in my opinion, than any other set in the world. Having said this, and having really meant what I say, no one can object to a few criticisms which are designed to be constructive.

We get this year a greater degree of simplicity of operation for the user. The Americans have a far easier problem in this regard. They only have to cover a certain wave-range, but the question of

high-frequency amplification and abandon reaction in some form or another as an independent adjustment. Two adjustments one can face—four or five belong, I hope, to a barbarous past.

The Popular Portable.

It is extraordinary to remark the vogue of the portable set, but it is easy to criticise the resulting quality. What is to be the compromise, because the public do love the fascination and the ease of handling and the reasonable price of a portable? They are so far putting up with the inferior quality. I want a portable, but I cannot listen to it after I've had my super set playing at me. It's excellent for a talk or variety, but for Queen's Hall—no! Here is a possible line of improvement to be thought out.

I bought a set the other day for a friend. It had a row of terminals, a few dials, and not one word of instructions! That is the kind of thing to send people crazy. The psychology of the buyer is such that when he makes his plunge he wants results at once—the salesman will tell you how much easier it is to sell a portable on this account. How bad a mistake to give a man anything very much to do when he installs his set; how hopeless if he isn't even told what to do!

The inside of every lid should have a

diagram of connections, a simple calibration chart, and some readable instructions. What is the wave-range of an average set? Two hundred and thirty to 500, and then 1,200 to 2,000, I expect. But why 230 the lowest? It has been known to the world since 1927 that the broadcasting band goes down to 200 metres. I am giving away no secrets when I say that important areas away from the range of other stations will be served by a 200-metre station very soon. Leeds works on 200 metres to-day, but I believe in consequence nearly everyone in that area listens to Bradford on 288.5 metres. Simply because none of the sets will tune down.

When will the single-valve set come into its own? And will it ever do so? Is the crystal to remain for the very poor person, and the cheap loud-speaker set to be the next type to buy for £10 to £15? It will be very interesting to see how long firms will continue marketing crystal sets and whether they are fitted with coupled circuits in view of the conditions imposed by the Regional Scheme. Many people tell me that the crystal set is dead.

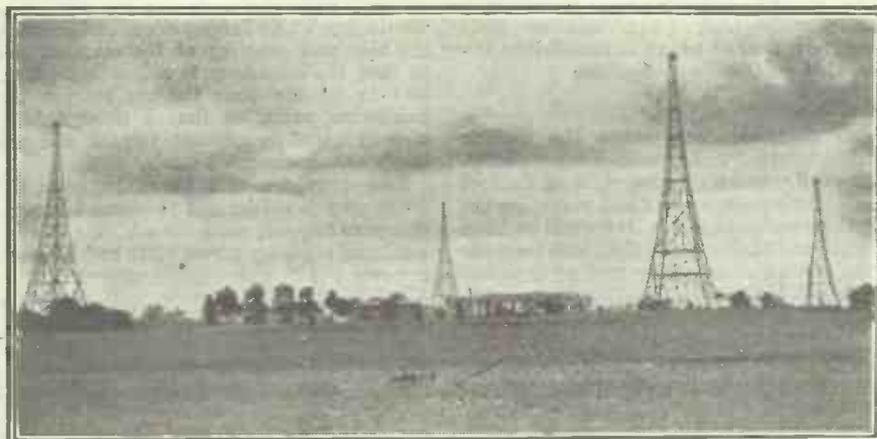
Will Crystal Sets Die?

It may be so, but an investigation of a poor quarter of London shows that it is still being used a lot. It may not be a good market for all but a specialised form of business, but I should not be surprised to see it continue in use in certain parts of industrial Britain for many years to come. If it does die, I wonder if the single-valve set will not replace it in large quantities, particularly under the conditions of the Regional Scheme.

Then surely one expects to get a portable cheap set for reception of short-wave stations. This is great fun, and I should think the set should have a ready market.

But good luck to the trade, and a bumper year to them all! Let's hope we can maintain our pride of place so difficultly won.

THE LONDON REGIONAL STATION.



A general view of the Brookman's Park Station. The two aerials are parallel to each other, supported by masts 200 feet high.

THE "PRESTO" THREE.

The Editor, POPULAR WIRELESS.
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G. A. AMOS.

Balham.

LOOPING THE LOOP.

The Editor, POPULAR WIRELESS.
Dear Sir,—May I thank the correspondent who described a gadget for making loops in wire for giving us a means of making neater wired sets and may I suggest an improvement.

The correspondent advises three or four blocks to be made for varying sizes, but find I that four different-sized nails arranged thus . . . allow for four different-sized loops. The nails are spaced to take one thickness of wire between them, while room for two thicknesses is left in the centre. The loop is formed as per original gadget, any three nails being taken.

Yours faithfully,
G. HAKE.

Llanaron, Wyke Road, Coventry.

AN OVERSEAS CONSTRUCTOR.

The Editor, POPULAR WIRELESS.
Dear Sir,—I have not noticed any report of the "P.W." "Short-Wave" Two, so perhaps a few details of my experiences with this wonderful set may be of interest to some of your readers.

This set was given in POPULAR WIRELESS, October 6th, 1928. I built it the following week, and have had excellent results ever since. My previous experience was nil, and I started off with an aerial 100 feet long, but soon brought it down to its present length, 22 feet. My first station was P C L on 38.8 metres, and others soon followed—5 S W, 2 X A F, 2 X A D, W 8 X K, P C J and Q J R X, and several not identified. On a voyage to West Africa I had these stations regularly and received the chimes of Big Ben through W 8 X K in December last.

Last April I built the "P.W." "All-Wave" H.F. Unit (January 19th, 1929), and also obtained the coils for the long and medium wave-bands. I was then able to get the news bulletins, and carried 5 X X 1,700 miles, and 5 G B 2,300 miles, using a 100-ft. aerial. It is impossible to mention all the stations received on these bands, but I can safely say I have had every station of note from Motala to Budapest.

I have since built the "P.W." Purity Cone (December 22nd, 1928), and with a P.M.2 in the last stage I was able to get 5 S W, 2 X A F, W 8 X K, and the new German station on 31 metres, all at good strength on the speaker, and on one occasion had C J R X at a distance of 6,500 miles.

I am now going to construct a four-valve set consisting of "P.W." "All-Wave" H.F. Unit, "P.W." "Short-Wave" Two, and the "P.W." "Plus Former" (May 25th, 1929), and with that I feel sure I will have as fine an All-Wave set as it is possible to have.

CORRESPONDENCE.

**THE "PRESTO" THREE.
LOOPING THE LOOP—AN OVERSEAS
CONSTRUCTOR—HOME-MADE SLOW-
MOTION DIAL—THE "PROGRAMME"
FOUR.**

Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

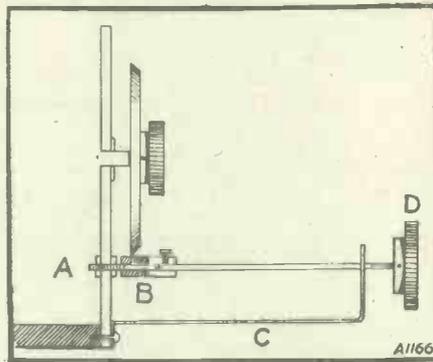
Wishing you every success, and with many thanks to the Research Department for such excellent sets.

I remain yours faithfully,
J. K. M.

Sierra Leone.

HOME-MADE SLOW-MOTION DIAL.

The Editor, POPULAR WIRELESS.
Dear Sir,—I enclose particulars of a slow-motion dial constructed mainly of Meccano parts, of which I am sure some of your readers will have a good supply.



A is a piece of Meccano rod, 1 in. long and tapped for half its length, held to panel by one nut each side. B is a Meccano coupling link which revolves on A and carries a 4-in. spindle fitted with a knob D. C is a Meccano strip which acts as a support for the spindle. With a piece of bicycle inner tube fastened round B, this apparatus will be found to give a very smooth control and will be free from hand capacity.

I have fitted this arrangement to a short-wave set and have found it satisfactory in every way.

The set I refer to is the "Handyman" Two, on which I have received 2 M E on 28.5 m. on about six occasions.

Trusting the enclosed will be of interest, and wishing "P.W." every success, I am,
Yours faithfully,
J. T. BEATON.

Stamford.

THE "PROGRAMME" FOUR.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have just hooked up the "P.W." "Programme" Four, of June 22nd last ("P.W."). It is yet only a three-valve set—H.F.-det.-L.F. transformer. It is, without exception, the most stable set I have yet built. (I have been particularly unfortunate in any det.-two-transformer sets I have built.) It gives very decent volume in the loud speaker. I particularly like simple sets like this one, using plug-in coils. A plug-in coil, made several years ago as described in Mr. Kendall's book on coils, was the first wireless construction I ever did, and very efficient it and subsequent ones were. In the above set I have coupled the aerial direct to the top of the first coil. I find I get considerably more volume by doing so, and we have no selectivity problems here. I hope you will soon give us a similar set with neutralising, and we are long looking out for a simple five-valve portable, using ordinary valves and ordinary components.

Yours faithfully,
J. BORTHISTLE.

Effernogue, Ferns,
Co. Wexford, Ireland.

SOME TECHNICAL TIPS.

Grid bias not only improves quality but greatly lengthens the life of the high-tension battery.

The best loud speaker in the world will give bad results when connected to an improperly-designed set.

However good the quality of reproduction from a set is, it will be spoiled if a large volume is forced into a miniature loud speaker.

Do not run long leads from your set to distant loud speakers unless you employ an output filter circuit to prevent H.T. wastage.

Use high-conductivity wire for the aerial, and do not allow it to swing near walls, buildings, etc.

SHORT-WAVE NOTES.

By W. L. S.

QUITE a number of readers have asked me lately whether Mr. Kendall's scheme, detailed in "P.W." from time to time, of providing an additional by-pass for H.F. from the plate to filament of the detector, by means of a "Formodenser," or something similar, could not be made useful for short-wave work.

Candidly, I do not think there is anything in it for the short-waver, since at these tremendously high frequencies so little capacity is needed to act as an efficient by-pass that no trouble ever arises.

Reaction Control.

On the broadcast waves the trouble really originated with circuits using capacity-controlled reaction; we lost sight of the fact that so little capacity was in circuit when the reaction condenser was in its normal position (about one-third in, probably), that from the point of view of complete and efficient by-passing of H.F. current the circuit arrangement left much to be desired.

This could be improved by using a smaller reaction control, and using more of the reaction condenser in circuit, or by the provision of an extra bypass condenser direct from plate to filament of the valve, or, in throttle-controlled circuits, across the H.F. choke.

For short-wave work I generally use a .00015 condenser for reaction, and arrange the size and coupling of the reaction coil so that the condenser is rather more than half in by the time the set reaches the oscillation point, so that I think this is already quite an efficient bypass and not likely to cause much trouble.

The provision of a Formodenser in the usual way is rather apt to cause alarming things to happen, since the addition of even a minute capacity across plate and filament severely upsets the reaction circuit.

Built "Backwards."

Has it ever struck you how conventional we are all becoming with regard to our layouts, circuits, etc.? The other day I decided that it would be much more convenient from my own point of view if my next short-waver were built "backwards," i.e. with the aerial and earth on

the right, and the battery terminals on the left. This arose because my transmitter is on the right-hand end of the bench, with the change-over aerial switch in the middle.

Well, it took me an incredibly long time to solder up that short-waver, just because the detector was on the right and the note-mag. on the left. I felt as if I were drilling the front of a panel from a back-of-panel drawing, and it took some getting used to before I really made headway with the arrangements of the components, especially the D.F. transformers.

Novel Features.

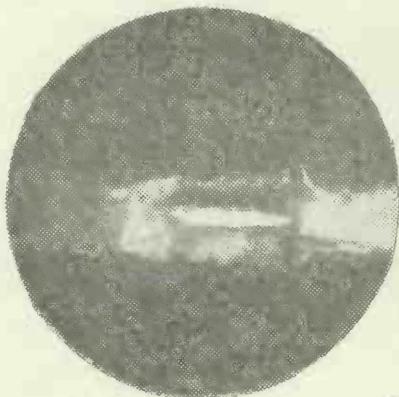
I hope to describe this set more fully at a later date, as there are some rather novel features incorporated, and I have been a little daring in more ways than one. The receiver has not yet been thoroughly tested out, however, and I want to make quite sure what it will do.

Some annoying rattles that crept in two or three nights ago were, after much trouble, traced to the stranded steel wire I use for my aerial halyard. Three strands had broken and the ends were rubbing together! This is a rather good example of the trivial things that can cause trouble to the short-waver.



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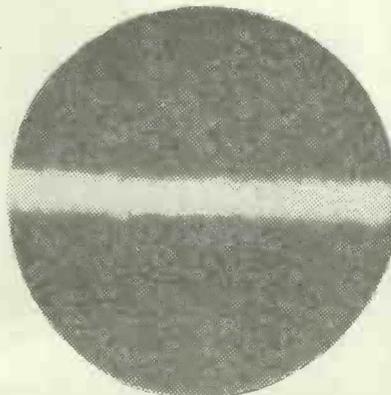
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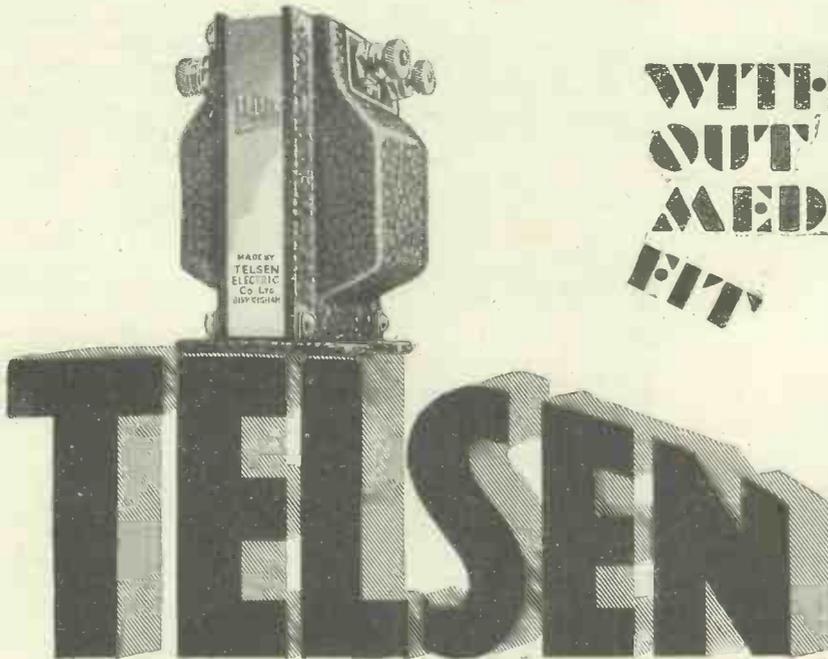


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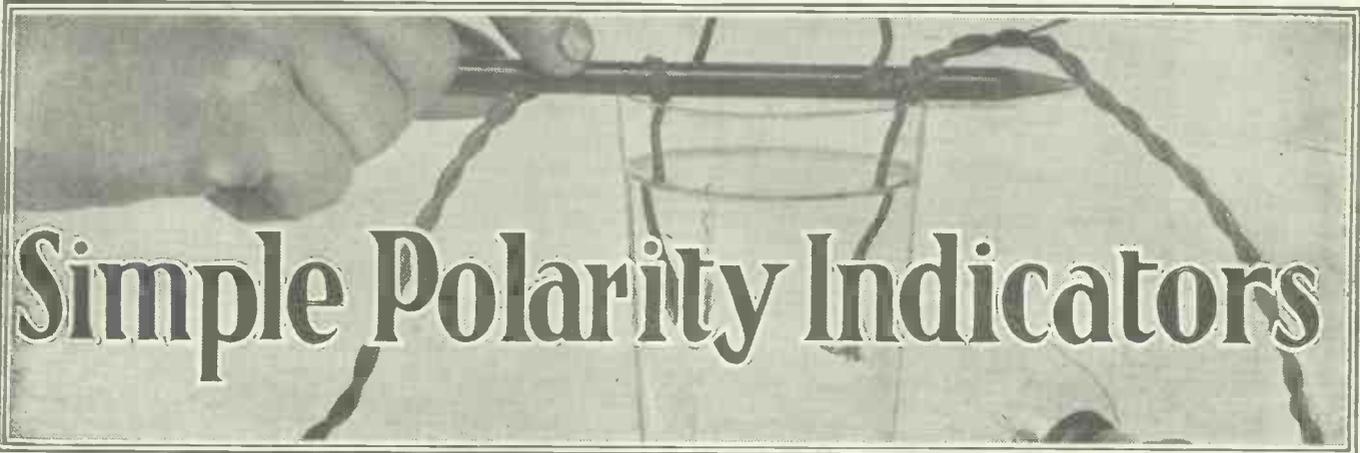
Ratios 5—1
and 3—1

8/6

Ratios 5—1
and 3—1

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Simple Polarity Indicators

WITH the present-day fairly general use of battery chargers and mains units a simple method of determining the correct polarity of mains becomes a necessity. An accumulator incorrectly connected to a charger and left in this way for a few hours may be permanently ruined.

In the case of H.T. units operating from A.C. mains the output terminals are, in most cases, marked in some way. (The mains terminals do not matter, of course.) With certain commercial chargers the practice is to bring out flexible leads

 * An article that will prove of value *
 * to all who use the electric light *
 * mains for radio purposes. *
 * By J. R. WHEATLEY. *

must be inserted in series with one of the leads to prevent a possible short.

A freshly cut potato with the two leads stuck a small distance apart is the third type of polarity indicator. The current passing through the potato

between the two ends of the wire causes a green stain to be left on the wire connected to the positive of the supply. But as a certain amount of mark is also often left on the negative lead, this test does not give as

definite an indication of the polarity as could be desired.

The last and most effective polarity indicator is the purely "chemical" type. Indicators of this type are extremely easy to construct, they are practically indestructible, and give a definite indication as to polarity.

Obtain from the chemist's two penny-worth of sodium sulphate and threepenny-worth of phenolphthalein (pronounced feenolthahleen).

Half fill an old tumbler or cup with warm water, and into this place as much of the former substance as will cover two pennies and sufficient phenolphthalein to cover a sixpence (not six pennies), and stir.

Inexpensive and Efficient.

It will be found that these two chemicals will not dissolve, but merely form a suspension. Test the solution by placing two leads from a 2-, 4-, or 6-volt accumulator into it (about 1 in. apart), and it will be seen that the negative lead turns the surrounding liquid a reddish colour. A slight shake causes the colour to disappear. By carefully adding very small quantities of each chemical in turn a point will be arrived at where the liquid is sensitive to 2 volts.

A suitable container for the liquid is the next consideration, and for this a length of glass tubing 2 in. long with a 1/4-in. bore, two small corks, and two terminals are required (see illustration).

To increase the surface contact, small pieces of sheet nickel, brass, or copper are soldered to the ends of the terminals.

After filling the tube with the solution, leaving a space so that the liquid can be shaken to disperse the colour, carefully seal the corks with paraffin wax or Chatterton's compound. The excess liquid should not be thrown away, for with this pole-finding paper can be made.

Obtain some good quality white blotting paper and cut into thin strips, immerse in the liquid until thoroughly impregnated, and then hang up to dry. Do not attempt to dry in front of a fire.

To use, moisten the paper slightly and then place the wires about 1/2 in. apart on the wet portion, when the negative lead will leave a red mark.



Details of the construction of this handy testing instrument are given.

and stamp the connecting spade tags. Sooner or later these tags become corroded, and it is difficult to determine the positive and negative leads.

Some form of polarity indicator would therefore appear to be a necessity for every power-from-the-mains wireless user.

It is extremely difficult to determine from inspection of twisted flex the relative polarity of the two leads.

The easily-applied tests include (1) voltmeter; (2) water test; (3) potato test; (4) chemical test.

Some Easily-Applied Tests.

In the first type a voltmeter of the moving-coil type may be used, for with this class of meter a reading is only obtained when the positive of the supply is joined to the positive terminal on the meter. If the meter is incorrectly connected the needle will tend to move in the wrong direction.

The water test is quite simple, but it is apt to be misleading. The output leads of unknown polarity are placed in a slightly acidulated solution about one inch apart. Bubbles of gas will be given off from the ends of both wires, but at one end the gas is produced in much greater quantities. This lead is joined to the negative terminal of the supply.

In practice the faults to be found with this test are: it is messy, and it is sometimes difficult to determine the lead from which the gas is liberated in the greatest quantity.

Should it be necessary to test polarity across two points between which a high voltage exists, a resistance, such as a lamp,



How the water test is carried out.

PARASITIC NOISES

Sometimes most mysterious noises are emitted by loud-speaker sets, and their origin completely puzzles the listener. In this interesting article the causes of some of these curious effects are described.

By H. A. R. BAXTER



THERE are many noises heard from loud speakers which are not broadcasting.

Some of the most peculiar sounds are due to Morse stations, but even if you do not know the code, you can generally recognise these, as they are very rhythmic in character. Of course, it sometimes happens that interruptions due to other causes operate to a sort of beat tune, which might lead those who cannot read telegraphic signals to think that this branch of wireless is at work.

But Morse messages are generally to some extent, tunable. That is to say, you hear them very loudly when your dials are at certain adjustments, but can get rid of them by twisting the dials round.

Some spark transmitters make disgustingly rough sounds; low and like animal growls. On the other hand you frequently hear most musical notes, some of extremely high pitch. If you hear a C.W. station working (and this is recognisable by the fact that the note alters as the tuning adjustment is altered), it is a sure sign that your set is in a state of oscillation.

A Rule to Remember.

The Fultograph wireless picture transmissions, which can be heard from 2 L O and 5 G B after the ordinary programmes have closed down, and from certain Continental stations, produce musical notes which every now and then break into a sort of burbling, but these transmissions, again, are tunable.

Sometimes telegraphic transmitters emit long, continuous notes; generally this is during testing, and if one of these notes happens to break loose right on top of your programmes, this may lead you to think that something has happened to the set.

It is a very good rule to ignore an interfering noise for the first half-minute or so. If it persists for a period much exceeding that, then it is time to commence investigations. The noises caused by atmospherics and those due to a faulty dry H.T. battery are frequently confused. Both can be crackling, frying sounds not unlike bacon sizzling in very hot fat. But most radio enthusiasts know that one can easily test for atmospherics by disconnecting the aerial and earth leads from the set. If the noises persist then you can be pretty sure that they are due to some outside source.

An Unfortunate Fact.

An accumulator, taken directly off charge and placed in service, can cause similar crackling noises for periods of a few minutes.

It is an unfortunate fact that a number of things can create the same kind of disturbance.

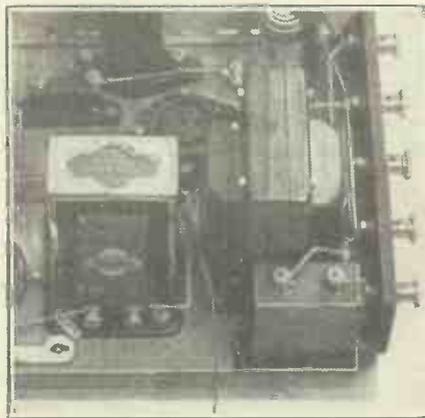
One of the most annoying forms of interference is that caused by another listener in close proximity operating his set on what is known as the "silent point." His set is

radiating all the time, but for the most part at exactly the same frequency as the broadcasting station. But, of course, no amateur equipment can hold a frequency with complete stability, and it only takes a slight swaying of the aerial, or something similar, to cause audible heterodyning to occur.

Sometimes a burst of heterodyning is rhythmic and there is a grunt-silence-grunt-silence-grunt-silence effect. And all the time there is a terrible mangling of the broadcasting going on both in the silent point gentleman's set and in the sets of those who are near him. Before now silent point reception has caused respectable owners of respectable sets to accuse their installations of having developed faults.

The Further Possibility.

This indicates the need for another rule that should be noted. That is, always endeavour to tune in another station and see what reception from there is like before taking further steps. There is always the



Sometimes L.F. chokes and transformers are found to act as inefficient loud speakers!

further possibility that the broadcasting station itself is producing the distortion. This very rarely indeed happens with our own B.B.C. transmitters, but it is a common occurrence on the Continent.

One of the most serious of all parasitic sounds made by radio sets is that popping similar to a slow-running internal combustion engine. The choking of a grid due to the disconnection of the grid circuit or the use of too high a value of grid leak can cause this. Motor-boating, which suggests a similar rhythmic noise, is a term generally reserved for the effects caused by L.F. instability following an unwanted coupling effect.

More often this is evinced by a howl, and one which no tuning will alter in pitch. A very microphonic valve can cause a similar sound. Sometimes one meets the condition

in a set where the tapping of a panel or case causes a "ping!" This undoubtedly will be a microphonic valve or valves, and if the set is at all unstable in character the "ping!" can resolve itself into a sustained howl.

Considerable mystification has been occasioned by L.F. components, such as chokes and transformers, acting as inefficient loud speakers. What happens is that loose laminations in the core vibrate in accordance with the L.F. impulses passing through the article. Sometimes chokes and transformers used in mains units hum. Provided that the hum is not loud enough to interfere with the music, one should not worry about it, for it will be due to the vibrations of the laminations in the component and not to anything which can seriously impede the operation of the instrument.

A Buzzing Loud Speaker.

If a loud speaker develops a buzz this may possibly be the result of dust getting into the works. And then there is the classical example, although I believe it has happened to quite a number of people, of a listener whose loud speaker suddenly started to make noises on its own during a period when the set was not in use.

It was a loud crackling, scratching sort of noise, not unlike rather fierce atmospherics. Eventually it was discovered that a small beetle had got behind the diaphragm and was endeavouring to dig its way out!

Another mysterious case was of an amateur whose set would always click around about sunset. It was a powerful multi-valver, and apart from this series of interruptions, which was short in duration, no other trouble of any kind was experienced.

A Curious Coincidence.

It was a long time before that amateur tracked the cause of the trouble. At long last he found that the noise originated in the switching on of the electric light next door. Not having electric power in his own house he had not the guidance of his own switches to tell him what was happening. Even so, it is not likely that real interference would have been caused except that by a curious coincidence he had his powerful multi-valver but a few inches from where the mains next door were run close to a wall.

Curious noises are apt to creep into a set via the earth lead. Especially is this the case when the installation is erected in a manufacturing district, where all sorts of earth currents are set up by power plants, electric railways and other such things.

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The 1930 Cossor Melody Maker is the last word in Screened Grid Receivers. Because it uses the wonderful NEW Cossor Valves it has enormous power and range. It has razor-sharp selectivity. It will cut out the local broadcast like magic and bring in programme after programme with amazing ease—only one knob to turn to hear the station you want. Designed to suit broadcasting conditions when B.B.C. Regional Scheme comes into operation—the 1930 Cossor Melody Maker is next year's Set which you can buy now.

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By means of an entirely new system of synchronised control, "tricky" tuning is done away with in the 1930 Cossor Melody Maker. Only one knob to turn to bring in the programme you want.

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In the 1930 Cossor Melody Maker there is no coil changing — merely turn a knob to alter from long to short wavelengths or vice versa. Never before has there been such a highly efficient Receiver with such simple controls.

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Because of the power of its NEW Cossor Screened Grid Valve the 1930 Cossor Melody Maker will bring your Radio from stations 1000 miles away. And because of the careful balancing of all the valves in the Set it gives an amazingly life-like tone. For volume, tone and range the 1930 Cossor Melody Maker is unequalled.

The 1930

COSSOR "Melody Maker"

The World's lowest priced Screened Grid Receiver of such advanced design.



A SET with two or three dials is not particularly difficult to handle. Such an outfit will doubtless have considerable power, so that there will be no need for "squeezing." The tuning-in of a certain station will depend upon precise tuning adjustment and not upon keenly-balanced reaction.

When reaction is being pushed to the limit, a set with one tuning variable requires delicate manipulation. The selectivity of a set is increased to an enormous degree by the close approach and such fine reaction adjustments will upset the tuning, so that the two controls have to be juggled about tenderly.

Definite Plan Essential.

It is hopeless to attempt to handle a two- or three-dialed receiver without working to a definite plan. Haphazard dial twisting will produce but poor results. It would be as futile as trying to open a combination lock without knowing the combination word or figures.

I have said that the fact the set has two or three dials will almost surely indicate that it has considerable power or sensitivity, and that means H.F. stages. If you have these H.F. stages properly neutralised, or if screened-grid valves are used, there is practically no danger of re-radiation from the set. You will be able to operate the set in an oscillating condition, without causing interference to other listeners.

If you have two tuning dials and a reaction control, this is how you should proceed with your station searching. First of all get the feel of the dials, that is to say, twiddle each one round and note how many degrees you pass through for each certain movement of the control knob. Get the idea thoroughly into your head that the clockwise movement of the tuning variable increases its capacity and, therefore, the wave-length to which the circuit in which it figures will tune.

Points to Remember.

Likewise, the higher the reading on the dial the higher the wave-length. If it is normal, the reaction condenser should function in a similar way, that is, the farther you turn it to the right the greater the reaction effects. Also note whether or not the reaction condenser needs a greater adjustment to produce oscillation towards the upper readings of the condenser dial.

 Here are some really practical
 hints and tips on the tuning of
 multi-dial sets.
 By D. GLOVER.

This is the more common condition, and it is generally found that very little capacity is needed from the reaction condenser to make the set oscillate on the lower wave-lengths, while it has to be nearly full in to do this on the higher wave-lengths.

The next thing you want to do is to line up the variables so that their readings are approximately the same for each wave-length. You can do this by tuning in the local station to start with. Put the reaction at zero, and then twist the tuning variables until you find that local station. You should have no difficulty in doing this. You will probably be able to locate the broadcasting by means of the one dial only.

When you have secured the station, tune it in to its loudest on the one dial, then, leaving that, tune in to the sharpest point on the other dial. If the two dial readings are widely different, it would be advisable to alter the dial of one variable so that the readings more or less correspond.

Lining up the Dials.

You will probably be able to do this easily enough by loosening a little grub screw that holds the dial to the spindle of the variable, gently twisting the dial without altering the moving vanes of the variable until the readings coincide, and then screwing up the grub screw again.

You will probably discover that the tuning is much flatter on the one scale than on the other. You may be able to lose your local station by means of a very small re-adjustment of one dial, the second dial acting more like a volume control, a big movement of it being needed before the station vanishes.

In this case, take the sharp tuning dial as your lead. Adjust this one very closely while you follow up on the other dial with the other hand, perhaps oscillating backwards and forwards over the approximate reading until the coincidence of the two adjustments brings in the distant broadcaster you require.

It is not advisable, nor is it necessary, to have the set in an oscillating condition and so locate stations by their squeals. In the circumstances, a little squealing

would not do any harm, as there will be no re-radiation, but the method is not adopted by experienced station searchers.

It is much better to have the set in that very sensitive condition just off oscillation. You then tune in music or speech and do not get lost in a maze of C.W. stations and "carrier" harmonics.

Endeavour to map out five or six reaction control adjustments corresponding with five or six areas of the tuning dials. Then, as you move upwards in the scales, so you can every now and then bring in just that little more reaction needed.

Starting Points.

If you have your dial readings fairly well balanced, you will be able to keep the dials in step very easily.

As you will no doubt discover, although one station and a few others close to it may preserve identical dial readings, the readings will tend to go out of line slightly unless—and this is not likely to be the case—the circuits themselves are balanced.

Therefore, the sooner that you can take the dial readings of a few widely separated stations the better. You will then have starting points, as it were, for searching in the different areas.

With three tuning dials, the procedure will be much the same; but you may find two of the dials provide pretty sharp tuning, although it is extremely unlikely that three will do so. Three dials will almost certainly mean two stages of H.F. amplification, and with this power you will almost be able to ignore reaction.

Making a Chart.

You will be able to leave the reaction control set at some arbitrary point, returning to this only when, having got the station you want tuned in, a trifle more "punch" may be desired. The main point to remember is that the dials must be kept lined up, and that an increased capacity adjustment of the one must be followed by similar adjustments of the others.

With three dials a calibration chart becomes almost a necessity if you want to go over from one programme to another without the necessity for searching each time. A calibration chart is very easily prepared. All that you have to do is to plot dial readings against wave-lengths on ordinary squared paper.

THIS is the time of year when many constructors think of launching out into their first largish set, and we have spent a lot of time lately in the "P.W." Research Department in thinking over ways and means of making such a departure as simple and inexpensive, and yet successful as possible.

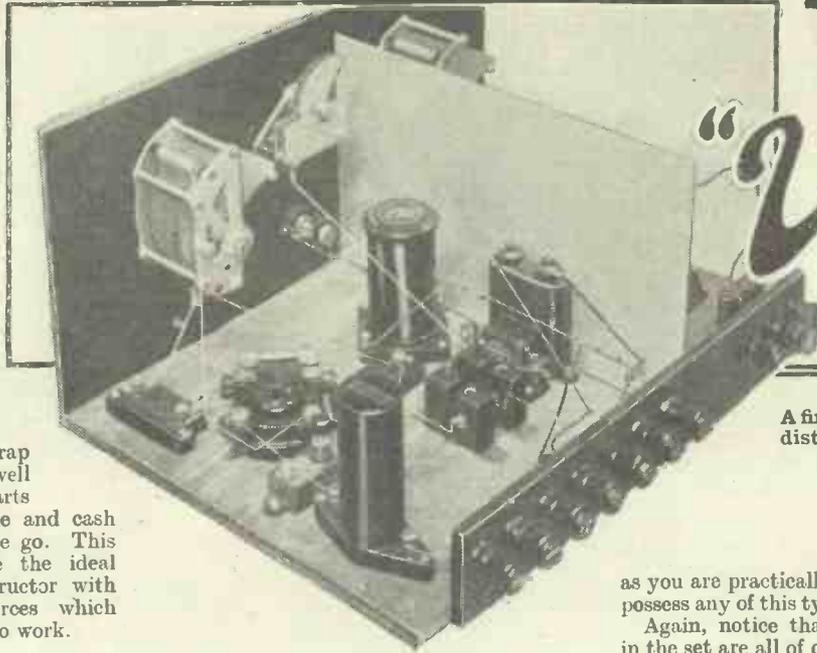
After working out many alternative schemes we have come back to a belief we have long held about the best way of making the change from a fairly small type of set to one of a more ambitious kind. We believe we are right in thinking that most people feel reluctant to scrap an existing set which is going well in order to make use of the parts and then spend a lot of time and cash in building a big set all at one go. This does not seem anything like the ideal scheme for the average constructor with the limited time and resources which handicap most of us in our radio work.

A Good Solution.

The scheme we favour permits the job to be done in two easy stages, and when you have completed the first you have again got a working receiver probably giving much better results than you were getting before. Then, as opportunity offers, you can collect the parts for the second stage and complete it at your leisure, whereupon you will have the desired big and powerful outfit, without having undertaken a very large task at any stage of the proceedings.

The idea is simply to build the installation in two parts. The first comprises the receiver proper, with the H.F. stage (or stages) and the detector, and as soon as this is finished you again have a working set. It will give headphone results only, of course, but if it is well designed and made it will do so from a very large number of foreign stations, and will probably be a big advance on your previous small set in this respect.

Then when you are ready you can build the second portion, consisting of a good



THE "Vanguard" TWO

A first-class and right-up-to-date two-valver, specially designed for long-distance work. It employs a screened-grid valve, and an L.F. amplifier can easily be added for powerful loud-speaker results.

Designed and Described by
THE "P.W." RESEARCH DEPARTMENT.

L.F. amplifier, and so bring practically everything up to loud-speaker strength. The final outfit, too, can be of very pleasing appearance if the two units have been designed to stand side by side and match up nicely.

We have prepared a special design on these lines, and we are describing the first unit thereof this week, with details of a powerful L.F. amplifier to follow later.

A Sensitive Unit.

The receiver portion proper consists of a screened-grid H.F. stage, and the usual detector valve, forming a headphone outfit which will bring in literally scores of distant stations, once you have got the hang of the controls. It must not, of course, be expected to give loud-speaker results on even the local station, because it contains no L.F. stages. That will come later when you add the two-valve amplifier which we shall be describing in a later issue.

Now take a look at the various photographs and diagrams, and you will begin to appreciate the care which has been expended upon this design in making it thoroughly simple to construct, and furthermore decidedly inexpensive, especially to the man who already has a few parts on hand. First, notice that every part contained in this set is of a thoroughly standard nature, and very many of them are such as you will have in hand already. The tuning, for example, is performed first of all by two standard variable condensers, and further by means of standard plug-in coils, the sizes called for being such

as you are practically certain to have if you possess any of this type at all.

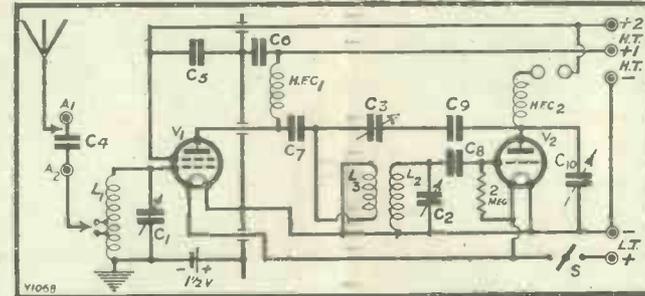
Again, notice that the fixed condensers in the set are all of capacities which you are likely to have, the grid leak is of the usual standard value, the reaction condenser is just the usual capacity, and so on. There are no special switches and although the receiver is not of the wave-change type, there are only three coils to change when you go from one wave-band to the other and so it is not by any means an irksome process. We ought perhaps, to explain that a wave-change set with an H.F. stage is really somewhat of a complicated business unless it is of the ultra-simple type, such as the "Titan" receiver, and so we decided not to incorporate wave-change switching in this particular set.

If this is your first really large set you will probably be interested to know something about how it works, and we will run over the circuit very briefly and give you a general idea as simply as we can. First of

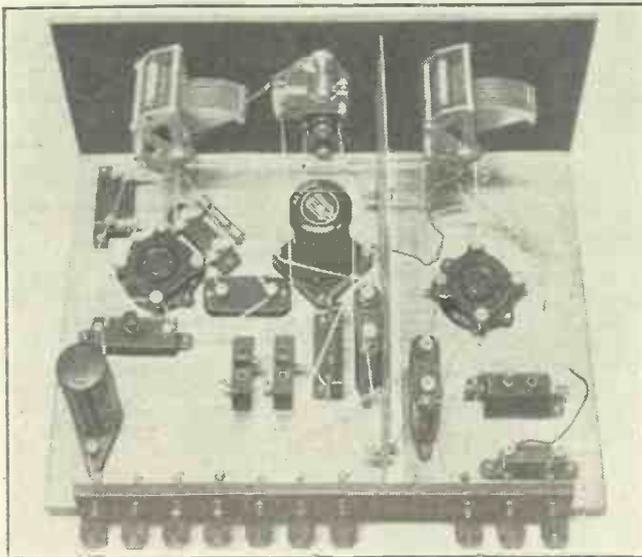
all, you will note that the screened-grid valve has the usual tuned grid circuit, with the aerial auto-coupled into this, with two tapping points giving a varying degree of selectivity. Further, there is a fixed condenser of suitable capacity, which can be brought in in series in the aerial circuit when

required, this again giving a further control of two separate degrees of selectivity. To get these two degrees you attach the aerial to either A2 or A1, the second of these (A1) giving the higher degree of selectivity, usually at a slight sacrifice of volume. The aerial coil, by the way, is a standard X type, which has two tapping points provided upon it, usually in the form of two terminals on the sides of the plug, or two sockets for the insertion of a pin in some position on the casing of the coil.

A point to be noted in passing is that a little grid bias is provided for the screened-grid valve, which improves slightly the performance of the valve itself, and also cuts down its consumption of H.T. current



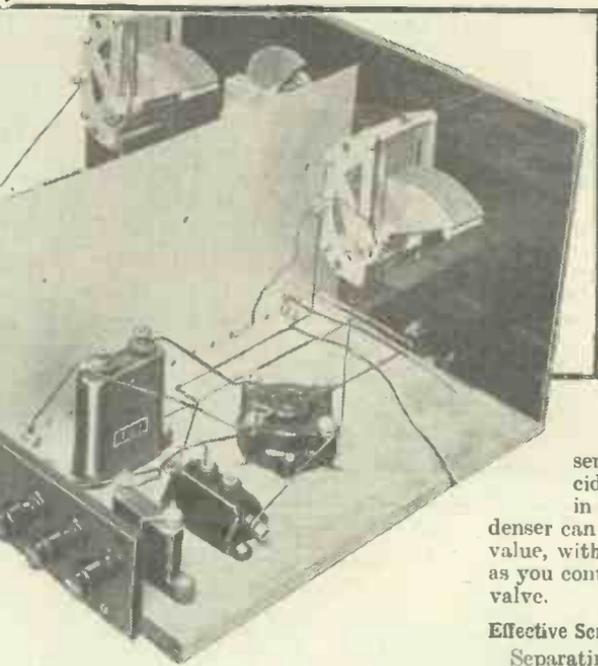
The circuit consists of a selective H.F. amplifier followed by a grid-leak detector.



The completed wiring shows there is plenty of available space.

COMPONENTS REQUIRED TO BUILD THIS SET.

- | | | |
|---|---|--|
| 1 Panel, 14 in. x 7 in. (Resiston, Keystone, Kay Ray, Becol, etc.). | 2 Sprung valve holders (Igranic, Benjamin, Lotus, Precision, W.B., Pye, Burndept, Magnum, Wearite, etc.). | (Ediswan, Lissen, Dubilier, Igranic, Carborundum, Cosmos, Mullard, etc.). |
| 1 Cabinet to fit with baseboard, 10 in. deep (Pickett, Cameo Raymond, Ready Radio, Bond, Gilbert, Lock, etc.). | 3 Single-coil sockets (Igranic, Wearite, Magnum, Lotus, Raymond, Peto Scott, etc.). | 1 H.F. choke suitable for parallel feed (R.I., Magnum, Varley, Wearite, Bowyer-Lowe, etc.). |
| 2 .0005-mfd. tuning condensers (Lotus, Lissen, Raymond, Igranic, Gecophone, Ormond, Utility, Colvern, J.B., Cyldon, Bowyer-Lowe, etc.). | 2 .0003-mfd. fixed condensers (T.C.C., Dubilier, Lissen, Clarke, Goltone, Igranic, Mullard, etc.). | 1 H.F. choke of any standard type (Lissen, Igranic, Dubilier, Ormond, Raymond, Precision, R.I., Climax, Varley, etc.). |
| 2 Vernier dials if condensers not of slow-motion type (Lissen, Igranic, Formo, Brownie, Utility, Lotus, Raymond, etc.). | 2 .001-mfd. fixed condensers (Igranic, Goltone, Lissen, Dubilier, T.C.C., Mullard, etc.). | 1 .0001-mfd. compression type variable condenser (Formo, Igranic, etc.). |
| 1 .0001 or .00015 reaction condenser (Utility, Lissen, J.B., Lotus, Cyldon, Ormond, Peto Scott, Raymond, etc.). | 2 1-mfd. condensers (Dubilier, Lissen, Hydra, Ferranti, T.C.C., Mullard, etc.). | 1 Standard screen, 10 x 6 ins. (Ready Radio, etc.). |
| 1 On-off switch (Lissen, Igranic, | 1 2-megohm grid leak and holder | 1 Terminal strip, 12 in. x 2 in. |
| | | 10 Engraved or indicating terminals (Belling-Lee, Eelex, Igranic, Clix). |
| | | Wire, screws, sleeving or Glazite. |



very considerably. This was not a point of such very great importance with last year's types of screened valves, but with those of this present season it appears to be a very desirable point. For this purpose you really want only a single small dry cell which can be placed upon the baseboard in a convenient position, which you will gather from the position of the two flex leads which go to it. If you cannot get hold of a single small cell, you might use a very small grid-bias battery, such as a 4½-volt unit, and tap out just 1½ volts.

Economising in Coils.

The intervalve coupling circuits are rather interesting, because we have here a simple but effective form of H.F. transformer arranged with plug-in coils. The parallel-feed scheme is used with an H.F. choke in the anode circuit of the H.F. valve, and the primary coil (marked L_3) is also the reaction coil, thereby saving one coil and making the set somewhat more compact and inexpensive. Tightly coupled to this, actually standing close up against it, is the tuned secondary coil L_2 , which forms the grid circuit of the detector valve in just the usual way. Reaction is of the capacity-controlled (sometimes called the Reinartz) variety, and we have provided our standard sensitivity-improving device on the detector valve—namely, an adjustable plate-to-filament bypass condenser. This is a "Formodensor" type of semi-variable compression condenser with a maximum capacity of about .0001 mfd., and it is very simply adjusted.

We may as well give you the necessary instructions for its adjustment while we are discussing this device. Start with the set switched on and the bypass adjusted to its minimum capacity. Now, gradually increase its capacity, noting that, as you do so, it becomes more difficult to get reaction—that is to say, you have to bring the reaction condenser further in to get oscillation. Increase the setting of the bypass condenser until you find you can only just get sufficient reaction with the reaction condenser nearly full in, and the adjustment is complete.

You will now find that the sensitivity of the receiver is decidedly better, with a slight increase in selectivity, and the bypass condenser can be left permanently set to this value, with no further adjustment so long as you continue to use the same detector valve.

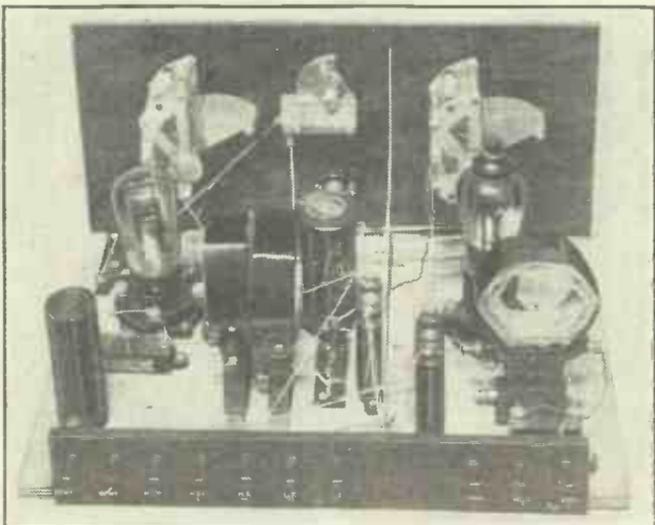
Effective Screening.

Separating the H.F. stage from the detector, there is the usual vertical partition screen, which is carefully arranged to cut off the stray fields of the coils and to prevent them from interacting with one another. In this way a good degree of stability is obtained, and you will actually find that the set is very well behaved indeed.

There, that concludes our survey of the main details of the receiver, and we can now get down to business and talk about constructional matters. The mention just made of the screen raises the first of these, which concerns the type of material to be used for wiring up. Now, you can use bare wire, if you like, for the greater part of the wiring, but you should note that all wires which go through the perforations in the lower edge of the vertical screen must be of the insulated type, such as bare wire covered with Systoflex sleeving or one of the special covered materials such as Glazite.

By the way, the lead from one side of the H.F. choke to the terminal on the top of the

(Continued on next page.)



Here, the valves are shown in position. Note the flexible lead on the top terminal of the S.G. valve.

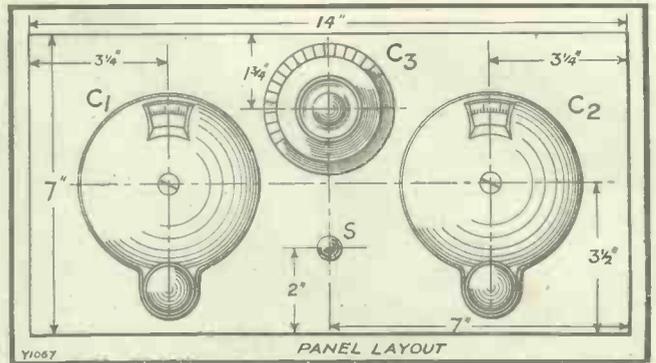
THE "VANGUARD" TWO.

(Continued from previous page.)

screened-grid valve should preferably be of light flex, or a piece of stiff wire covered with sleeving and carefully bent to shape, so that it just goes straight across to the top of the valve. This lead is a rather important one, and should be kept short and direct and well away from other wires. The general constructional work will be found very simple, and, as usual, we find it rather difficult to find anything which we can helpfully add to the information contained in the various diagrams. Just note, however, that you should take a little care to

make the proper earthing connection to the screen at the point indicated at the back of the set. Another point to note where a connection is made to the screen is at the front of the set near the panel, where a short flex lead comes off and goes to the positive of the grid-bias battery for the H.F. stage. Otherwise, it is merely a job of screwing down the components as indicated and wiring up, and we think you will find it presents no difficulty whatever.

Now for some very brief working data



for the set, and we can leave you to put it on test and find out for yourself how delightfully simple it is to operate, all that is required being just a little practice in running the two dials together and keeping the reaction adjusted so that the set is in its most sensitive condition. This latter, by the way, is a very simple matter, since you will find that the reaction does not need to be critically set on a receiver like this, which gives good volume without the use of much reaction.

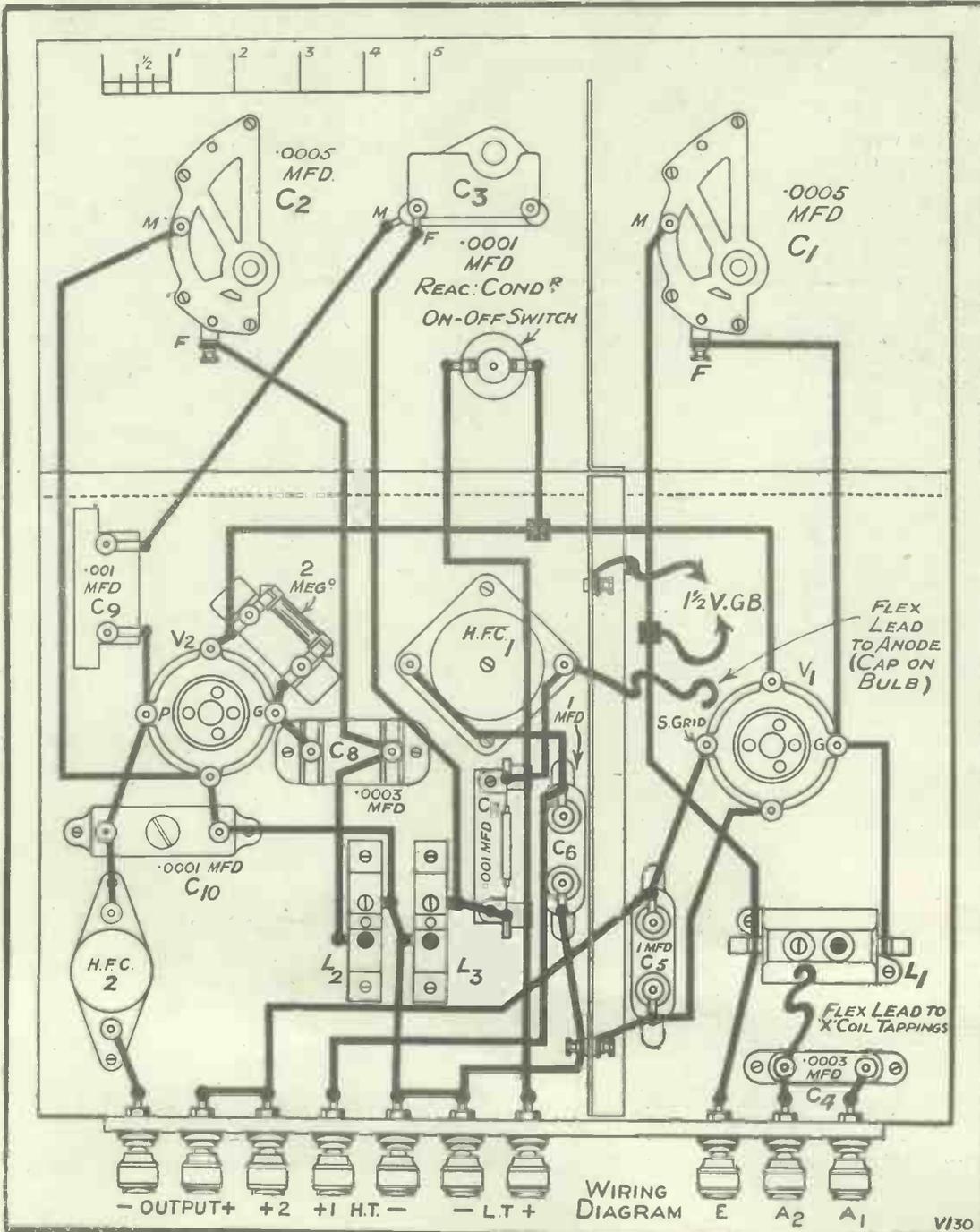
Working Data.
Working H.T. voltages should be these. On H.T. + 2 you should put about 70 to 80 volts, adjusting it for the loudest signals on weak stations. Then, on H.T. + 1 you should put about 120 volts, since this feeds the anode of the screened-grid valve. It does not pay to be economical here, because on less than 120 volts the screened-grid valve cannot possibly give its best. Here are the coil sizes. L₁, a No. 60 X-type; L₂, No. 35 or 50, or 40 if you have it; L₃, No. 60 plain type. For the long waves, L₁, a No. 250 X type; L₂, a No. 100 or 150 (possibly a No. 75 if greater selectivity is desired at the sacrifice of a little strength); L₃, a No. 250 plain.

Working Data.

The Valves.
The choice of valves is simple. Two-volters go perfectly well in this set, and all our usual tests were performed with this type. The first should, of course, be of the screened-grid type of the upright variety, with a terminal on the top. The detector should be of the H.F. type, one with an impedance of about 20,000 to 30,000 ohms being suitable.

The Valves.

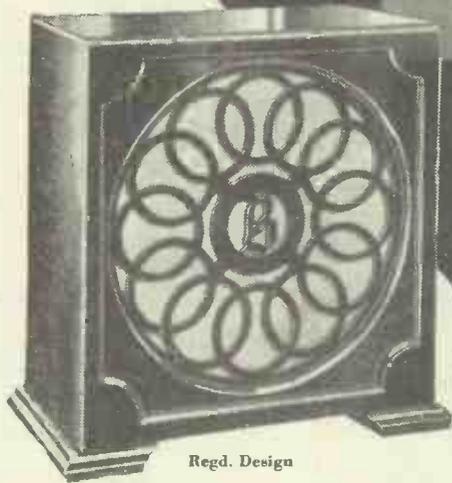
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WIRING DIAGRAM

W30

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Regd. Design



THE MISSING NOTES



BY THE
WONDERFUL
NEW

HERE is one of the greatest achievements in the history of the Radio—a loud speaker that reproduces the broadcast in your home *exactly as it is played in the studio*. It omits nothing! It invents nothing! It finds notes that other loud speakers miss. It reveals instruments you've never heard by Radio before. It is the new Brown Duplex Loud Speaker.

The greatest of many Brown triumphs, this wonderful new loud speaker owes its superior performance to two entirely new features of design—the new "Vee" Movement and the new Duplex Cone. In no other loud speaker will you find them. That is why from no other loud speaker will you get a tone so sweet and so mellow—a volume so rich and so full. Only the Brown Duplex Loud Speaker "re-creates the *living* artiste." Ask any Wireless Dealer.

IN THREE MODELS:
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Design as illustrated.

Model V10 . . . £5 10 0

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Also obtainable by easy payments, ask your Dealer for particulars.

Brown

DUPLEX LOUD SPEAKER

FROM THE TECHNICAL EDITOR'S NOTE BOOK

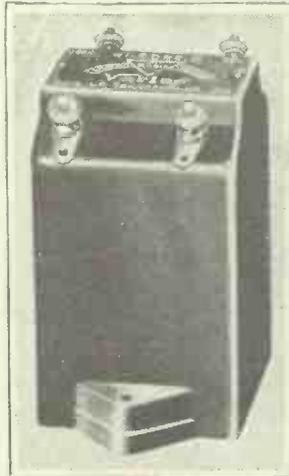
Tested and Found-?



NI-CORE II.

FOR years we judged an L.F. transformer by its poundage. Constructors were warned that unless the component was large and heavy it was pretty certain not to be much good. The main reason for this was that a big core of iron was necessary in order to build up respectable magnetic qualities.

Nowadays, one cannot take the dimensions of an L.F. transformer as any sort of guide at all to its potential powers. Metallurgists have been hard at work and have discovered alloys capable of colossal permeabilities. Perhaps I have used the



This is the "Ni-Core" II L.F. Transformer, which is reviewed on this page.

word discover in rather the wrong sense. It is more the fact that they have discovered how to control these alloys from a manufacturing point of view, rather than their properties.

In the latest alloys there is a large proportion of nickel, and the mixture of nickel and iron from an electro-magnetic point of

view is a temperamental one. Slight discrepancies during their formation can make all the difference between magnetic and non-magnetic results. And in regard to their magnetic permeabilities, remarkable exactitude is essential for satisfactory results. The whole business is the work of the specialist and the transformer manufacturer who can command the powers of such is fortunate.

The Varley people are, of course, well placed, because they have had a long and varied experience in the making of all types of transformers and their researches on the subject are always intensive. They are additionally fortunate in that they have at their disposal practical engineers and scientists of the highest grade. The combination of their efforts in the direction of modern transformer design is to be found in

the Ni-core, which is indeed a wonderful radio component.

There are two Ni-cores available, Ni-core I, at £1, which is the senior model, and Ni-core II, which retails at 15s. A sample of Ni-core II has been sent in for test purposes. It weighs a mere 9 ounces, while its overall dimensions do not exceed 3 inches

in any direction. It is a neat little article and it has achieved "lines" that compare most favourably with any other components of the kind. The Ni-core, however, has the special advantage that while it conveys the sleek impression of a product of a vast factory, it bears the distinction of an individually fashioned piece of gear. Its bakelite moulded casing is a first-class example of the moulder's art.

On test, I found this Ni-core II gave results quite up to expectation. It would have taken a very massive and very expensive transformer of only a dozen or so months ago, to approach it. The best results are achieved when a shunt H.T. feed is employed so that the steady anode current does not flow through the primary winding of the article. In these circumstances the frequency distortion is of a very small order. The Varley people can congratulate themselves on being able to start the radio "season" with such a fine trump in their hands.

HARBROS EASIFIX.

Hart Bros. Electrical Mfg. Co., Ltd., are makers of various kinds of wires and conductors, but undoubtedly their most popular and useful production is their patent Easifix flexible. This is particularly suitable for loud-speaker extension leads or distant-control wiring. It consists of two or three wires, arranged flat and untwisted and built into a fabric structure.

The conductors are separated from each other, but are held together with a webbing of silk which at the same time forms a complete covering over the whole. You can get the material in any one of twelve colour designs, so that it can match practically any surroundings.

And the special fixing pins enable you to run it rapidly, and without doing damage, over walls and panelling. It is a great advance over ordinary twisted flex. Apart from the simple and easy way in which it can be fixed in position, it has the great advantage that its

self-capacity is very low. It is obtainable in any continuous length at 3d. per yard.

WIRELESS LICENCE HOLDER.

Radio licences must be produced on demand, although I expect it would take some "P.W." readers a long time to find theirs. Rex Patents Company, of Park Road, Kingston-on-Thames, have placed a wireless licence holder on the market at 1s. 6d., and it is said to be the first article of its kind.

Certainly I have never seen anything like it before. In appearance, it resembles a large season ticket holder and, encircled

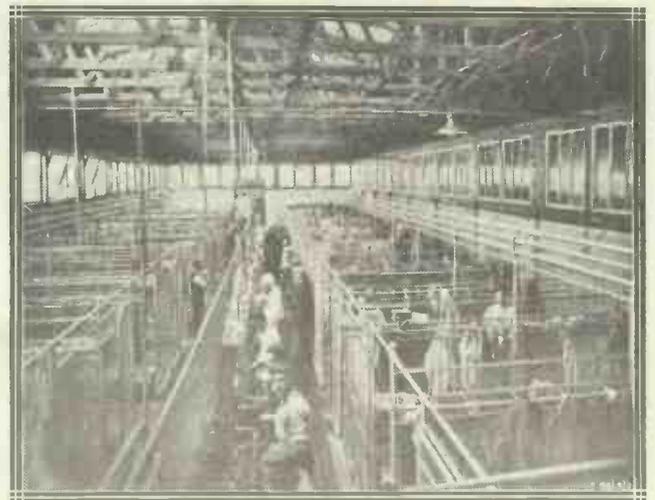
Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

in gold in large letters on it is "Wireless Licence." A ring is provided for hanging it on the wall if required. It is quite a satisfactory arrangement, and should achieve some popularity.

PUSH-PULL TRANSFORMERS.

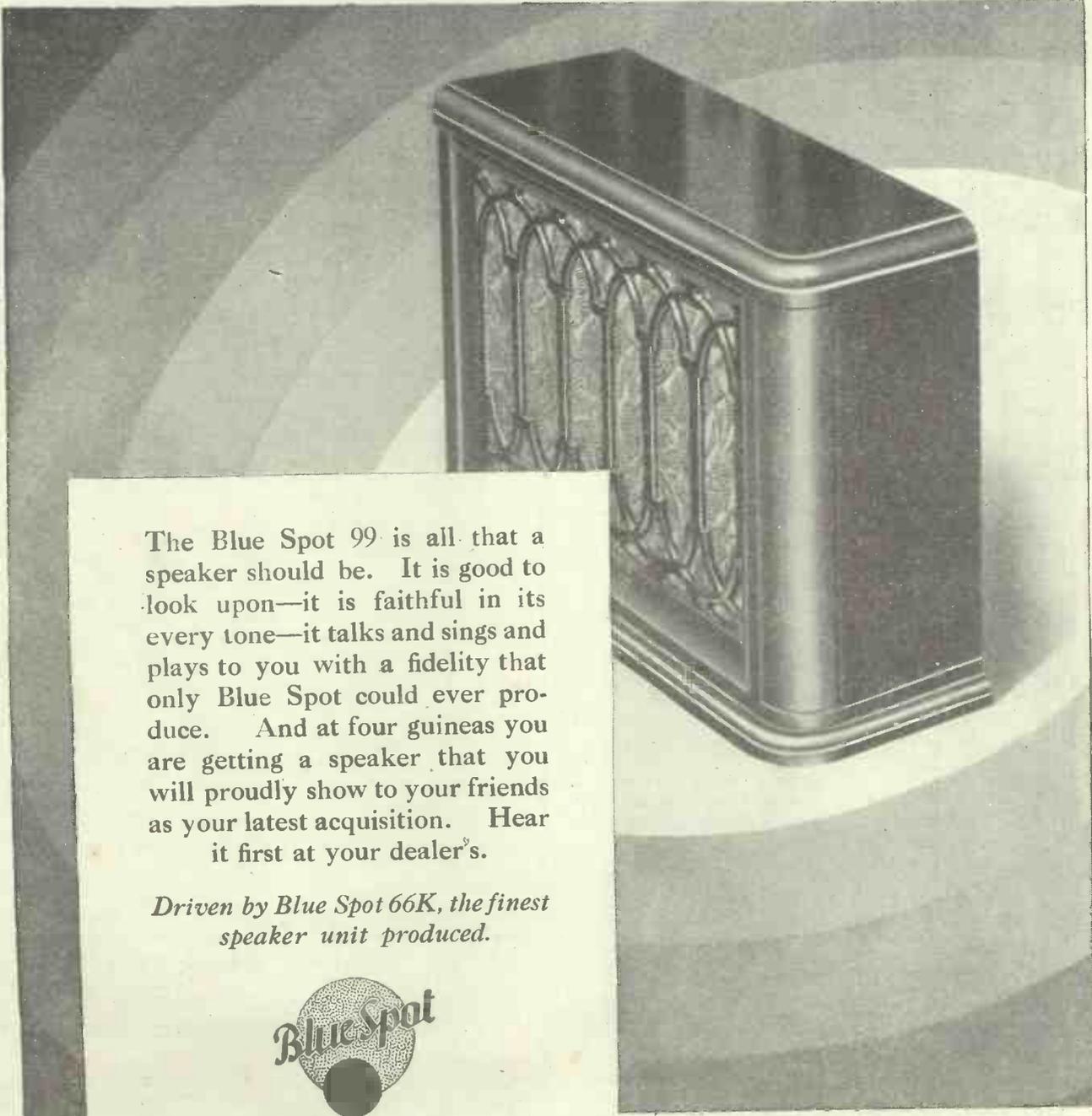
In our issue of September 14th a "Radio-torial" correspondent asked whether he could use certain apparatus for Push-Pull output purposes. Commenting on this, Ferranti Ltd. inform us that their Push-Pull list W.C.412 includes charts and data which enable constructors to estimate the required ratio in any particular case. Copies of this useful list are available for anyone interested in the subject. Directly referring to our correspondent's query, Messrs. Ferranti say:

"We should like to comment on the question of using separate chokes or transformers for push-pull, and would point out that this arrangement nullifies one of the very great advantages of the push-pull arrangement, namely, the absence of D.C. magnetisation of the output component, which is vital in obtaining good reproduction, particularly of the lower register."



A workman's cloakroom at the Exide works. The Chloride Accumulator people devote much attention to the welfare of their staff.

BLUE SPOT 99—£4:4:0



The Blue Spot 99 is all that a speaker should be. It is good to look upon—it is faithful in its every tone—it talks and sings and plays to you with a fidelity that only Blue Spot could ever produce. And at four guineas you are getting a speaker that you will proudly show to your friends as your latest acquisition. Hear it first at your dealer's.

Driven by Blue Spot 66K, the finest speaker unit produced.



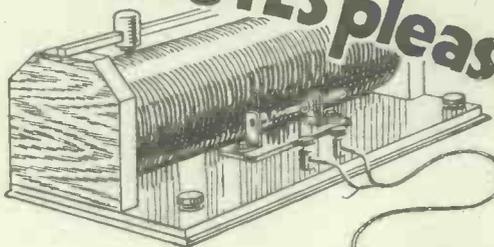
F. A. HUGHES & CO., LIMITED, 204-6, Great Portland Street, London, W.1

'Phone: Museum 8630 (4 lines).

Distributors for Northern England, Scotland and North Wales: H. C. RAWSON (SHEFFIELD & LONDON) LTD., 100 LONDON ROAD, SHEFFIELD. 'Phone: Sheffield 26006; 22 ST. MARY'S PARSONAGE, MANCHESTER. 'Phone: Manchester City 3329.

DO YOU REMEMBER?

Stand by for 5 MINUTES please!



That used to be the usual finish to each broadcast item. Sometimes it was ten minutes—sometimes even fifteen, somehow we didn't seem to mind then. What was a few minute's silence here and there in a wonderful "Wireless" programme? It wasn't a programme as we know it now either—only a couple of hours in twenty-four—but we enjoyed it to the full. Now we ask for better things—but that was seven years ago. Yet, even then—and years before too—T.C.C. Condensers were being used in transmitter and receiver alike. They were the standard of those days—they are still the standard to-day. Remember this when next you want a condenser—use only the "condenser in the green case"—and be safe.



T.C.C. Condensers are made in types for all purposes. Here is illustrated a 2,000 mf. Electrolytic Condenser, price 15s. od. There is also the Double Type—4,000 mf.—price 27s. 6d., and the new 500 mf. 40 v. Type, price 20s. od.

T.C.C. CONDENSERS WERE USED THEN

Adv. Telegraph Condenser Co., Ltd., Wales Farm Rd., N. Acton, London, W.3



M.P.A. COMPONENTS —BEST IN RADIO!



MADE TO A STANDARD THAT SETS A STANDARD!

M.P.A. ELIMINATORS

Wide research and experience are behind these new components. Every Eliminator is tested to over 1,000 volts A.C. for breakdown and complies in every way with I.E.E. regulations.

UNIVERSAL MODEL A.C. For input voltages from 200-250 volts. Supplies H.T. in 6 Tappings from 200/60 volts, output at 200 volts 50 Ma. L.T. (A.C. 4 v. — 4 amps.). Grid bias in 20 one volt steps. Price £12 10 0. (Exclusive of Marconi Royalties).

GENERAL PURPOSE MODEL A.C. For input voltages from 200-250 volts. Supplies H.T. in 6 Tappings from 200/60 volts—output at 200 volts, 50 Ma. L.T. for ordinary (D.C.) valves variable 2/6 volts, and Grid Bias, 20 one volt steps. Price £16 16 0. (Exclusive of Marconi Royalties).

POWER MODEL A.C. For Public Address Systems and Power Amplifiers. For input voltages from 200-250 volts. Supplies H.T. 400 volts and six for 200/60 volts. Output at 400 volts 100 Ma. Output at 200 volts 45 Ma. L.T. (A.C.) valves 4 volt and 6 volt. Grid Bias 20 one volt steps and one variable supply to 150 volts. Price £23 0 0. (Exclusive of Marconi Royalties).

M.P.A. CHOKES Power Smoothing Choke (Type SM/500).

EXCEPTIONAL EFFICIENCY! FIRST-CLASS WORKMANSHIP! Carrying capacity 500 milliamps, suitable for smoothing in power amplifiers. Tested to over 1,000 volts for breakdown. Complies in all respects with I.E.E. regulations. Price 60/-.

M.P.A. Chokes, L.F. Maximum inductance at full load. No increase in temperature. Comply with I.E. Regulations. Tested to over 1,000 volts A.C. for breakdown.

"A" Series:		Carrying Capacity
30 Henries	.. .. .	170 m.A.
50 Henries	.. .. .	90 m.A.
150 Henries	.. .. .	55 m.A.
Price 37/6		
"B" Series:		Carrying Capacity
30 Henries	.. .. .	55 m.A.
50 Henries	.. .. .	28 m.A.
150 Henries	.. .. .	12 m.A.
Price 25/-		

M.P.A. MAINS TRANSFORMERS

High Efficiency with first-class workmanship. Tested to over 1,000 volts A.C. for breakdown. Comply with I.E.E. Regulations in every respect. Blue print of suggested circuit supplied with each transformer.

AMT/50—Primary tapped for all A.C. voltages. Secondary 200 + 200 volts. Full wave. 45 milliamps output. Filament-heating 2 volts + 2 volts — 4 amps. output 2.5 volts + 2.5 volts 2 amps. output. Price 65/-.

AMT/100—Primary tapped for all A.C. voltages. Secondary 400 + 400 volts full wave. 100 milliamps. output. 200 + 200 45 Ma. For G.B. or intermediate or both. Filament heating 4 + 4 volts — 3 amps. output, 2 + 2 volts — 3 amps. output, 2.5 + 2.5 volts — 2 amps. output, 2.5 + 2.5 volts — 2 amps. output. Price 105/-.

M.P.A. CHANGE OVER SWITCHES

SILVER-GOLD ALLOY CONTACTS. HIGH-CLASS PRECISION WORKMANSHIP. Rotary cam switches of very low capacity. Positive contact in each position. Highly efficient.

TYPE "A"—3-pole 2-way switch with additional adjustable pair of contacts. Ideal for radio gramophone combinations. Price 9/-
TYPE "B"—3 pole 2-way switch. Price 7/6
TYPE "C"—2-pole 2-way switch. Price 6/6

M.P.A. POTENTIAL DIVIDER

For H.T. and G.B. supply. Another product of the M.P.A. Research Laboratory. 20,000 ohms resistance for Grid Bias and 2,000 ohms (heavy duty) for H.T. supply. 8 values H.T. 20 tappings G.B. in one volt steps. Carrying 50 Ma. on H.T. Tappings. Price 7/6

SEE THEM ON STANDS 21 & 22 at the MANCHESTER RADIO EXHIBITION.

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All the best dealers stock M.P.A. Products. M.P.A. WIRELESS LTD. (Dept. 3), Radio Works, High Rd., Chiswick, W.4





IMPROVING LOUDSPEAKERS

Though somewhat old-fashioned, the horn loud speaker is certainly not to be despised, and many little improvements can be effected by such "wangles" as are described in this article.

By J. F. CORRIGAN, M.Sc., A.I.C.

WIRELESS reproduction certainly may not reach its peak of efficiency when it is obtained through the agency of the many little horn-type loud speakers which used to be on the market, and which still function nightly in many an amateur's home, but nevertheless the man who, without more ado, places these instruments in the category of "duds" and "wash-outs" whenever you happen to mention

should be satisfied with the instrument in that particular respect.

The trouble with many of these small speakers, however, is that they are inclined to be shrill and rattly, particularly on the higher notes. Moreover, some of them hardly deliver the bass notes at all. In this latter respect, however, little can be done to improve the instrument, but much of the shrillness, rattle, and buzz which sometimes accompanies the reproduction given by these instruments can be done away with completely.

A Detector Dodge.

For instance, the very simple expedient of supporting a small horn-type loud speaker on a camera tripod is capable of getting rid of much of the extraneous noise of the reception. The reason being in most cases that the speaker can be kept clear of surrounding objects which would be liable to vibrate, and also that the height of the instrument can conveniently be adjusted to a suitable degree. Incidentally, this method of supporting a small loud speaker is an excellent one for outdoor work, and also for testing and experimental purposes where the instrument is required to be transported rapidly from place to place.

Another way of improving the tone of a loud speaker which is worth a trial is to connect a crystal detector *in parallel* with the terminals of the speaker, as shown in the close-up photograph, Fig. 1. The crystal detector tends to filter away any small distortion which may be present. If, of course, the resistance of the detector is too low, too much of the current will leak across it, and the reception strength of the speaker will certainly not be improved. However, if a spare detector of the permanent, semi-permanent, or cat's-whisker type is handy, a trial of this nature is worth making.

Paper Protection.

Very often, horn-type loud speakers, big and small alike, give bad tone owing to dirt having collected upon the diaphragm, or to the latter having become rusty. The remedy for this type of trouble is obvious, and it can be prevented from recurring more or less simply by gluing a piece of thin but tough paper over the stem of the speaker, as shown in the illustration, Fig. 2. For merely trial purposes, the paper may be fastened down by means of a tightly-fitting rubber band, but, as a permanent fitting, it is best glued down.

This device entirely prevents dust and

dirt from settling upon the diaphragm, and, if any slight diminution in the strength of reception is apparent, it can be removed by pricking a few holes with a needle in the paper cover. In most cases, however, no decrease in the reception strength will be noticed.

The Flannel Bandage Treatment.

The resting of a small loud speaker upon a sheet of glass, supported upon corks, as illustrated at Fig. 3, will go a very long way towards ridding the reception of any objectionable accompaniment of rattle. Such a method of supporting a loud speaker is very useful in those cases in which the instrument is liable to vibration from external causes. A purer tone is afforded, and distortion minimized.

"Throaty" speakers of the diminutive horn type can generally be cured by wrap-



Fig. 1. A permanent crystal detector across the input terminals is well worth trying.

their name, makes a very great mistake indeed.

The output strength of a small horn-type loud speaker is more or less fixed. Beyond reasonable limits you cannot improve it without introducing the most appalling distortion into the reception, and, therefore, provided that one obtains a reasonably comfortable volume of reception from one of these diminutive speakers one



Fig. 2. Thin but tough paper will prevent dust from settling on the diaphragm.



Fig. 3. The loud speaker rests upon a glass sheet, supported by corks.

ping a long strip of flannel around the stem of the speaker, as illustrated in the heading photograph. The appearance of a speaker so treated is certainly not very elegant, even under the best of conditions, but the improvement in tone which the treatment will often effect is nothing short of amazing. If, therefore, your loud speaker suffers from a sort of perpetual death-rattle, if it appears to have rheumatism in its throat, and if it evinces any objectionable "booming" propensities, try the flannel bandage treatment illustrated above.

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RADIOTORIAL

All Editorial communications to be addressed to the Editor, POPULAR WIRELESS, Tallis House, Tallis Street, London, E.C.4.

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The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

CONNECTIONS FOR A SELECTIVE CRYSTAL SET.

M. L. (Newbury Park).—"I understand that the B.B.C. recommend a double circuit crystal set (whatever that may be), so that when the second programme is sent out from Brookman's Park, even a crystal set will be able to receive on either wave-length without interference from the other transmissions.

What are the connections for a circuit of this kind, and what are the parts required?

You will need a two-coil holder and the pair of coils, two variable condensers (.0005 mfd.), a crystal detector, and a .0003-mfd. fixed condenser (this latter may sometimes be dispensed with). On the panel you will need aerial and earth terminals, and a pair of telephone terminals, and if possible the various connections should be soldered and not merely tightened with pliers.

The earth terminal must be joined to the moving plates of both the variable condensers, to the fixed and the moving coil holder, to one of the telephone terminals, and to one side of the .0003-mfd. fixed condenser. The remaining side of this fixed condenser is then joined to the remaining telephone terminal and to the crystal detector.

The other side of the crystal detector goes to the remaining side of one of the .0005-mfd. condensers,

and to the nearest coil holder. If we suppose that this is the fixed coil holder, the remaining one will be the moving, and the vacant side of this should be joined to the vacant side of the other tuning condenser, and also to the aerial terminal.

This completes the wiring, and in operation you will soon find that tuning is quite easy, and by varying the position of the coils relative to each other the selectivity varies to the required degree.

WIRING UP A ONE-VALVER.

C. L. (North Kensington).—"In 'P.W.' you gave the connections for a one-valve Hartley circuit which I thought I would like to make up. Unfortunately I do not understand you when you say, for instance, 'remaining side of the aerial coil holder to earth terminal, to a flexible lead which must be connected to the centre tap on the grid coil, to L.T. —, H.T. — and to one of the filament terminals.' Do you mean that several wires run from the coil holder to the above-named points, or that a wire runs from the coil holder to the earth terminal, then to the grid coil, from the grid coil to L.T. — and then to H.T. — and filament?"

When several points have to be connected together, as so often happens in a wireless set, there is no need to run separate wires from point to point, but if they all lie in a straight line, one straight wire will connect up the lot just as well as separate wires.

In this case, for instance, we have to connect up one side of the aerial coil holder, the earth terminal, the centre-tap on the grid coil, the L.T. —, the H.T. —, and one of the filament terminals.

If all these various components, etc., happened to be fixed to the set in line, then one straight wire can run straight down the lot, and so wire them together by touching each point as it passes. Owing to considerations of space, however, these points never are in a straight line.

The best way to wire up is to use a minimum of wires, the exact positions being a matter which has to be decided by the designer of the set, or left to the constructor or experimenter who is fitting up the various parts. The idea to bear in mind is that all these points must be connected together by as few wires as possible, travelling by as short routes as possible, and it does not matter a bit in what order they are connected together, provided all the points are touched in turn.

(Continued on page 226.)

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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 224)

When one wire is fixed to another wire (either soldered to it or screwed firmly down to it) they are in effect one connection, so that if you were connecting up as directed above, and then found you had omitted to join, say, the H.T. — terminal to the other points, you could take a lead from it to either the coil holder or to the earth terminal, or to the filament terminal, and it would not matter in the least to which of these points it went so long as you joined the H.T. — terminal to one of the points mentioned. For efficiency's sake, remember that all wires should be kept as short and direct as possible.

A TWO-VALVE SHORT-WAVER.

T. E. (Cardiff).—"Is it possible to adapt the 'Sydney' Two or the 'Titan' Two for plug-in coils? I am desirous of making a short-wave set which I intend to use for short-waves only. If you could give me the connections for the circuit, I would be pleased. I have a copy of the 'P.W.' which shows a plan of the short-wave 'Titan,' but I have a set of Igranic short-wave coils, and if possible I would like to make use of them instead of the one coil."

The "Titan" Two blue print is now out of print, but the "Sydney" Two blue print is No. 32, and could be obtained from the Query Department, price 6d. (postage extra). Unfortunately this does not use plug-in coils such as you wish to employ, so we suggest in the circumstances that you should use the 1929 Antipodes Adaptor, since this employs plug-in coils, and would appear to exactly fulfil your requirements. (This was described in "P.W." No. 375, August 10th, 1929.)

"TITAN" COIL UNIT FOR TUNED ANODE.

G. M. (Canterbury).—"My set has one screened-grid H.F. valve, detector, and two low-frequency stages, and the screened-grid operates on the tuned-anode principle, for which I have been using plug-in coils, so as to change if I wanted long waves.

"Recently I tried out a 'Titan' Unit instead of coil changing for the aerial side of this receiver, and I have been staggered by the improvement in reception and the convenience of just pulling in and out the switch when wanting to change from one wave-length to another. Consequently I wish to do the same by the anode circuit, but I am very uncertain of the connections, and should be glad if you could tell me these in order that I may employ a 'Titan' unit in this connection also."

You will need to disconnect everything between the plate of the S.G. valve and its reaction condenser, and remove the coils, etc., substituting in their places the "Titan" coil unit, being careful to ensure that the spacing, etc., of this (and of leads to the switch) is adequate. The connections are not difficult, as will be seen from the following:

Reaction condenser should be connected to R, on the "Titan" unit and R, on it should be joined to that S terminal which is joined to the O. on the loading-coil, and also to one side of the switch. (The "aerial" winding (primary) will not be used under the new arrangement.)

The 216 tapping on the coil, and the S terminal to which it is attached, should be joined to the second side of the three-point switch, the third contact of this (the one which carried the flexible lead) should be joined to H.T. positive and to one side of the variable tuning condenser. The remaining side of this variable condenser is joined to the plate of the screened-grid valve, to the grid-coupling condenser, and to the G terminal on the unit.

REGIONAL RECEPTION.

M. J. (Norwich).—"A man I travelled to London with the other day, was telling me of the wonderful results he had got with a 'Brookman's' Three valve set which he had taken from your paper, consisting of an H.F., Det. and L.F., using either a pentode or power valve in the last stage. Where was the set described, and is it really super-selective, as he made out?"

The full description of this receiver will be found in the September number of "Modern Wireless," and the set really does give remarkable selectivity on account of its special circuit, the design of which was based on the "Kuttemout" Two, described in POPULAR WIRELESS.

USING A POTENTIOMETER TO PREVENT HUM IN D.C. SET.

M. L. S. (Leyton).—"Some time ago in 'P.W.' you gave a stunt whereby a potentiometer could be used across the filament of the detector valve to prevent hum in a D.C. mains-driven set. I believe anode-bend rectification was used, and I should be glad if you would give me the connection for this, as I have mislaid the copy."

The arrangement in question was one in which an H.F. choke was used in place of the ordinary resistance to supply the negative voltage to the grid of the detector valve in order to provide the necessary anode-bend rectification conditions. The potentiometer was one of 400 ohms or more resistance, and was connected across the two "legs" of the detector filament, the slider being taken to the positive terminal of the anode-bend grid-bias battery.

The negative side of this battery is connected to one end of the choke, and the other end of the choke is connected to the grid of the detector valve and to the fixed condenser used for coupling.

WAS IT ATMOSPHERICS?

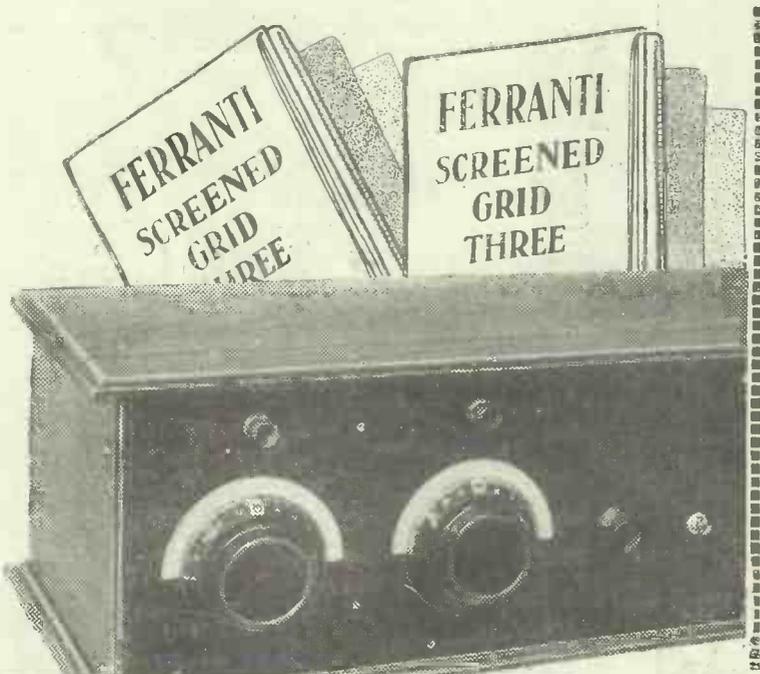
"TROUBLED" (Cardiff).—"Lately I have been getting a lot of scratching or frying noises, and some of my friends tell me these are atmospherics caused by lightning, and others say one of my resistances is wrong. Is there any way of making sure?"

Usually a fault which is due to a faulty resistance is more or less continuous, whereas atmospherics depend upon weather conditions. One rough and ready guide as to whether or no the noises are due to atmospherics is to disconnect the aerial and earth from the receiver, and if the noises continue when this is done, you can be fairly sure that they are due to one of the components inside the set having become defective.

PREVENTING H.T. BATTERY SHORTS.

"CONDENSER CONTROL" (Ipswich).—"Reaction is controlled on the condenser Reinartz principle, and I wish to add a fixed condenser in-series with the reaction condenser to prevent

(Continued on page 228.)



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The Set—

for the home constructor with a true appreciation of quality in radio reproduction.

The full-size free constructional chart makes assembly simple, and satisfaction certain. Ask your dealer, or write direct for a copy.

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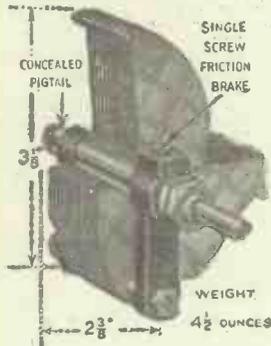
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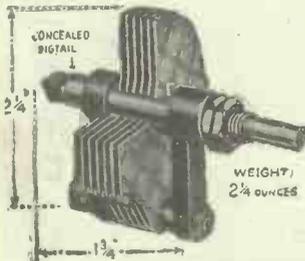
- 0005
- 00035
- 00025
- *•00015

4/6 each

*Double spacing of vanes for Ultra-Short Wave work.

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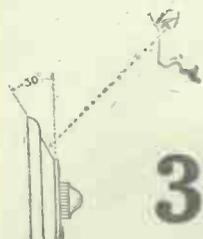
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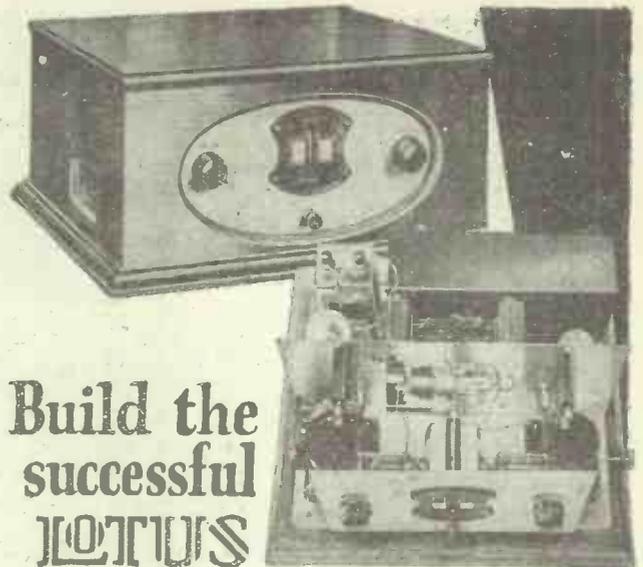
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The kit is complete without valves, batteries and cabinet and the main components are already mounted. Follow the simple diagrams and instructions given free and you can have a new Lotus S.G.P. in a few hours.

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Name.....

Address..... P.W.5/10/29

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 226.)

shorts. I am told that a .001 is O.K. the value of the reaction being .0003 mfd. I have a .001 on hand and should like to use it. Is it O.K.?"

Yes, the extra condenser added in such circumstances should have a capacity much larger than that of the reaction condenser, and .001 being considerably greater than .0003, is quite suitable.

RANGE OF A B.B.C. STATION.

"COLONIAL" (London, S.W.1).—"I am amazed at the strides which have taken place in broadcast developments since my absence abroad and I find I am completely out of touch with developments to-day. One thing that interested me and which is apparently known to everyone else so that it is never mentioned in print, is the range of the various stations. On my three-valve set I can get plenty of foreigners but very few British stations, and I should like to know what is the estimated range of these latter?"

According to the B.B.C.'s own estimate, the following ranges are those at which really satisfactory reception is possible on the average receiver. Daventry 5XX covers nearly the whole of the British Isles, though at extreme ranges some fading and night distortion may make its appearance at time, especially in mountainous districts.

Daventry 5GB and any new regional transmitters = 80 to 100 miles. London 2LO 30 to 35 miles. Other main stations, i.e. Aberdeen, Belfast, Cardiff, Glasgow, Manchester, etc., 25 to 30 miles.

Bournemouth and Edinburgh have higher power than the remainder of the relay stations, the range of the former (6BM) being estimated at 15 to 20 miles and of Edinburgh of from 5 to 8 miles. The other relay stations, i.e. Bradford, Dundee, Hull, Leeds, Liverpool, Plymouth, Stoke-on-Trent, Swansea, have an estimated range of from 3 to 5 miles.

In certain circumstances good reception is obtainable at ranges far greater than these, and B.B.C. stations are received very well on the Continent,

being in fact picked up much more easily there than in certain parts of our own country. The above figures, however, are based on the service range, i.e. direct ray reception only, and take no notice of the reflected ray reception which is obtainable after nightfall.

THE JUDGMENT OF PARIS.

"PUZZLED" (Nr. Coventry).—"At times I get mixed up with the two long-wave Paris stations, and cannot judge which is Eiffel

with the words "Radio-Paris" occurring, which, of course, is not done in the case of Eiffel Tower.

Eiffel Tower (which employs equal power, works on a lower wave-length (1,444 metres).

THE "REGIONAL" THREE.

"REGIONAL" (Rickmansworth).—"What parts are covered and where can I get details of the 'Regional' Three?"

Details of this set were given on the "P.W." Blueprint Circuit No. 46. The components required are as follows:

- 1 Panel, 14 in. x 7 in. x 1/2 in. or 2 in.
- 1 Cabinet to fit, with baseboard about 10 in. deep.
- 1 .0005-mfd. variable condenser, preferably slow-motion type or with vernier dial.
- 1 .0001 or .00015-mfd. miniature-type reaction condenser.
- 2 On-off switches (one must be of the push-pull type commonly used for wave-change switching. Note flex lead soldered to tip of plunger).
- 1 Standard loading coil.
- 3 Single-coil sockets.
- 3 Sprung valve holders.
- 1 R.C. coupling unit, anode resistance about 250,000 ohms, grid leak 1 or 2 meg.
- 1 L.F. transformer of fairly low ratio.
- 1 Fixed condenser of .0003 mfd. and one .001 mfd.
- 1 Grid leak of 2 meg. and one of 1/2 meg. each with holder.
- 1 H.F. choke.
- 1 Terminal strip, 12 in. x 2 in., and 8 terminals.
- Battery plugs, flex, wire, screws, etc.

ACCESSORIES.

- 1 Power and 2 H.F. type valves.
- Plug-in coils, Nos. 25, 35, 50 and 60.
- H.T., L.T., and G.B. batteries.
- Phones or loud speaker.

THE RUN-DOWN H.T.B.

D. C. (Amersham, Bucks).—"I am using a 'Cossor Melody Maker,' but find that while the quality was splendid at first, it is now falling off very rapidly, and the set has become quite harsh and tinny compared with what it used to be.

"A friend who knows a bit about this kind of thing, suggested the high-tension battery

(Continued on page 230.)

Mark Antony Said—

"LEND ME
YOUR EARS"



But if you build
The Magic Three

—to be described Next Week—

You'll want 'em yourself!

Tower and which is Radio-Paris. What is the exact wave-length of the latter and is there any distinction of signals by which these can be identified?"

The present wave-length used by Radio-Paris is 1,725 metres and there are frequent announcements

TWO VOLTS

Universal	.1 amp.	5/6
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Super H.F.	.18 amp.	5/6
Super-Power	.15 amp.	7/6
Hyper-Power	.3 amp.	9/6
Pentodion	.3 amp.	18/6

5/6 UNIVERSAL

FOUR VOLTS

Universal	.075 amp.	5/6
Resistor	.075 amp.	5/6
Super H.F.	.075 amp.	5/6
Super-Power	.1 amp.	7/6
Hyper-Power	.15 amp.	9/6
Pentodion	.15 amp.	18/6

POWER 7/6

DARIO

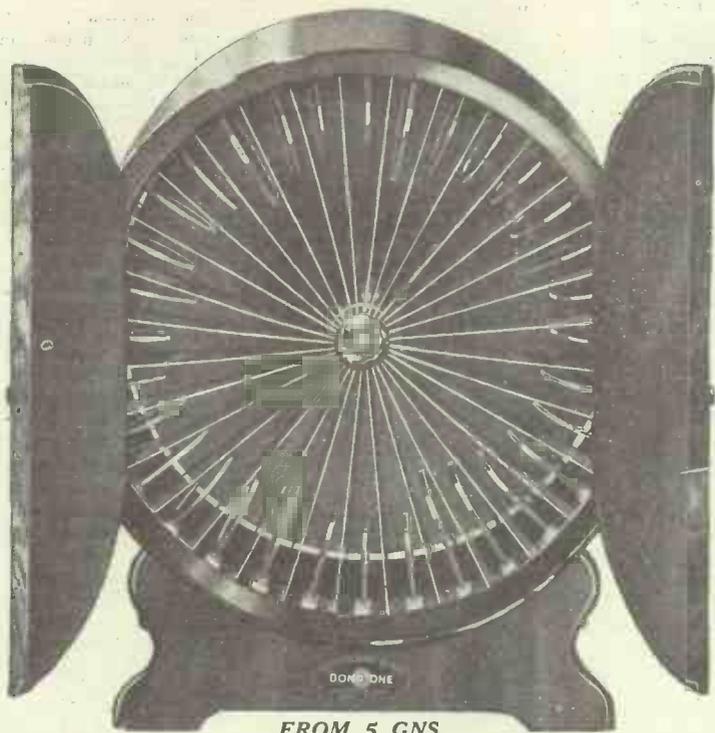
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The phenomenal success of the British General Tuning Unit during the past year and increased production in all directions have enabled us to reduce considerably overhead charges and to make a big reduction in the cost to the public. And besides being cheaper it is better. The reversible moulded dial is now marked with white filled degrees and figures. Owners of last year's model who desire one of the new dials can obtain same for 1/-. And remember that this new A.T.U. gives you all wave lengths between 220—2,000 metres on one dial.

From all Dealers of
Repute or direct from

**BRITISH GENERAL MANUFACTURING
COMPANY LIMITED**

Brockley Works, - - - London, S.E.4

REDFERN'S REG. NO. 469456. **Ebonart** NON-METALLIC SURFACE EBONITE **RADIO PANELS**

Recommended
for
"FERRANTI"
S.G.
RECEIVER.

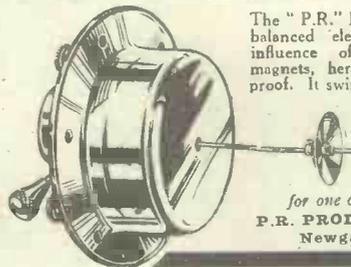
MAXIMUM INSULATING PROPER
TIES AND LEAK-FREE SURFACE
Consider an "EBONART" Panel a
necessity, especially when constructing
a set employing H.F. STAGES.
Supplied in Black and Mahogany
colours. One side Polished Surface
or Moire Silk Design.

REDFERN'S RUBBER WORKS Ltd.—Hyde, Cheshire

THE NEW LOUDSPEAKER ALL THE REFINEMENTS OF THE MOVING COIL

ONLY
12/6

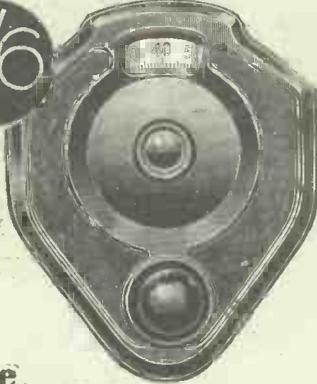
The "P.R." Unit will reproduce every note as clear as a bell—the full depth of the big drum to the harmonics of the violin—the reality of the performance will surprise you. Try one—give your set a chance to show what it can do.
SUPERIOR IN TONE VOLUME



The "P.R." Loudspeaker Unit is driven by a fully-balanced electro-magnetic armature under the influence of powerful cobalt steel, permanent magnets, hermetically sealed and absolutely foot-proof. It swings to the weakest impulse, bringing out the treble notes and the rich double bass of the organ. Fitted with a simple tonal adjustment that "stays put." Most powerful Unit giving full strength from a 2-valve set!!! No extra H.T. Ask your dealer for one or send your remittance direct to—
P.R. PRODUCTS, Dept. S.2, P.R. HOUSE,
Newgate Street, London, E.C.4.

Brownie

3/6



the
DOMINION
Slow Motion Dial

A VERNIER Dial at 3/6! Bring your set up-to-date by fitting this slow-motion dial. The mechanism is of special non-backlash construction which makes very fine tuning easy. Finished in smooth black or beautifully grained mahogany bakelite, this unique dial gives high-class finish to every set in which it is included.

Brownie

wireless

Nelson Street Works,
London, N.W.1.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 228.)

was running down, but I have only had this one in use three months, and it is of first-class British make, of the type shown on enclosed leaflet. Do you think that a battery of this

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared, and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers an unrivalled service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this an Application Form will be sent to you free and post free immediately. This application will place you under no obligation whatever, but having the form you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS PLEASE NOTE: Inquiries should NOT be made in person at Fleetway House or Tallis House.

make should last only three months, or what do you think the fault is, if it is not the battery?"

We are afraid that the battery is the source of the whole trouble. Although it is of good make, the one

marked by you is really *too small* a battery to supply the current required by your three valves, and consequently you have been overworking it, thus shortening its life very considerably.

A battery of inferior make would not have lasted as long as three months under the circumstances, but we feel sure that if you buy a battery of the same voltage and make; but of *larger* capacity, you will find that although it costs more, it will give infinitely longer service owing to the fact that the current supply demanded of it will be well within its power.

THE KIND OF COIL.

H. S. V. (Leighton Buzzard).—"Will an ordinary split-primary coil do for this set instead of the binocular coil which was recommended?"

Not in the particular set to which you refer, although sometimes an ordinary coil can be used instead of a binocular. In this instance, however, the space around the coil is very limited, and the designer of the set was forced to use a binocular instead of an ordinary coil to avoid damping effects.

TINNING THE SOLDERING IRON.

"TIN HAT" (Luton).—"How should a soldering iron be prepared or 'tinned,' and does this operation have to be done every time the iron is used?"

A well-tinned soldering iron can be used frequently and will remain properly tinned if put away for a time, so that it is worth going to a little trouble to tin the iron properly. The actual tinning consists simply in providing the business end of the iron with a thin layer of solder.

To do this you must first of all clean the tip of the iron, for about three-quarters of an inch back from the end, by filing it carefully. (A particularly good job is made by finally polishing the surface with emery cloth.) Heat the iron as if for soldering, and whilst it is still hot spread a thin layer of flux on the tip of the iron, immediately after rubbing the tip on a few pieces of soft solder placed on a tin lid.

If the iron is properly heated, the solder will adhere to the tip of the iron and form a bright coating all over it. This will last for a long time, but will need renewal if iron is overheated, when it must be re-tinned in the same way again. Always have a clean cloth handy when soldering, so that the tip occasionally may be smoothed on this, and any impurities or dirt removed as soon as noted.

The New Osram MUSIC MAGNET

YOURS
for **10/10**

6 MAGNETS

1. Single Tuning Control.
2. No changing of Coils.
3. No soldering.
4. The simplest to assemble.
5. Widest possible choice of stations.
6. No aerial oscillation.

Complete with Solid Oak Cabinet guaranteed throughout by the G.E.C. More stations, selectivity and volume. Can be assembled and wired by a novice in 90 minutes.

To WARNER'S (Dept. P.W.), 12, Norton Folgate, Bishopsgate, E.1.

I enclose P.O. value 10/10d. being first payment for your guaranteed Osram Music Magnet Kit.

Name

Address

The latest Screened Grid circuit and the best components at the lower initial cost, and the balance is payable in 12 payments of 10/10d. Where will you find such wonderful value. There is no need to wait, just pay WARNER'S for your pleasure in easy monthly payments. All that is necessary to secure the set of the season is to send us your name and address and 10/10d. when the complete Kit will be sent to you direct from WARNER'S, the largest stockists of wireless goods in the country.

Let us know your requirements.

Any article can be obtained through us on Easy Terms (Ireland & Overseas excepted). All products stocked by us (and we are the largest radio stockists in the country) are from reputable makers.

Phone: BISHOPSGATE 8010.

WARNER'S

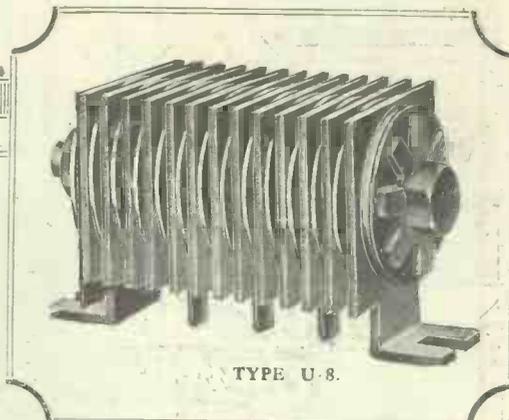
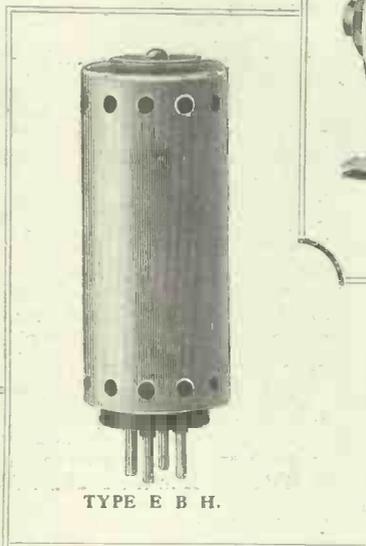
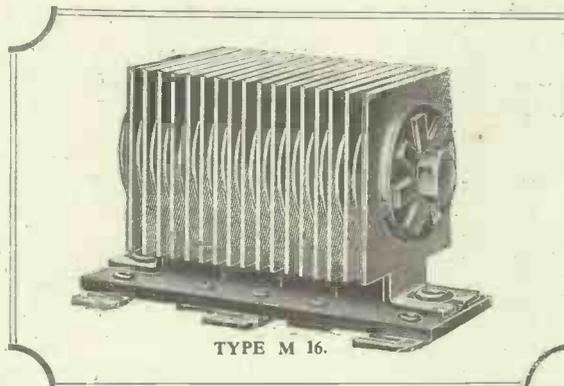
RADIO CORNER.

12, NORTON FOLGATE,
LONDON, E.1.

IGRANIC-ELKON

**METALLIC RECTIFIERS
SUPERSEDE FRAIL
RECTIFYING VALVES**

FOR ACCUMULATOR CHARGING
FOR L.T. SUPPLY UNITS
FOR H.T. SUPPLY UNITS



**LONG LIFE
WITH
DEPENDABLE SERVICE**

WRITE TO DEPT. R 130
FOR FULL
PARTICULARS.



**YES! BECOL
ARE PRIZE WINNERS
AND PANELS GUARANTEED.**

TESTED TO 104,000 VOLTS
LOOK FOR TRADE MARK
DO NOT BE PUT OFF WITH AN IMITATION

Send for copy of BECOL Handbook on Wireless Circuits, general data and illustrations of windings. Post free 4d.

Sole Makers:
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"HARBROS" (Regd.) TWIN EASYFIX FLEX

(Regd. Patent)
THE CAPACITY REDUCING FLEX
FOR LOUDSPEAKER EXTENSIONS

Ask your Dealer for a 12 yard sample packet
with Fixing Pins. Price 3/-

Or send direct to:—
HART BROS. ELECTRICAL MFG. Co., Ltd.
QUEENSWAY, PONDER'S END, MIDDLESEX

WHY PAY 10/6 FOR A VALVE? HERE IS JUST 4/6 AS GOOD FOR ONLY 4/6

LIST OF P.R. SUPER GOLDEN SERIES.						
	Type.	Fil. volts.	Amp.	Imp. ohms.	Amp. fac.	
4/6 EACH Post id.	GPR 22	.095	24,000	13.5	H.F. Det.	
	GPR 32	.095	12,000	9	L.F.	
	GPR 42	.095	40,000	32	R.C.	
	GPR 9 3.5-4	.09	22,000	14.5	H.F. Det.	
	GPR 10 3.5-4	.09	10,000	9	L.F.	
POWER 7/6 EACH Post id.	GPR 11 3.5-4	.09	44,000	41	R.C.	
	GPR 17 5-6	.14	20,000	17.5	H.F. Det.	
	GPR 18 5-6	.14	11,000	9.5	L.F.	
	GPR 19 5-6	.14	75,000	41	R.C.	
	SUPER- POWER 12/6 EACH Post id.	GPR 20 2	.15	6,000	7	Power
GPR 40 4		.15	6,000	7	"	
GPR 60 5		.15	6,000	7	"	
SCREENED GRID 15/- Each Post id.	GPR120 2	.3	3,000	4.5	Super Power	
	GPR140 4	.2	3,500	4.5	"	
	8G 25 2	.2	220,000	150	S.G.	

Why pay fancy prices when you can get a perfectly finished British made valve with a superior coating giving astonishing selectivity with a minimum H.T. consumption, which is the general opinion of the thousands who use P.R. valves. There are many valves on the market but none are guaranteed—Ask yourself why.

The P.R. guarantee covers seven months with the right—not a favour, remember—but a right to exchange the valve under the guarantee. All you have to do is to post any defective valve to us, complying, of course, with the terms of the guarantee which is attached and enclose a note stating defect—You will receive a new valve by return of post.

P.R. PRODUCTS,
9, P.R. HOUSE, NEWGATE ST.,
LONDON, E.C.4

Opposite G.P.O. Tube Station.

POST 4d:
2 Valves or
more POST
FREE.

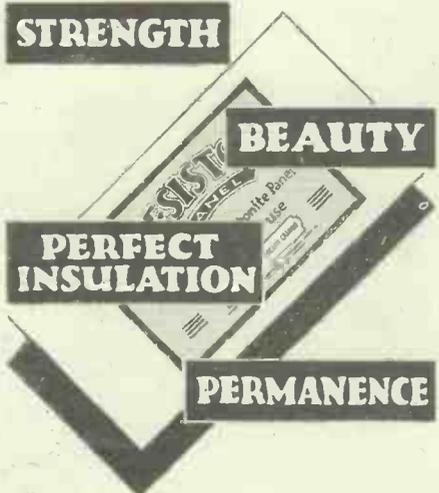


Tell us your set—
we will send correct
valves, Matched
Valves 1/- extra.

Send C.O.D. if desired.

Telephone: CITY 3788.

**ASK YOUR DEALER FOR
THEM. ACCEPT NO OTHER.**



LET the panel of your set be as sound as the components within! Select a panel that will give you long service, and beauty in appearance, too. A Resiston Panel will give a perfect finish to your Set. Distinctive in design, everlasting in strength! Ask your Wireless Dealer to show you a Resiston Panel, or write direct:

THAT'S THE

AMERICAN HARD RUBBER CO. (Britain) LTD., 13a, Fore St., E.C.2.



CAJ 725

BUYING YOUR NEW VALVES.

Some Important Points for Every Valve-Set Owner.

A YEAR ago the screened-grid valve had been known for about twelve months in this country, and the upright model of screened-grid valve was being placed upon the market more or less tentatively, much argument being indulged in as to the relative merits of the horizontal and vertical types of these valves. This year definitely sees the death of the horizontal type, for there are now vertical screened-grid valves of all three voltages, and their efficiency is such that, to put it colloquially, the old horizontal type has been "knocked into a cocked hat."

With the advance of the screened-grid valve we have had an equally rapid advance of the pentode, which is now available in some makes in all three voltages, and in other makes in the 2- and 4-volt series.

Very Muddling.

One would have thought that all lettering as to voltage, amperage, etc., would have been standard in all makes of the valves; but even to-day we get such things as R.C. valves being quoted as "H" by some firms, making the average user think of them as H.F. valves, while others prefer not to have any identification mark for their valves other than H.F. and L.F.,

and to leave the rest, with the exception of, perhaps, a special detector valve, to the knowledge of the user.

Unnecessary Confusion.

The man-in-the-street does not want to waste his time studying the various peculiarities of wireless manufacturers. He wants to get down to business, and to be able to choose his valves without having to look up catalogues and translate the wonderful systems employed.

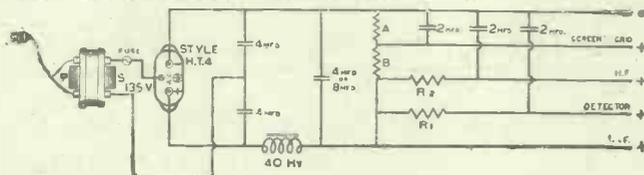
The above extracts are from an article by K. D. Rogers on "This Season's Valves" appearing in the current (October) issue of "Modern Wireless," now on sale everywhere, price 1s. Dealing with the question from the practical point of view, this gives a special review of all types of receiving valves marketed by the various manufacturers for the 1929-1930 season. If you are purchasing new valves for your set, be sure to read this helpful article.

NEXT WEEK

THE
"Magic" Three
with
Free 1/- Blue Print

THE LATEST AND BEST

A new circuit



for a high-tension eliminator which will give 30 milliamps at 180 volts, or 50 milliamps at 150 volts, with full-wave rectification. It is built up round the new

WESTINGHOUSE METAL RECTIFIER

STYLE H.T.4.

which has been specially designed to obtain full benefit from the valuable "voltage doubler" principle.

The price of this rectifier is only 37/6.

Did you get your copy of "The All-Metal Way 1930" at the Radio Show?

The above circuit, and others, are given in this book, together with full instructions.

A copy will be sent on receipt of a 2d. stamp and your name and address.

THE WESTINGHOUSE BRAKE & SAXBY SIGNAL CO., LTD.,
82, YORK ROAD, KING'S CROSS, LONDON, N.1.



EXACTLY RIGHT - every one tested

EDISWAN GLASS-ENCLOSED VACUUM RESISTANCES.

(Grid Leak or Anode)

Ediswan are the only British made resistances of this type on the market. All resistances are thoroughly tested before leaving our works, and are absolutely accurate and noiseless in operation. Obtainable in values from 5,000 ohms to 5 megohms. Overall length, 45 mm.

CARTRIDGE CONDENSERS.

These condensers are ideal for the man who likes to experiment. In a second, you can pull one out of the clips and put in another of a different value. They are made in values from .0001 mfd. to .001 mfd. Overall length, 45 mm.

For the best results.

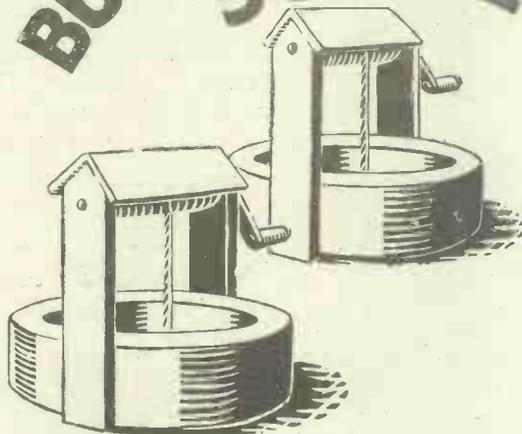


W.3.

EDISWAN

Made only by The Edison Swan Electric Co. Ltd.,
123/5, Queen Victoria Street, London, E.C.4.

**BOTH LOOK
ALIKE
BUT ONE DRIES
SOONER**

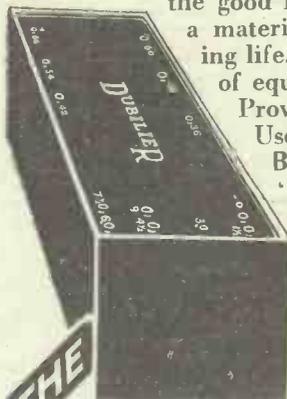


Two wells, equal in diameter, their water content at the same level . . . but one is deeper. One could still be drawn upon long after the other had been exhausted.

So the new Dubilier H.T. Battery differs from all the good makes in having a materially longer working life. No other battery of equal size lasts so long.

Prove this for yourself. Use a Dubilier H.T. Battery in your set now.

"A Bit about a Batter." is an interesting booklet which you can obtain free from your dealer.



SUPERIOR (Single Capacity)	
9 v. - 1/6	66 v. (with G.B. Tappings) 7/11
63 v. - 7/6	99 v. - 11/9
66 v. - 7/9	108 v. - 12/9

SUPREME (Treble Capacity)	
60 v. - 13/6	63 v. - 14/3
100 v. - 22/-	

**THE
DUBILIER
BATTERY**

LONGER LIFE AT LOWER COST.

Dubilier Condenser Co. (1925) Ltd., Ducon Works, North Acton, London, W.3.

B3

**A Happy, No-Drudgery,
Spare-Time
Business
for YOU**



Here is your chance to become a Master Man in a Spare-Time Business which is expanding enormously; one which is competing successfully against large combines.

Just sit down and think over this carefully. Our enormously successful Patents are in great demand everywhere. They have become tremendously popular, and as the Wireless and Electrical Business extends, which it will do and is doing to an unthinkable degree, this demand will increase proportionately. We will Licence you to manufacture our articles under our own Patent Rights, so that you can participate in the Big Profits.

**Profits
Guaranteed!**

No 'Plant' Needed.

No special knowledge or skill is needed, and of your market being over-crowded. If necessary we will purchase all your stocks no expensive "plant" or machinery of any kind is required, and, even though you have the slightest knowledge of Electricity or Wireless, you can commence to turn your spare hours into GOLDEN Hours! There is no drudgery. Indeed the work is so simple and easy that you require no special accommodation—the kitchen or any spare room can be your workroom—and the whole of the family, including the children, can help you. The work is of fascinating interest and your profit is only limited by the amount of time you have to spare.

Earn up to \$300 a Year!

\$300 a year EXTRA can easily be yours. New vistas will open out to you. It will smooth the way to success and enable you to be independent of employers and industrial upheavals. All those luxuries and necessities you have long desired will be yours! Let us hear from you NOW! You are not asked to attempt to revive a "dud" industry, but are offered a Novel and Live Business—a growing business! Somebody is going to make a BIG PROFIT in your district, and that somebody can be YOU! Send the coupon AT ONCE and full free particulars will be forwarded. Any questions you ask will be answered fully. We have nothing to hide—no expensive "plant" to sell you. This is a Plain, STRAIGHTFORWARD, MONEY-MAKING Proposition, ONE THAT HAS BEEN ESTABLISHED A DECADE! As man to man, can you afford to let it pass by?

Send this Coupon NOW!

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Sir,—Please send me at once, and FREE, full details as to how I can Make Money at Home in my spare time. I enclose 2d. stamp for postage.

Print your name and address boldly in capital letters on a plain sheet of paper and pin this coupon to it.

"Popular Wireless," October 5th, 1929.

TUNGSRAM BARIUM VALVES



a
name known
all over
the world.

After Tungram Lamps, Tungram Barium Valves—a better valve at a lower price and destined from the first to achieve the same success as the lamp.

Complete range of 2-, 4-, and 6-volt types available, fully covered by British patents.

Prices 5/6 to 10/-.

SEE THE FULL RANGE AT YOUR DEALER'S



If you have any difficulty in obtaining write direct to:—

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(Great Britain) Ltd.

RADIO DEPT.

72, Oxford Street, London, W.1.

Branches in Birmingham, Bristol, Cardiff,
Leeds, Manchester, Newcastle & Nottingham

L. F. VALVES.

By Dr. J. H. T. ROBERTS, F.Inst.P.

REGARDING the question of low-frequency amplification, I should like to refer to the valves which I am using in my amplifier. Although these valves are types very well known and in very wide use for L.F. amplification purposes, it is only fair to say what extremely good results they can be made to give.

I say "can be made" to give advisedly, as, like other valves which are designed to give super-results, they require to be operated under proper conditions. Proper conditions usually refers more than anything else to anode voltage and grid bias, especially the latter.

NEXT WEEK:

THE MAGIC THREE

Order your copy of "P.W." now!

Most amateurs are careful (for very good reasons) to give attention to low-tension voltage and filament current and, as a general rule, high-tension voltage is reasonably near the mark, although many a valve is made to operate very much under its rated anode voltage.

Grid Bias.

It is in the matter of grid bias that the greatest number of mistakes are made, particularly in cases where the grid bias runs up to quite a large figure. For example, with the L.S.5 operating at 400 volts on the anode, a negative grid bias of 40 volts is specified, whilst with the L.S.5A at 400 volts on the anode, a negative grid bias of 100 to 120 volts may be used, giving an anode current of 30 to 35 milliamps.

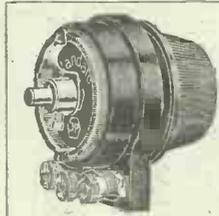
Although amateurs are repeatedly advised to give careful attention to the question of grid bias, it is surprising how often this advice is ignored. Probably the reason for this is that quite good results can be obtained when the grid bias is very far from the correct value, and therefore the amateur no doubt thinks that the valve is operating more or less as intended.

What he does not see is that the anode current is very much conserved when the grid bias is raised to its proper value, and with valves consuming such a large anode current it is clear that a heavy load is thrown upon the high-tension battery.

BEHIND THE VOLUME CONTROL KNOB

of the best Sets
you will find a

ROTOR-OHM



Rotor-ohms are fitted by the most important and discriminating set manufacturers.

Because they are truly variable, smooth as velvet and accurate as a precision instrument should be.

If any difficulty is experienced in obtaining Rotor-ohms, order direct from us, mentioning your dealer's name.

Type	Ohms	Milliamps
F	0.2,000	37.5
K	0.5,000	23.0
G	0.10,000	16.5
H	0.25,000	10.5
C	0.50,000	7.5
D	0.70,000	2.0
B	0.100,000	5.0
J	0.200,000	4.0
L	0.500,000	2.5
M	0.1 Megohm	1.3
A	1/10.7 Megohms	0.2

PRICES: 5/9 (Standard Type)

6/6 (Potentiometer Type)

ROTOR ELECTRIC LTD.

(Dept. P.W.),

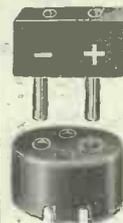
2/3 Upper Rathbone Place, London, W.1.

Telephone: Museum 2641-2642.

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RD29

2/-

"RED DIAMOND" WALL PLUG



Solid Ebonite. Highly Finished. Perfect Insulation. Two size plugs and sockets so that it is impossible to insert plugs in reverse.

Or by insured post 2/3.
Of all high-class Radio Dealers,
or Sole Makers:

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Radio Dept. 46, 21/2, Gt. Sutton St., London, E.C.1.

DECORATE YOUR LOUD SPEAKER YOURSELF.
Transfers giving painted effects on FABRIC, WOOD, METAL, Etc. Sample and Catalogue 1/- P.W., AXON LTD., JERSEY, ENG.

PLEASE MENTION "POPULAR WIRELESS" WHEN REPLYING TO ADVERTISEMENTS.



THE WANDER PLUG WITH THE POWERFUL GRIP

Look at its prongs of special spring-metal that grip the socket—its insulated holder—the neat engravings on the head—its finish. Replace your old wander plugs with Belling-Lee to-day, and put an end to bad contacts and loose plugs.

Ask your dealer for Belling-Lee Handbook, "Radio Connections."

BELLING-LEE
FOR EVERY RADIO CONNECTION



THE NEW H.C. CELL

means
**BETTER
 H.T.
 SERVICE**

An entirely NEW MANUFACTURING PROCESS is employed in the construction of MAGNET Wireless Batteries. It gives a standard of battery performance hitherto non-existent, and maintains smooth, effortless power for a greater length of time.

All MAGNET Batteries are fitted with super-grip screw terminals.



**H.T.
 BATTERIES
 with the
 NEW
 H.C.
 CELL.**

88

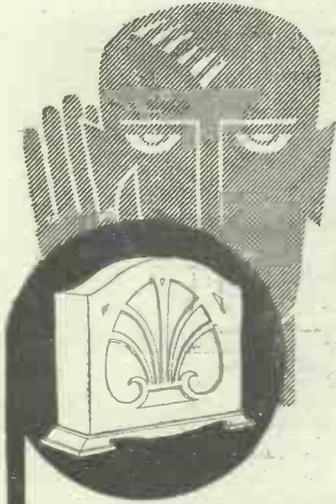
Magnet

WIRELESS BATTERIES

MADE IN ENGLAND,
 Sold by all Wireless Dealers.

- PRICES :**
- STANDARD TAPPINGS:**
 L.4920 (60-volt) - 9/6
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- WITH GRID BIAS TAPPINGS.**
 L.4921 (60-volt) - 11/-
SUPER CELL TYPE.
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- GRID BIAS BATTERIES.**
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 L.4908 (16½-volt) - 3/6

Write for Folder
 No. L 5237.



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An entirely new principle in loud speaker construction

Much more than a new loud speaker, the Puravox embodies a revolutionary change in loud speaker construction. Its patent spider diaphragm and piston motion drive abolishes distortion, brings within hearing the beauty of low organ notes, and distinguishes each instrument in orchestral music. There has never been anything like it before. The Puravox can be used with any wireless set. Every wireless set will be improved by it. Every wireless owner can afford it.

FREE 7 DAYS TRIAL

No need to believe what we say. Ask your dealer for a Puravox. Take it home and try it. If it pleases you, keep it. If not, simply take it back within the week and your money will be returned in full.

PURAVOX

"1930"

CONE LOUD SPEAKER (PATENT)

The model illustrated is 57/6 in Mahogany Cabinet. Other models from 32/6 to 85/-.

SEND FOR FREE CATALOGUE

To FALK STADELMANN AND CO. LTD.,
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Please send me complete list of Puravox Loud Speakers.

Name.....

Address.....

If contemplating a new Wireless Set, get particulars of the Erescapone

SUCCESS ON THE SHORT WAVES.

A Receiver with all Modern Refinements.

PROBABLY if you were to ask any experimenter with short-wave experience dating back to the early days what he considered to be the greatest difficulty to be overcome on the really low waves, he would not hesitate long before answering, "hand-capacity effects." If he had been having a spot of trouble with them lately, he would probably even add an adjective or two!

The more recent types of short-wave receivers are a considerable advance on their earlier forerunners in this respect. For example, it has been found that certain precautions in the layout, such as the obvious one of seeing that all high-potential points are kept as far back behind the panel as possible, will do a great deal.

Curing the Trouble.

Considerable light has been thrown on the puzzling phenomenon of hand effects to earthed portions of the circuit, such as the filament wiring and the spindle of the tuning condenser.

In such circumstances relief can usually be obtained by disconnecting the earth

NEXT WEEK

1/- Blue Print FREE

of

The "MAGIC" Three The Set of the Year.

altogether, or using instead a few yards of wire on the floor as a counterpoise.

Another expedient which often works is to connect the earth merely to the bottom of the primary coil, and to remove the usual connection from that point to the filament circuit. We then have the usual circuit from the aerial down through the primary coil to earth, but the rest of the set is unearthed.

Effective as these devices are, and considerable as is the improvement they produce, the problem of hand effects on the reaction condenser, and the allied one of the alteration of tune when reaction is adjusted, remains to trouble us. Comparatively recently some noteworthy progress has been made in these directions also, and it is now possible to produce a set which marks a distinct step forward.

Such a receiver is the "M.W." "Wave-master" Two, and a full description of this set is given in the October issue of "Modern Wireless," now on sale.

The design has been specially worked out to provide an example of the latest developments in short-wave circuits combined to produce a receiver of exceptional capabilities to tune over short, medium, and long waves.

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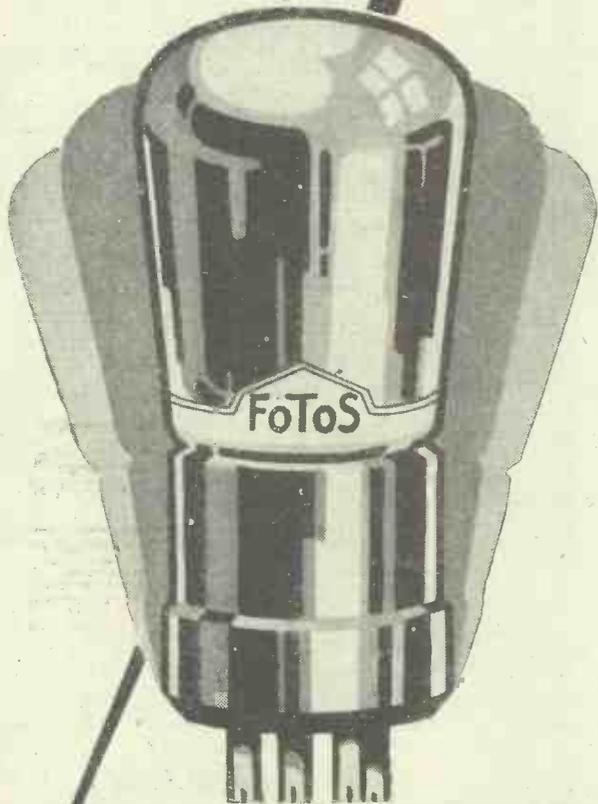
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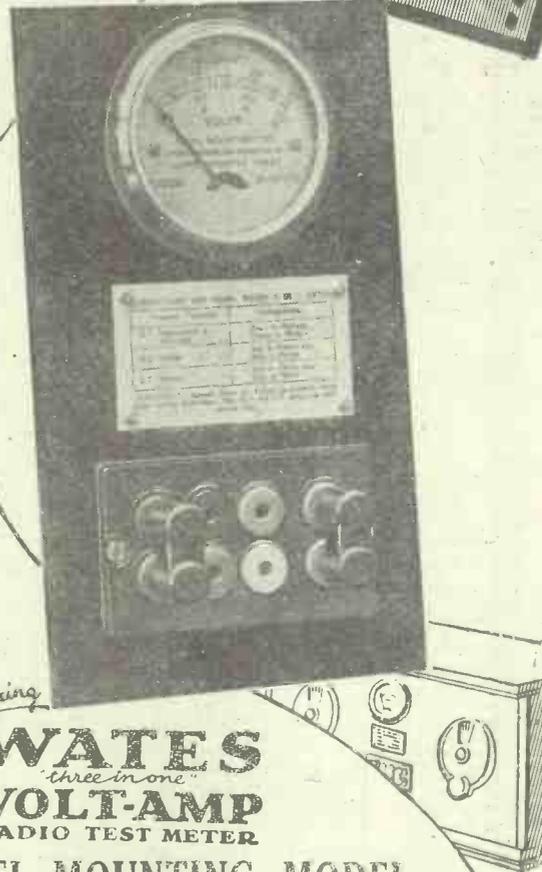
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This model is extremely ingenious and presents unrivalled possibilities to all set owners who have long felt the need of a "3 in 1" meter for panel mounting purposes. *Meter finished in highly polished nickel. Supplied complete with plugs, sockets and discs, drilling dimensions and fitting instructions. Obtainable direct, or from Halford's Stores, Curry's Stores and all Radio dealers.*

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- Res. 5,000 ohms.
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Illustration shows meter and discs in position on piece of ebonite. Note pleasing appearance of fitting.



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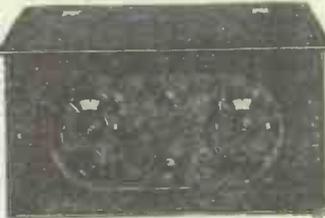
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PUNCH WITH PURITY

How to make an ordinary set handle more energy without distortion. By A. JOHNSON-RANDALL.

THE present-day loud speaker is a great advance on the horn types so popular a couple of years ago.

It is not more sensitive; in fact, in many cases it requires more energy put into it to give the same aural intensity as the less modern horn type.

The chief development has been in its response to a wider range of frequencies, or, to put it non-technically, of musical notes.

The old horn-type speaker would not give the bass notes, neither would it respond so evenly to the fundamental notes and their various harmonics and overtones which go to make up the perfect rendering of the broadcast programme.

Now, possibly all this would appear to have little or no bearing upon the title of this article.

"More Than Enough" Required.

Actually, however, this improvement in loud speakers generally is most important when we come to the question of amplifying and reproducing distortionless music.

When the old-type horn speaker was in common use it was not so vital to deliver distortionless energy. For one reason, a certain amount of distortion was permissible because the ear could not detect it, since the speaker did not emphasise it.

Secondly, the modern loud speaker, if it is of the type designed for super-quality, needs more energy in order to get the best out of it. For this reason it becomes necessary to "boost up" the volume by increasing the "power" of the set.

How best can we do this? Well, suppose we look at it from the commonsense point of view.

We must make sure that our set is capable of supplying adequate volume—or, rather, more than adequate volume—without being "pushed."

Reaction Makes it Worse.

If the set is a small two-valver it is no use employing reaction in order to get the required signal strength. We must add another valve, either H.F. or L.F. Usually it is easier and more straightforward to add an L.F. valve. Reaction will only increase the risk of distortion. A properly designed amplifying stage will give us plenty of energy and no distortion.

Hence, for a small set it is advisable to make up a separate amplifying unit if we desire to increase the power. Any other scheme is likely to lead to disappointment owing to the danger of distortion.

It is quite possible that the existing receiver already incorporates three or four valves. If so, then for all practical domestic purposes there should be an adequate reserve of energy available provided we can make use of it without spoiling the reproduction.

The crux of the whole situation is the last stage of the set. It is here where the distortion is so liable to take place. In nine

(Continued on page 240.)



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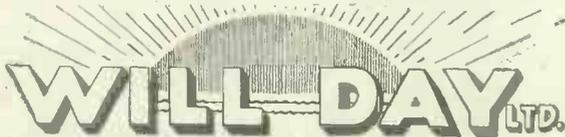
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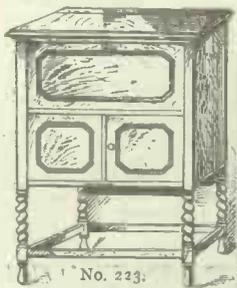
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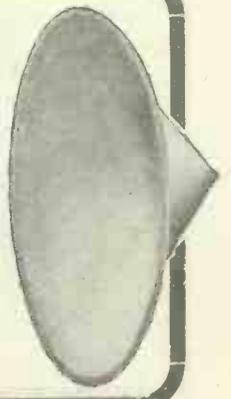
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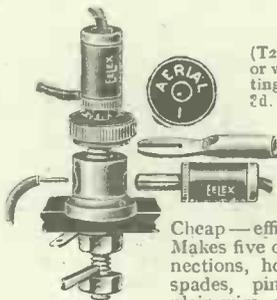
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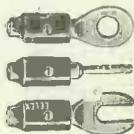
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PUNCH WITH PURITY.

(Continued from page 238.)

cases out of every ten, if we increase the volume the last valve is overloaded unless care is taken in choosing a suitable type.

Let us consider the case of an ordinary small power valve. With 120 volts H.T. we can obtain just about enough energy to give sufficient undistorted volume from a sensitive loud speaker to fill a small room.

Controlling Volume.

To achieve this we have to be very careful not to apply too big a "kick" to the grid of the valve. In other words, if our set is working well within its limits, it will be necessary to use the volume control. Suppose, now, that our speaker is a first-class design capable of giving plenty of bass, and that our amplifier has a couple of high-efficiency stages of the modern R.C.-transformer type. In order to prevent distortion, even at "small-room" strength, we shall have to cut down the volume on all passages where there is a preponderance of bass notes, because it is on the bass that our valve becomes most readily overloaded. Thus, if we are to ensure undisturbed reproduction at all times we must either increase the H.T. voltage, and also the grid bias, or use a larger valve.

The MAGIC THREE GIVES MAGIC RESULTS

See Next Week's "P.W."

It is impracticable to increase the H.T. beyond certain limits because (i) the valve will not "stand it," and (ii) the maximum voltage available in the case of the average listener is usually not more than 150 volts.

The remedy, then, is to use a super-power valve and to employ the maximum available H.T. voltage, together with the makers' recommended grid bias for that particular H.T. value. At the same time, the volume control on the set can be reduced in order to increase the signal strength or energy applied to the grid of the valve.

The H.T. Problem.

A super-power valve, used in conjunction with a good medium-sized set, will give all the undistorted volume required for the average room.

Some listeners expect to get good reproduction on 60 volts H.T. With the average valve it is quite impossible to obtain respectable loud speaking in this way. The H.T. applied to the last valve should not be less than 100 or 120 volts. If you have 150 volts available, use them, but do not forget to increase the grid bias accordingly. So before changing your valve for one of the "super" type, make quite sure that you are using plenty of H.T. and the proper grid bias.

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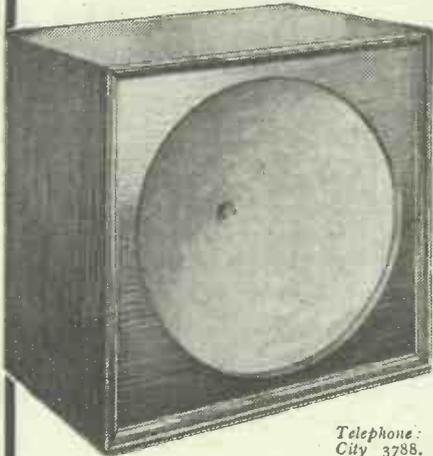
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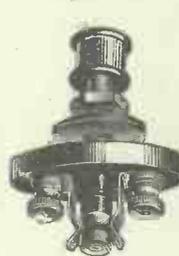
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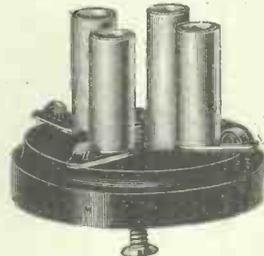
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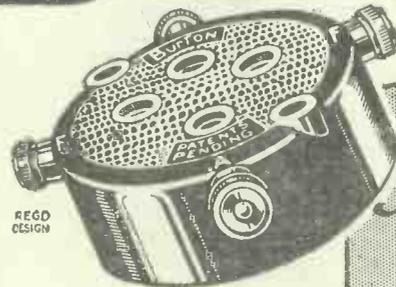
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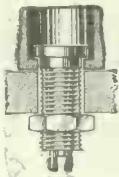
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TECHNICAL NOTES.

(Continued from page 198.)

bending is much greater than in others; all depends on the length of the pivoted arm and upon the design of the governor.

I have known a case in which the act of winding up the motor almost stopped the turntable from rotating altogether, whilst in another case which came under my observation recently, the top panel of the gramophone was made of thin three-ply wood and was so very flexible that it was utterly useless setting the speed regulator at all. In this case, as I only wanted to use the machine at one definite speed of 78 revolutions per minute, I fixed a definite stop on the motor itself, thereby putting the speed regulator on the top panel "out of action," although it remained in position.

If, therefore, you find erratic behaviour of this sort in your gramophone you should try pressing on the top panel to see whether this has the effect I have described. If so, it may be necessary to secure slats of wood on the under surface of the top panel so as to stiffen it.

Motor Design.

I cannot understand why the manufacturers of gramophone cabinets should not before now have given attention to this important point. Incidentally, it is bad design anyhow to fix the motor and the speed regulator independently upon a flexible panel (and a thin wooden panel must always be more or less flexible); a much better design is to have a metal bracket projecting from the frame of the motor, this carrying the speed regulator which passes through a hole in the wooden panel but does not touch the panel. In this case distortion of the panel is entirely without effect upon the setting of the speed regulator.

Electrical Joints.

I am frequently asked by readers whether it is necessary to use soldering paste in making electrical joints or whether ordinary soldering spirit will serve equally well. As a matter of fact, when carrying out experimental work myself—whether in radio or other scientific work—I invariably use ordinary soldering fluid even for electrical joints, but then I take the precaution to clean the joints very carefully afterwards with water, either by means of a very small brush or with the aid of a tiny wad of cotton wool soaked in water.

In view of the importance of cleaning the joint afterwards, and the danger of this precaution being overlooked, perhaps the use of ordinary soldering fluid should not be recommended for amateur electrical work. The principal reason why I prefer the soldering fluid is that I always find it to be quicker and to cause the solder to wet the surfaces more readily.

(Continued on next page.)

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TECHNICAL NOTES.

(Continued from previous page.)

Paste Fluxes.

On the other hand, there are now excellent soldering pastes on the market which will enable you to make a perfect soldered joint with very little trouble, and, although, for the sake of appearance and general cleanliness, it is desirable to remove any excess of the paste after the joint is completed, as a rule nothing very serious will happen if you forget to do so.

There is one simple precaution, however, which you should take when using a soldering paste, more especially in radio work, and that is to avoid the sputtering of the paste upon neighbouring ebonite panels, and so on. If this is allowed to happen a greasy coat is formed which, though not actually injurious in itself, collects dirt very quickly and may give rise to surface leakage in that way.

Shielding.

Some little time back a contributor to this journal made a number of interesting and very useful remarks on the precautions which should be taken when using a metal panel or, indeed, for that matter, when using a mains-supply unit. As you know, there was, in the early days of mains units, a good deal of criticism on the ground that such units were liable to expose the user to the damage of a severe electric shock—the

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severity of the shock depending, of course, upon the particular circumstances of the case: in some cases it might have been that quite a dangerous electric shock could be sustained.

Fortunately, by the co-operative efforts of the Institution of Electrical Engineers on the one hand, and the general body of radio manufacturers on the other hand, mains units are now designed in such a way that it is virtually impossible for even the most uninitiated user to be in the least danger when using them.

Earthing.

It has been pointed out that if the positive terminal (in the case of direct-current electric-supply mains) is earthed at the generating station, then the earthing of the negative terminal will cause a short-circuit of the mains terminals and, unless some appropriate resistance be in the circuit, an accident may result—perhaps nothing more than the blowing out of the main fuses, but still something to be avoided if possible.

If the earth lead, however, contains a large capacity condenser this danger is avoided, since there is no D.C. connection

(Continued on next page)

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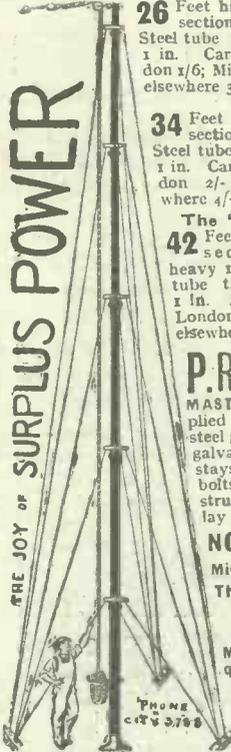
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TECHNICAL NOTES.

(Continued from previous page.)

to earth, although at the same time the ordinary functions of an earth connection, so far as reception of signal currents is concerned, are still available.

This is all very well so far as it goes, but when we turn to the low-tension circuit in which there is a connection to the negative of the mains we are up against another possible danger since (in the conditions mentioned above) the negative terminal is at a considerably different potential from earth, the positive being earthed. In these conditions it is possible to get a shock by touching any part of the low-tension circuit, on the one hand, and any earthed object on the other hand.

Combination Panel.

As a matter of fact, although a metal panel has many advantages, the chief of which is its shielding effect, I have never been entirely in favour of metal panels, for reasons generally similar to those mentioned above. If you want to secure the shielding effect, avoiding hand capacity and so on, it is perhaps better to use a combination of the metal panel and the ebonite or other insulating panel, the insulating panel being, of course, on the outside.

It will be necessary, as before, to provide insulating bushes in proper places, so as to prevent contact with the metal panel. In this way there is no danger of making contact with the metal panel and yet you have the shielding effect of the metal and also it serves as a convenience in wiring up the circuit inside the cabinet.

Pick-Up Noises.

When using an electric pick-up it is surprising what a number of snags one may encounter, more especially if there are any electric-light leads in the vicinity or if the leads to the pick-up require to be fairly long. I have just had a particular case where a very small A.C. motor had to be used at a distance of about 3 ft. from an electrical pick-up.

The leads to the motor were well away from the pick-up leads, but at the same time the reproduction from the pick-up was accompanied by a generous background of crackles from the motor. It proved impossible to overcome the trouble by any placing of the pick-up leads and it was finally reduced to a minimum, though not quite cured, by earthing the pick-up arm, and also earthing the metal frame of the motor. No doubt the effect could have been completely cured by shielding the motor, but in the case in question this was not considered necessary.

Electric Drives.

This, however, brings me to an important point in connection with electrically-driven gramophones where a pick-up is to be used. In a case of this kind, clearly the electric motor is in very close proximity to the pick-up and the chances of extraneous noises from this cause are very considerable.

Electric gramophone motors in these days are specially designed so as to produce as little sparking as possible, but in my opinion the only really satisfactory electric drive is one which is completely shielded. Even then, the pick-up frame and tone-arm should be well earthed in addition.

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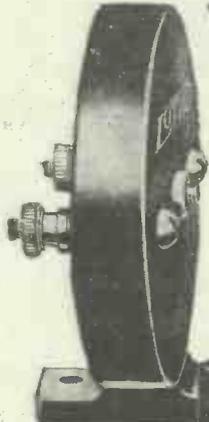
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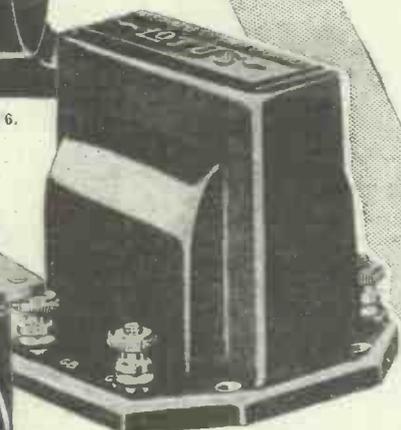
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Draw the curtains and gather round the table. Now's the time to try your hand at building one of the new radio sets with Lotus components. You'll enjoy the trouble-free building, the easy slipping together of these well-made units. Each is a masterpiece of mechanical perfection, strong, neat and accurate.

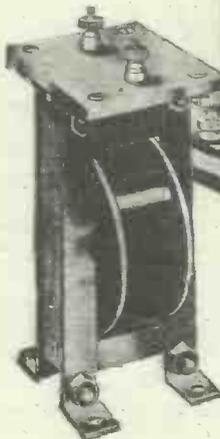
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Lotus L.F. Intervalve Transformer, 12/6.

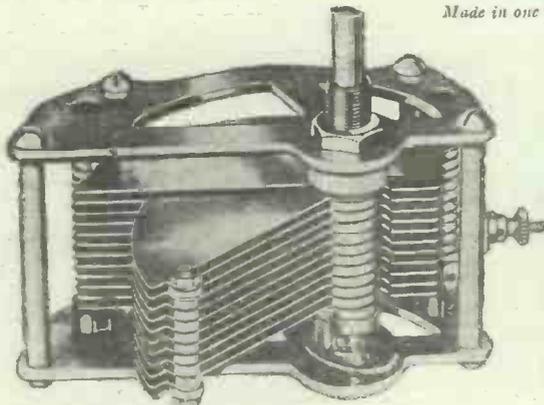


Lotus L.F. Power Choke, 15/-.

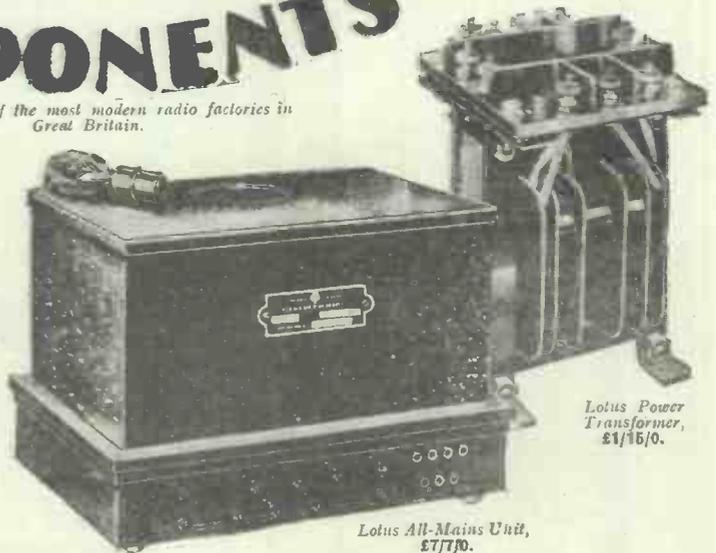
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LOTUS COMPONENTS

Made in one of the most modern radio factories in Great Britain.



Lotus Logarithmic Condensers in all capacities, from 5/-.

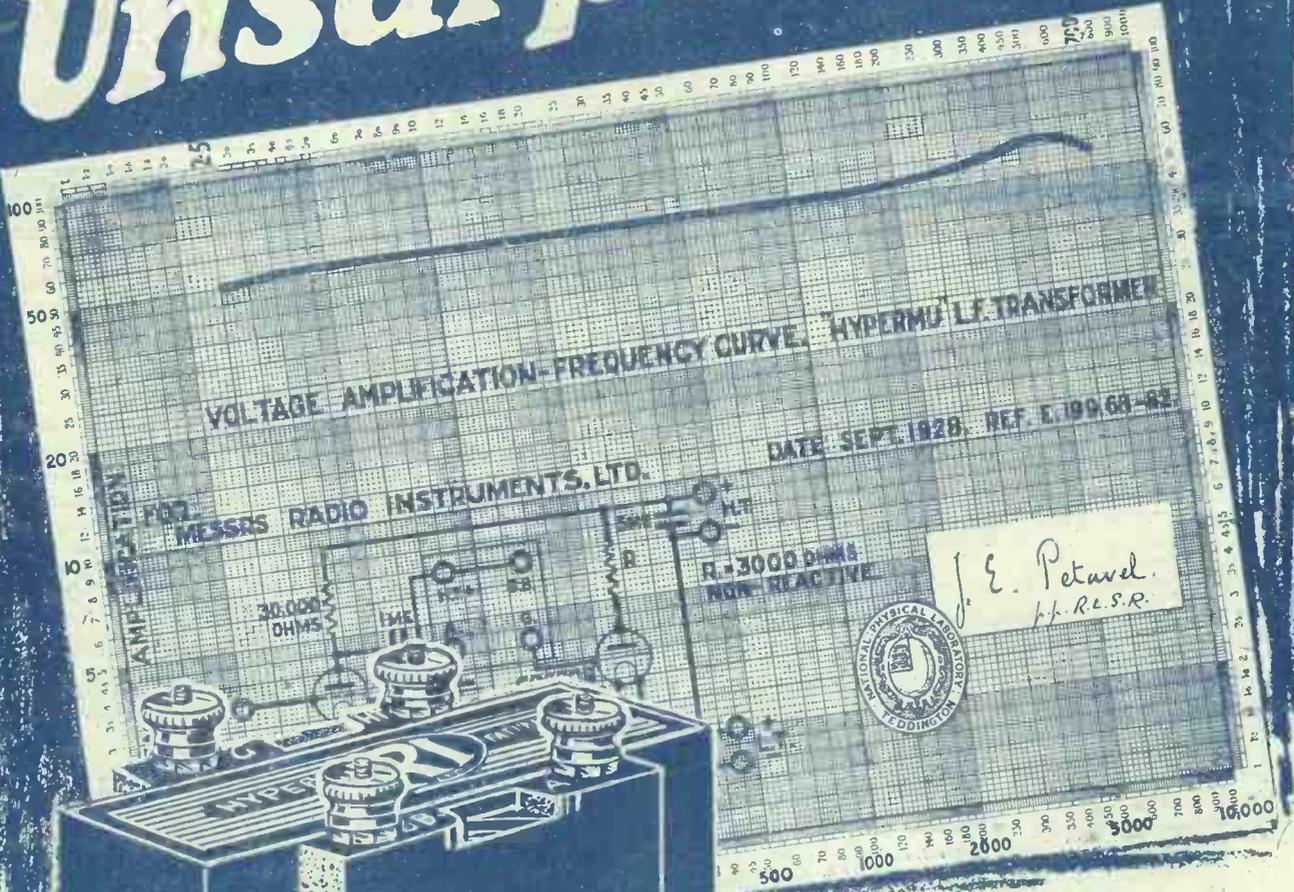


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Garnett, Whiteley & Co., Ltd., Lotus Works, Liverpool

Unsurpassed!



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still remains unbeaten as
the most complete curve
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amplification from
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The importance of the continuity of this curve below 50 cycles back to 25 cycles is obvious, whilst the advantage afforded by the slight emphasis of sideband frequencies in the region of 7,000 cycles contributes added brilliance to musical reproduction. Moreover, the absence of resonant frequencies below 50 cycles absolutely precludes the possibility of low-frequency oscillation.



Write for Hypermu Leaflet.

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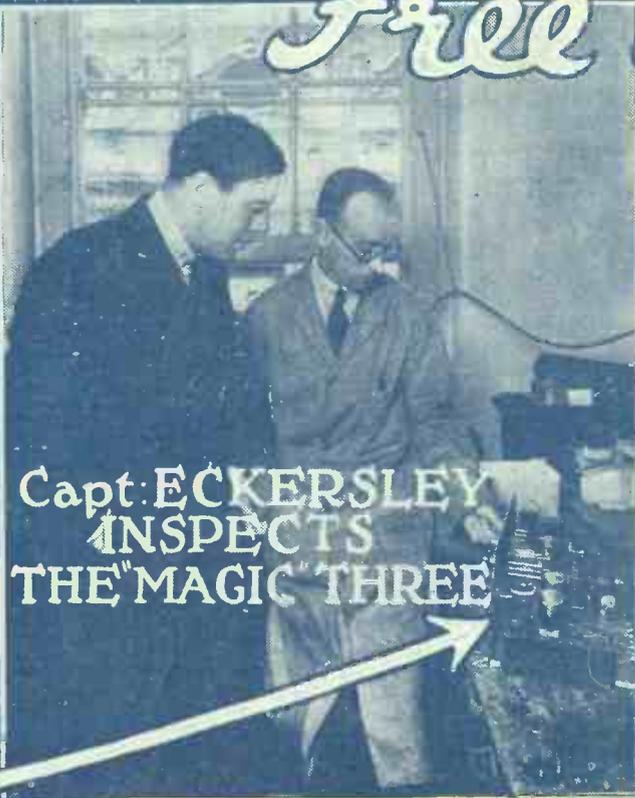
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The Most Wonderful Set Ever Designed
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Cheap and Easy to Build

.. for those who prefer to build their own cabinets



TO many Radio enthusiasts the price of the 'Lion' quality of reproduction is a difficulty, especially when it is purchased enclosed in an Amplion cabinet. Others, to whom the price does not present any obstacle, have their own ideas as to how they desire to mount it. Perhaps they desire to make a cabinet for themselves to their own design.

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that you might actually be in the studio!



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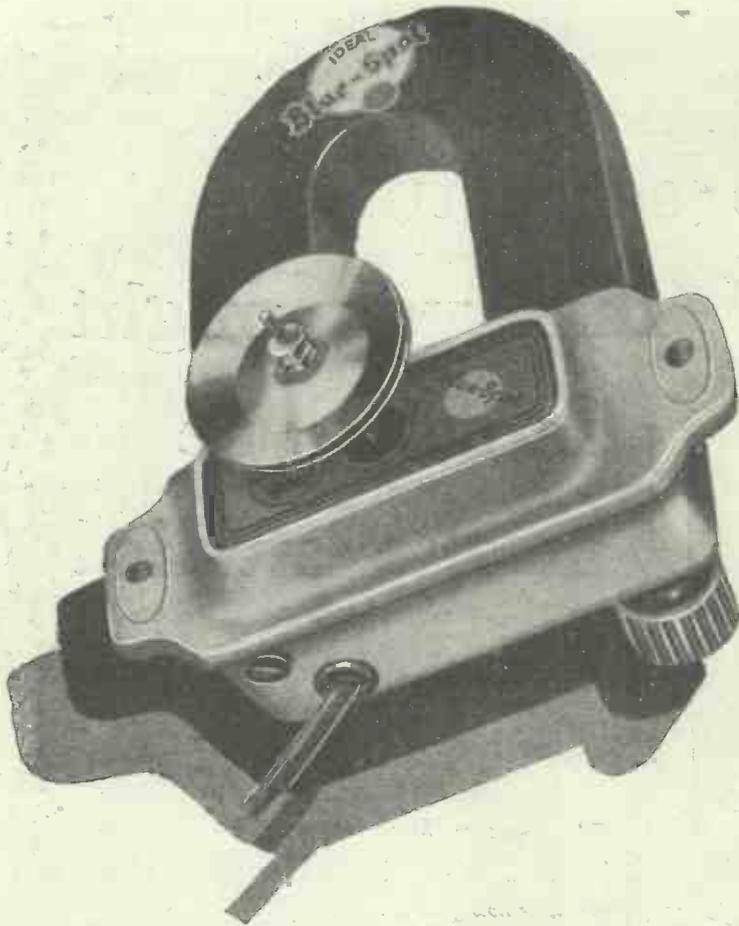
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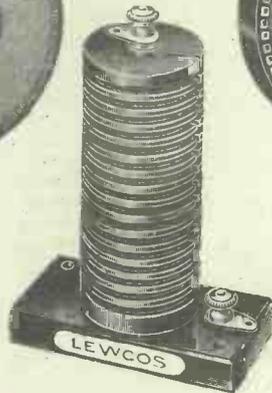
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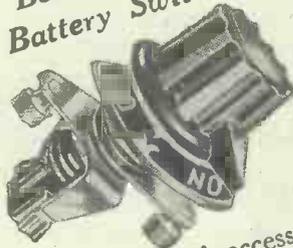
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Price
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each

EXPERIENCE, backed by
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DOES THAT CIRCUIT CALL FOR A 5-PIN VALVE?

Here's the Valveholder
for it—



This is a new Benjamin product—a Valve-holder designed expressly for use with all 5-Pin Valves with centre leg connection. The well-known Benjamin anti-microphonic feature is incorporated, and also patented, which ensures perfect contact when using either split or solid pin Valves. The pin sockets are in standard positions, enabling the 5-Pin holder to accommodate, if necessary, the ordinary 4-Pin Valve.

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If you want to hear the broadcast in your home as it is played in the studio, buy a Brown Duplex Loud Speaker. In no other speaker will you find the features which are responsible for such amazingly realistic reproduction. Only the wonderful "Vee" movement and the new Duplex cone can give a tone that is so much sweeter and more mellow and a volume that is so much richer and more magnificent. Ask any Wireless Dealer!

THROUGH THE WONDERFUL

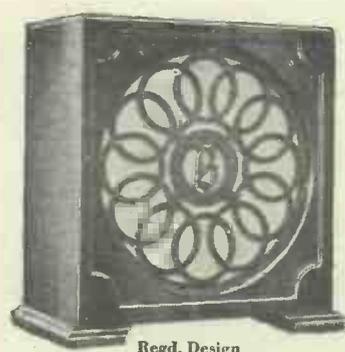
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IN THREE MODELS:

Design as illustrated. Mahogany or Oak.

V10 £5 10s. V12 £7 10s. V15 £12 10s.

Obtainable by easy payments. Ask your Dealers.



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Brown DUPLEX LOUD SPEAKER

Advt. S. G. Brown, Ltd., Western Ave., N. Acton, London, W.3.

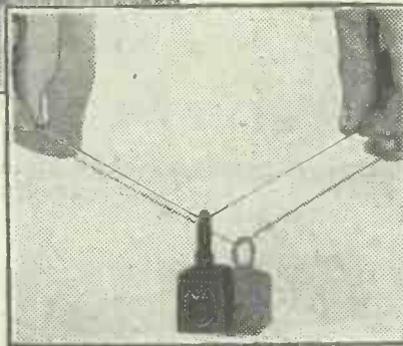


Sensational Filament strength of the NEW COSSOR



THE wonderful NEW Cossor filament is reinforced—just like ferro-concrete!

It has a solid tungsten core that is actually tougher than steel. And this core carries a thick, highly emissive coating. By a special Cossor process, core and coating are combined into a filament of enormous strength and pliability. Because of its pliability the NEW Cossor filament cannot become brittle. And because it cannot become brittle it will not break. Even after 1000 hours use the NEW Cossor filament will easily bear the weight of the whole valve. Not only in its filament but in its design, in its construction and in its method of manufacture the NEW Cossor is a wonderful stride forward in Valve development. Try the NEW Cossor in your Set—you'll get a new thrill from Wireless.



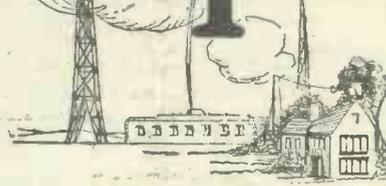
**Evidence
you can see!**

This illustration shows an actual test of the strength of the wonderful NEW, Cossor filament — unaided it easily supports a 6 oz. weight. Never before has such a strong filament been used in any Valve

The Strength of its filament is only one of the many striking features of the NEW Cossor. You can read all about the others in a 32-page Book—"All about the NEW Cossor." Ask your Dealer for a free copy or send a post-card to A. C. Cossor, Ltd., Highbury Grove, London, N.5

**— it easily bears
a six ounce weight!**

Popular Wireless



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**PICTURE TESTS.
 AGE OF MIRACLES.
 CRITIC UP TO DATE.
 A MYSTERY SOLVED.**

**HEARD HELSINGFORS.
 FARTHEST NORTH.
 THE TITANIC "TITAN."
 PLAIN SPEAKING.**

RADIO NOTES & NEWS

"The Best-Laid Schemes."

SOMETIMES one is almost forced to the conclusion that there is a special little imp sitting aloft with the job of taking us down at appropriate times. A specially good Queen's Hall programme seemed to call for a select gathering to listen to it at my house, and I had the set at concert pitch. Nothing could possibly fail. Battery charged to repletion; spare valves at hand—all was Sir Garnet. Halfway through the second item—f-z-z! The electric-light fuse went and cut off not only the light but the H.T.!

Short-Wave Picture Tests.

EXPERIMENTAL picture transmissions on 41-42 metres are being made daily by Fultograph Gesellschaft, M.B.H. Austria, IV. Prinz Eugenstrasse 10, Vienna. In order to render possible a comparison of the ranges of telegraphy, telephony, and picture telegraphy, the following schedule will be observed: Telegraphy 10.10 a.m. to 10.20 a.m.; telephony, 10.20 a.m. to 10.30 a.m.; pictures, 10.35 a.m. to 10.45 a.m. A similar programme will be sent out in the afternoons from 3.10 p.m. till 3.45 p.m. Call-sign, U.O.M. Reports will be welcomed at the above-mentioned address.

The Return Volley.

MADAME SONYA MICHELL, the lady who said that the world was "fed up" with Beethoven and Chopin, has experienced an unpleasant repercussion in the form of rumours that she said that because she is unable to play the works of those composers. This unexpected come-back naturally provoked the lady to a spate of explanations and a special performance to prove that the rumours were unfounded. I don't doubt that she is a delightful pianiste, but I think that she made a bad break and will not try to "stand off" any more great masters.

An Awkward Disinterment.

WHILST we all owe and acknowledge a debt to Thomas Alva Edison for certain of his inventions, in particular to his "Edison effect," the attempts of people in the U.S.A. to credit him with the invention of the electric lamp are astonishing to us. In this connection I hope that it will do the Americans good to know that in the "Electrician" of September 20th, 1879, it was reported that

an article in the "New York Star" denied that Mr. Edison had really invented anything in electric lighting. The surprising thing is that Edison himself apparently makes no effort to shift the chorus of praise into the proper direction, the memory of Swan, the real father of the lamp.

The Age of Miracles.

SOMETHING happened recently which in reality stamps 1929 as a wonder year. Not a reduction of the Income Tax, I am sad to say, but a medical consultation by wireless telephony between doctors in Berlin and Buenos Aires. This was preceded by the transmission to Buenos Aires by wireless of a photograph of the patient's

eye. I submit that this is one of the most remarkable incidents of the twentieth century, all the more significant inasmuch as it was not a "stunt" but the application of the most recent developments of science to everyday work.

Acknowledged With Thanks.

GREETINGS to N. C. (Denton), H. W. T. (Brighthouse), L. P. N. (Oxford), and a number of other keen followers of "P.W." I cannot find a basis for notes of general interest in your communications but wish to thank you for writing. Always glad to hear from anybody, barring tax-collectors and girls I have promised to take to the "talkies." Shouldn't mind a few letters from you saying what impressed you most, favourably or otherwise, at the Radio Show.

'NEATH SUNNY SKIES!



The Marchese and Marchesa Marconi photographed on board their famous yacht "Elettra," during a recent cruise.

Critic Up to Date.

IT is difficult to follow a musical critic at the best of times, but "The Listener" of the "South African Wireless Weekly" has got me guessing and gasping. Criticising a bit of Wagner, he writes, "Listen to the withering scorn of the phrase, 'Das war ein schatz mein Herr und Ohm.'" I listen, but nothing seems to wither. Anyway, why drag in an in-offensive chap like old Ohm? What would our valve filaments do without him?

"On This Spot Stood—"

THE practice of putting up plaques to mark where something once stood is being overdone. The City

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

is now speckled with notices of the kind, so that one may see on the wall of a pawnbroker's, "On this site stood the dormitory of the Friars of St. Bingo," or something like that. A Bournemouth man now suggests that a memorial be erected on the spot where Marconi's aerial stood when he sent a message from Bournemouth to Alum Bay. Hardly important enough, I suggest, compared with later achievements.

Gallons of Ink.

AMONGST those who ought to erect a monument to Marconi are the ink manufacturers. Chicago station, WLS, in an account of its five years' work, reports that during that period it has received over a million letters from listeners. Verily! the pen has been busier than the cocktail shaker. It is added that over four thousand artistes and speakers have faced the microphone. Only two and a bit per day! Even our B.B.C. can beat that, in speakers alone!

Mystery Solved.

SEVERAL kind readers, including E. L. M. A. (Swanscombe)—where the cement comes from—write to say that E. J. M. M.'s mysterious station which announced itself, in Cockney-American, as Milan, was Ballan testing with Skegness on 25-728 metres. This, then, was evidently the Post Office's Australian telephone circuit being tried out. Quite a nice little pick-up. E. L. M. A. did it at strength R5-7 on 0-v-R.C.-Trans.

Helsingfors Wanted.

WRITING about our article "Hearing Helsingfors" (Sept. 14th), A. R. (Helsingfors) says that the trouble about picking up his home station in England is due to the small power used. He would be glad if anyone who has received it (221 metres) would let "P.W." know details of the triumphant receiver and the type of aerial. He adds that Lahti (1796 m.) ought to present no difficulty to a three-valver. Finnish stations begin at 4 p.m. and close at 8.15 p.m., except on Sunday, when they operate almost all day. Thanks in advance for your reports, oh fans!

Our Big Bruvver!

IF you missed the Radio Show, the next best thing is to invest in the October "Modern Wireless" (*Socrates*). This issue is just a plain doggone snorter. Read "Adventures with a Crystal Set," by Capt. Eckersley and be happy. Besides this, there are articles by Sir Oliver Lodge, Mr. A. Corbett-Smith and Victor Olof (of the Sextet). Last but not least, full details of the "Exhibition" Five, the "Olympia" Three, the "M.W." "Wave-master" Two, and (O boys!) the "M.W." "DX." How they do it all for a bob—is known only to those who do "P.W." for threepence.

Farthest North.

ABSOLUTELY the most northerly radio station is that which has been built by the Soviet authorities at Tranquil Bay, Franz Josef Land. They had to break the ice to get there, I'll warrant! The station works on 43 metres, and will be used in

connection with a meteorological station which has been set up there to register the "depressions" and frostbites.

The Race for Television.

I HEAR that Mihaly is arranging for demonstrations of television and telecinematography in London this month, and that he is applying to the P.O. for facilities equal to those granted to the Baird Co.

SHORT WAVES.

An American millionaire in London recently appealed by wireless telephone to his barber in New York to cross the Atlantic and cut his hair.

So wireless has its uses, after all.

Our recent article headed: "Home-Made Bass" has brought in quite a lot of letters from readers who express great disappointment that this only refers to deep notes, not "liquid" ones.

We read in the "Sunday Graphic" of a conversation which took place some time ago:

"You know that fellow who does the weather report from Daventry at 10.30 a.m.?"

"Yes, what about him?"

"Well, he always seems so sleepy. Why do you suppose they keep him on?"

"I can't imagine, but, as a matter of fact, he is very sleepy."

"How do you know?"

"He happens to be me!"

Wireless Announcer (communicating with kitchen): "Will Mary Jane Wilkins please come at once to the breakfast room, where her master and mistress are urgently waiting, perturbed at the critical condition of their breakfast, which appears to have met with a slight accident."—*"Passing Show."*

Little Richard: "Our garage man has a fine radio set, Mamma."

Unsuspecting Mamma: "What makes you think that, dear?"

Little Richard: "Why, I heard him say he would get Hades when he got home to-night."—*"Kettering Leader and Guardian."*

A scientist says our ears are growing larger and our faces longer.

No doubt, in both cases it is due to broadcasting.—*"Sunday Express."*

THIS RADIO LANGUAGE!

Why is it, asks a correspondent, that dry batteries are not dry; accumulators don't accumulate and condensers don't condense?

And why is it, we reply, that you make demands on our radio language?

Item in Canadian programme: "7.30. Listen to my tale of woe. By H.T. Mix."

We daresay a good many of us have heard the tale of woe that comes from an H.T. mix-up.

A correspondent writes from Edenbridge saying he has three controls on his radio set—his mother-in-law, his wife and his daughter, and he wants to know if we can recommend any means of overcoming this interference.

Why not let them listen to a few talks?

Don't Miss This.

THAT Radio Gift Book that every reader is going to be presented with next week is a real hummer. Be sure to order your next week's "P.W.," or otherwise, if it's a case of "sold out," don't blame me.

Seen a Loud Speaker Lately?

MR. M. H. AYLESWORTH, the boss of the National Broadcasting Company of the U.S.A., may be a great man and a "regular guy," but if all his statements are characterised by the accuracy which distinguishes what he is said to have told Americans about British radio, then he has got on in spite of the fact. According to a writer in "Popular Science Monthly," Mr. Aylesworth says, "I have just returned

from Europe. One curious thing about English radio sets is that headphones are used with most of them. There are few loud-speakers." Now isn't that a pity?

World-wide Telephony.

I HEAR that the long-distance telephony services of this country are being kept healthily busy. There is a commercial receiving station at Wallington full up with relaying calls from America, and work on the perfection of the Australian circuit is proceeding steadily and an experimental call of 13,000 miles has been made successfully.

That Titanic "Titan."

THIS set bids fair to rival the popularity of the "Sydney" Two and one or two other winners which have been evolved by our technical staff. A. G. C. S. (Ipswich) becomes almost lyrical in his praise of the "Titan" Three—"its ease of operation, its selectivity and its great power are exceptional." He used one at Portsmouth (!) and in a single evening logged thirty-eight stations all at comfortable L.S. strength. Almost enough to start the sceptics off again, isn't it?

On Your Mettle!

F. H. C. (Christchurch, N.Z.) says that he has looked in vain in "P.W." for news of the picking-up of Christchurch, New Zealand, 3 ZC, 50 metres, which operates on Wednesdays and Saturdays from 2.30 a.m. till 5.30 a.m. G.M.T. Well, failing anyone else, I look to A. W. M. (Middlesbro') to remove this blot from the escutcheon of home DX experts. (He'll have to get an alarm clock, though.)

Another Challenge.

THE other challenge is directed to the address of the radio trade. F. H. C. warns them that the sets they are sending to N.Z., "are getting a bad name, for the simple reason that they have not got enough pull in them." They want sets which will bring in all the "locals" at full L.S. strength and all the main Australians. Most of the sets in use are American 5-valvers. Mains-driven sets are required; 250 volts, 60 cycles in all instances. British manufacturers should look into this.

Plain Speaking.

WHEN I saw a B.B.C. announcement that on October 10th 2 LO would broadcast a drama called "The First Second," the action of which takes place "during the infinitely short space of time taken by sudden death to establish itself," I came definitely to the conclusion that the final authority for passing B.B.C. programmes is the wrong one, whoever he, she, or they may be. I could not imagine a more senseless thing than the inclusion of this item in a programme to be heard, maybe unexpectedly, by aged people or the sick, not to mention the rest of us.

More Plain Speaking.

ARE those responsible so little alive to their grave responsibility that they have no consideration for the sensitive, the morbid and the delicate? They make a great fuss about eliminating the controversial element from certain items, yet they pass this.

ARIEL.

SELECTIVITY and the REGIONAL SCHEME

BY
CAPT. P. P. ECKERSLEY
M.I.E.E.

LYING in a hot bath, four years ago, or more it must be—how time flies!—I had an idea. That idea constitutes the basis of B.B.C. policy to-day—to give alternative programmes. That idea is going to be talked of and derided and praised among listeners in London for the next few months. Because a lot of people will wish I had drowned. I am unrepentant because I think that the provision of facilities to give the public real alternative programmes to the great majority of listeners, represents a real step in advance.

But there is a question. Will the public be able to adjust their sets so that they can select between the two programmes that are to be simultaneously radiated from

* The new Regional Scheme "does not involve any scrapping of sets; it may involve modification or addition." Our Chief Radio Consultant here discusses the "problems" that have arisen and will arise among listeners owing to the opening of Brookman's Park.

Thus, at first, as a warning and an experiment, an after-midnight test takes place. The resulting letters are analysed. So-and-so many enthusiasts, so-and-so many failed to hear one at all, so-and-so many got confusion. Then the B.B.C. may arrange an alternative during programme hours; one day a week at 10.30, say. Again public reaction will be tested. Then they will arrange, perhaps, two days, then three days a week, and so on until at last everyone is happy.

But what is the problem really? How the Americans would laugh if they thought this selectivity problem could ever even occupy the attention of a technician, much less serious administrators! Why, a cheap American set can cut out ten local stations flooding the city with hundreds of millivolts and pick up something distant as a matter of course. The local stations may be only 10 kilocycles apart, but the American lady of the house moves her one dial and hears WXYZ or WZYX as she pleases.

No one who has studied the subject suspects there is a real difficulty in designing a high-quality set capable of selecting two equal (or nearly equal) strength transmissions of whatever strength if there is a

frequency between the two of over 200 kilocycles!

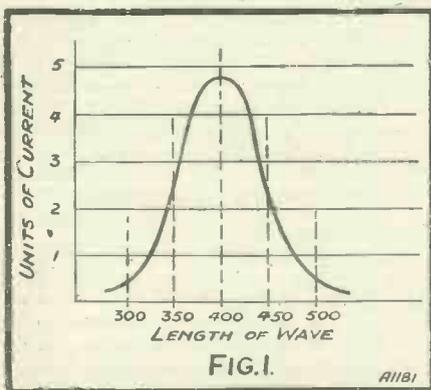
But transmission conditions determine receiving technique, and so long as a considerable city is flooded by one overwhelmingly strong transmission, so long will one find a mass of crude cheap apparatus quite unsuitable for selection, since obviously there has been no incentive to select. In the old days poor people heard of wireless, learnt how to build a 10s. set, built it, heard the programme, and have remained content with the technical arrangements of broadcasting ever since.

Modification But NO Scrapping.

The fact that their cat's-whisker is dead, their set out of tune, their 'phones insensitive through long use, does not bother them, because the overwhelming signal crowds its way past a host of technical imperfections. Then, as they say, this new-fangled scheme throws everything out.

The B.B.C. would have been quite wrong, and their advisory committee wrong to recommend, to go ahead with a scheme which involved the initial scrapping of a

(Continued on next page.)



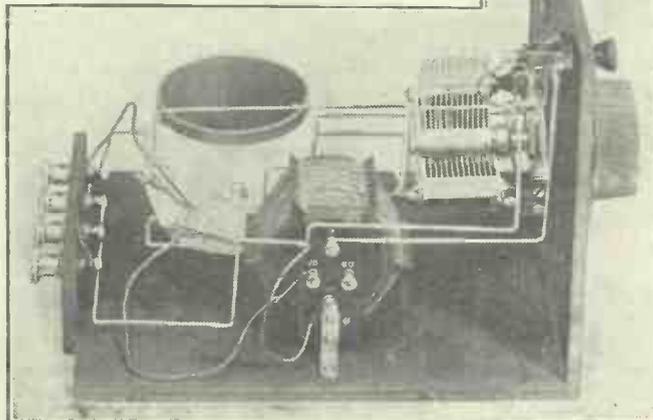
A. typical Resonance Curve.

the new B.B.C. station at Brookman's Park? Will they not, in fact, suffer a confusion of two programmes?

Preliminary Tests.

To my mind the question is not so acute as many imagine it to be, firstly, because I have proved to myself that the very simplest sets will be capable of the required selectivity; secondly, because a wise B.B.C., with its information bureau properly tuned to sense public feeling, can advance towards the finality of the two co-existent programmes as quickly or as slowly as the public set adjusts itself to the new conditions.

A SELECTIVE WAVE-CHANGE CRYSTAL SET.



Such a set as the above is able to deal with the new conditions, and is very easy and cheap to build.

SELECTIVITY AND THE REGIONAL SCHEME.

(Continued from previous page.)

large percentage of existing receiving sets. But the scheme does not involve any scrapping; it may involve modification or addition, but a few shillings and a little ingenuity should suffice in the great majority of cases to put things right.

What, after all, is the problem? Simply stated, it is that if we connect an aerial through an inductance to earth, we get an electrical system which responds more to wireless waves of a certain definite length than to those of any other length.

We can express this fact on a graph paper as in Fig. 1, where the vertical lines represent the current induced in the aerial by waves of various length shown on the horizontal scale.

What Resonance Means.

Thus (Fig. 1), we could say that if we kept our aerial conditions constant, and connected some form of meter to read the current induced in it, and then step by step changed the wave-length of a suitable sending station, the current could rise and fall in the receiving aerial something like as shown. The current reaches maximum when the wave-length has some definite value. (Four hundred metres in our case, as shown in Fig. 1.)

We should obtain very much the same shape of curve if we kept the wave-length of the suitable sending station constant and changed the electric constants of the circuit (by, for instance, changing the inductance or capacity values) through a certain range of adjustment. The resulting curve is called a resonance curve because, at what we call the point of tune—i.e. where the aerial receives the maximum current—the circuit is "resonant" to the frequency of the oscillations in the sending aerial.

If we connect a detector across the inductance, and if we modulate the intensity of the waves emitted from the sending station in sympathy with a musical sound, then, obviously, at the point of tune or resonance point we shall hear the station's modulations most strongly. Most listeners, of course, know that by turning the dials on their sets they find an adjustment where at any rate the station is loudest.

Now, in some types of sets a fractional movement of the dial of the tuning condenser (usually) suffices to bring in and cut



Inserting a wave-trap in a modern set

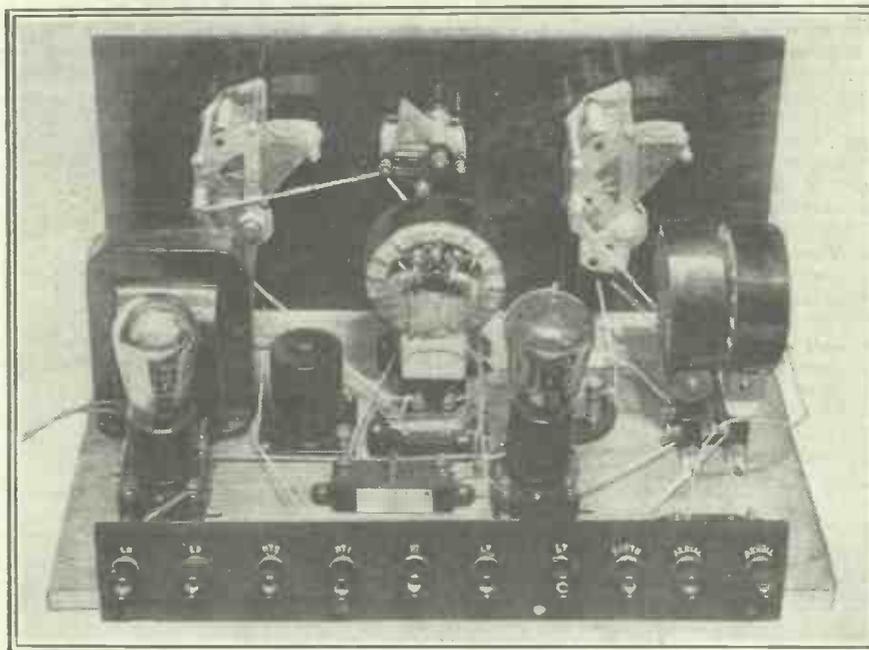
out the station to be heard; the point of tune is very sharply defined. In other sets, particularly crystal sets close to a sending station, one may turn the adjustments through copious movements and still hear the modulations of the transmitter—i.e. still hear the programme.

Obtaining Selectivity.

We say that one set is selective, the other unselective; one set will "tune out" or "cut out" the local station, the other will not. In a further article I will try to show the meaning of selectivity as it is influenced by the design of the set and particularly the size of the aerial in relation to the local field strength.

(To be concluded next week.)

DESIGNED FOR THE REGIONAL SCHEME.



This set incorporates a super-selectivity circuit between the aerial and the grid circuit of the first valve. The receiver is the "P.W." "Kuttemout" Two.

BROADCASTING IN GERMANY.

By A. GULLILAND.

THE Funk-Stunde A.-G., of Berlin, is the broadcasting company responsible for the programmes sent out by Berlin Witzleben and Berlin O, and the relays Magdeburg and Stettin. The company is also responsible for part of the programmes sent out by the Königswusterhausen transmitter.

The Funk-Stunde is also the most powerful of the nine German companies, and the greatest number of listeners belong to the region served by its transmitters. Well over half a million listeners are local listeners of the Funk-Stunde. On June 1st the former Director of Programmes left his post, and Dr. Hans Flesch, up till now Director of the Frankfurt and Cassel stations, came to Berlin in his place.

Novel Outside Broadcasts.

Dr. Flesch's studies were devoted to medicine. His natural inclination was towards things musical and literary, and now we find him as artistic head of the Berlin broadcasting company.

Since his advent a breath of fresh air has been felt in Berlin. It was his idea to send somebody down to Barcelona with a microphone and have him report directly to the German stations his commentary on the world exhibition. Another of his ideas is the "lost microphones" in Paris. He is sending a man to Paris with a microphone, and listeners will get Paris impressions straight from the spot.

Of course, British listeners probably know already that Berlin and Königswusterhausen are sending out alternative programmes as far as the evening is concerned. Here the same points of view are prevalent as with the B.B.C. The two programmes are built up so that one will be lighter than the other and, of course, no two talks will be put on at the same time.

Repeat Performances.

Dr. Flesch frankly confessed that he had taken over one important feature from our own B.B.C. programmes—that of repeating an important performance at a later date over another transmitter. He does this with radio plays and other special studio productions. This gives the listener the opportunity of hearing a good thing twice.

I left Dr. Flesch with the impression that Berlin and its programmes are going to become very much more *alive* than they hitherto have been. Direktor Knöpfke, the man who looks after the money-bags, said that he—or, rather, the Funk-Stunde—had the means, and that a gentleman sitting near had the brains; and, laughingly, he added that the two together would make Berlin one of the names in world broadcasting.

A new large broadcasting house to contain all the studios and offices now scattered in Berlin will probably be ready by next year.



The Northern Wireless Orchestra in the main studio at Manchester (B.B.C. photo).

NOTES FROM THE NORTH

The building of the B.B.C.'s new Regional twin-wave station in Yorkshire, and other items of interest to Northern listeners are reviewed in this article.

From A SPECIAL CORRESPONDENT.

THE small town of Slaithwaite, near which the North Regional high-power station is to be erected, is annoyed with the B.B.C. After due consideration Slaithwaite has written to the B.B.C. protesting against the latter's decision to call the new station "Moorside Edge" and not "Slaithwaite." Slaithwaite was evidently looking forward to the publicity and fame similar to that won by the town of Daventry.

New Name Fixed

The B.B.C.'s decision in the matter is not likely to be altered, however. The question of the new station's name was carefully considered and the controversy over the correct pronunciation of the name Slaithwaite had to be taken into account. And whether it be "Slewit" or "Slough-it" or "Slayth-waite" the name is not exactly an ideal one for broadcasting.

The preliminary work on the contract for this station—the second of the five Regional high-power stations—is now in full swing high on the moors above Slaithwaite. Moorside Edge should be ready for service a year hence. Like the London Regional station, it will give two alternative programmes, one of which will usually be "local" and the other relayed from London or from some other place outside the Northern Region. Northern listeners, who (being round about 100 miles from Daventry) are not nearly so well served with broadcasting as listeners in the Midlands and in the South, may obtain some idea of what the opening of Moorside Edge will mean by comparing the power of each of the two Moorside Edge transmitters with the present North of England transmitters.

Complete Broadcasting Region

Ignoring Newcastle, which station will definitely not close down when Moorside Edge opens, there is only one main station in the North: Manchester. Each Moorside Edge transmission will be 30 times as powerful as the Manchester transmission, and 230 times as powerful as the transmissions from the Leeds, Bradford, Hull, Sheffield, Liverpool, and Stoke relay stations. These transmitters will all close down when Moorside Edge is in full swing.

The building of this new high-power station is just the final stage of the process of turning the North of England into one broadcasting region. Everything else has been done. The region's new offices, control-rooms, and studios, at Manchester are now in full action; the B.B.C. staff in the North has been reorganised on a Regional basis with Mr. G. E. Liveing, the North Region Director, at its head; and

there are now no longer any individual programmes from northern stations—all programmes are either relayed from within or without the region simultaneously by all stations in the region (those named above).

The North Region is, in fact, the most advanced of all the B.B.C.'s new Regional organisations, and on the programme side it is doing good work in its endeavour not only to entertain, but to reflect in its programmes every activity in the North.

A great number of outside broadcasts are being embarked upon and an endeavour is made to broadcast every public event of sufficient importance and suitability. The latest success of this sort was the relay of an eye-witness account of the Amateur T.T. Motor-Cycle Race.

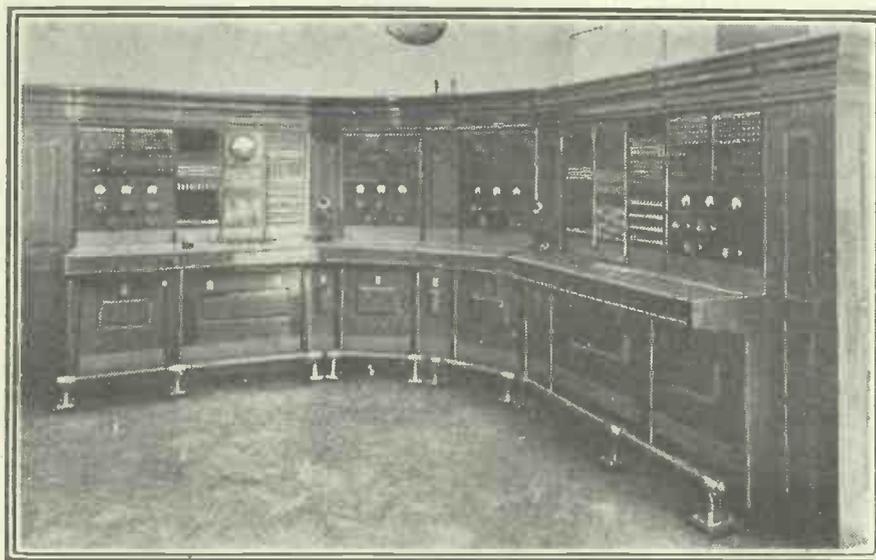
This was relayed from the T.T. grandstand in the Isle of Man and was the first broadcast ever made from that island. Broadcasting from Manxland was practic-

known for his dramatic work, and he is still as keen as ever on it. In September he took a well-earned holiday in Spain, but a heavy programme of rehearsals for forthcoming dramatic productions was waiting his return.

Broadcasting House.

During a recent visit to the Regional headquarters at Manchester—Broadcasting House—I went into the control-room, which is the "last word" in radio engineering—streets ahead, in fact, of even the London control-room. There is a huge control panel with rows of little signal lights, keys, and press-buttons. Everything is automatic. The engineer touches a button and this radio robot does the rest.

I noticed that, as in programmes and in administration, everything is ready for Moorside Edge. The control apparatus is in duplicate, ready to supply Moorside Edge with its two programmes simultane-



This photograph shows the control-room switchboard at the new North Regional headquarters at Manchester (B.B.C. photo).

ally impossible until the recent installation of telephone cable between the island and England, when the Post Office, in laying the cables gave special attention to the future use of the cables by the B.B.C. It is probable that the professional T.T. Races next summer will be broadcast.

One of the old-stagers among B.B.C. officials, Mr. Victor Smythe, is largely responsible for such prompt and efficient arrangements for outside broadcasts in the Northern Region. Mr. Smythe is better

ously. Even the two check receivers are there, waiting to be tuned to the two wavelengths to be used by the high-power station. Although the present northern transmitters will be dismantled most of the studios will be retained, and all Moorside Edge transmissions will be relayed via the new control-room at Broadcasting House. This building stands in Piccadilly, in the centre of Manchester, and is a very handsome place, both from within and without.

LATEST BROADCASTING NEWS.

**ARMISTICE
BROADCAST FEATURES**

**NORWAY'S PROGRAMME.—
"HUNTINGTOWER" ADAPTED
FOR SCOTLAND—SOCCER
ON THE AIR—DEAN INGE
AND H. G. WELLS—
FAREWELL TO NEWCASTLE'S
EXHIBITION.**

OUR readers, already acquainted with the fact that a special radio performance of "Journey's End" is to be a feature (though the final item) of the Armistice Day broadcast programmes, will be interested to learn that on Thursday, November 14th, which, incidentally, is the official birthday of the B.B.C., they are to hear an auction sale of the original MS. of the famous play. The auction is to take place at the Peace Commemoration Dinner of the League of Nations Union, at the Guildhall, London, when the speeches, including those by Lord Cecil, Mr. Philip Snowden, the Chancellor of the Exchequer and General Smuts, will be broadcast.

The sale of the MS., which at the request of Mr. R. S. Sherriff, the author of "Journey's End," is on behalf of the funds of the Union, will be conducted by Sir Herbert Morgan. The play has recently been produced in Swedish at Stockholm, and is also running in New York, Paris, and Berlin, as well as being in the process of making a talking film. Mr. Vernon Bartlett, who is regularly heard in broadcast talks, is now collaborating with Mr. Sherriff in writing the "novel of the play," surely the most outstanding success of the present generation.

Norway's Programme.

National Programmes, which since last winter have been few and far between, are being revived, and the next country to be included in the series is Norway, the time and date chosen being 9.35 p.m. on Thursday, October 17th. The programme includes Bjorsen's poem, "Bergliot," spoken against the background of music which Grieg wrote for it, Grieg's "Symphonic Dances," and compositions by Svendsen and Ole Bull. Excerpts from Ibsen's plays, "The Pretenders" and "Brand," and "The Lament of Gudrum," from William Morris' translation of an old saga will also be heard.

"Huntingtower" Adapted for Scotland.

A radio adaptation of John Buchan's popular novel, "Huntingtower," the film version of which was "starred" by Sir Harry Lauder, will be broadcast from all Scottish stations on Saturday, October 26th. It has been prepared by T. P. Maley and is called "The Joyous Adventure of Mr. Dickson McCunn."

Soccer on the Air.

The first running commentary on an Association football match during the present season is being broadcast from 2 L O, 5 X X and other stations to-day (Saturday, October 12th), when listeners

will hear a description of the second half of the game between the Arsenal and Derby County relayed from the Arsenal Football Ground at Highbury.

A fortnight later, at 6 p.m. on Saturday, October 26th, listeners throughout the Northern region will be given an eye-witness account of the match between Liverpool and Manchester City, which is to be played on the Anfield Ground that afternoon. The play will be described by Mr. Ernest Edwards, a well-known Liverpool sporting journalist.

Dean Inge and H. G. Wells.

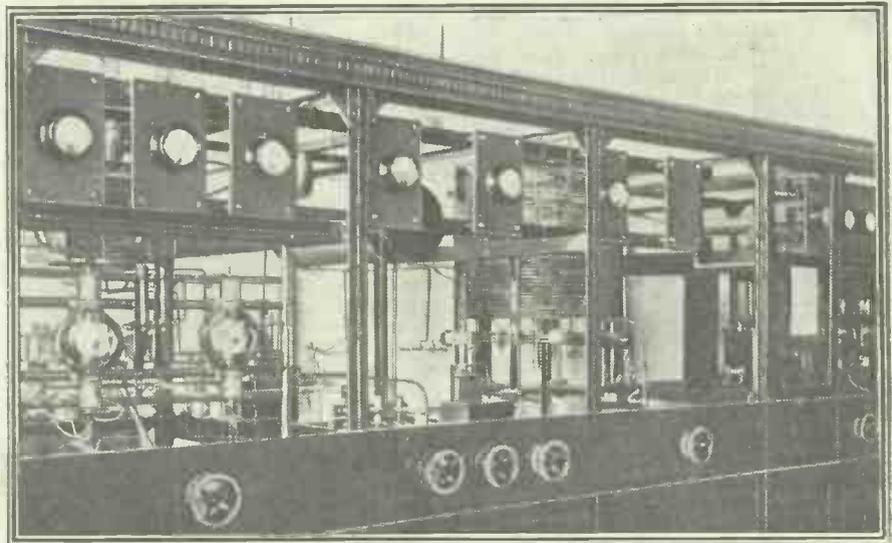
Following the first visit to the London Studio of Dean Inge on October 7th when he broadcast his impressions on current affairs under the title of "Points of View," Mr. H. G. Wells will be heard by listeners in the same series of talks on Monday,

October 21st. Mr. Wells will speak for half an hour, beginning at 9.15 p.m.

Farewell to Newcastle's Exhibition.

The last of the extensive series of musical concerts which have been relayed from the North-East Coast Exhibition will be heard on Saturday evening, October 26th, the day on which the Exhibition closes, when Captain H. G. Amers, its Musical Director, will conduct the Orchestral programme in the Festival Hall. Thousands of letters of appreciation have been received from listeners in connection with the concerts during the season, not only from listeners in the North, but also from others who have heard them via the London and Daventry Stations. Five days after this broadcast farewell, that is on October 31st, Newcastle will lose its identity as a broadcasting station, passing to the national common wave with other, former relay stations.

THE STATION WITH THE LONGEST WAVE-LENGTH.



Kovno (1935 m.) has often been heard in this country, and here is a view of the main transmitting panel.

TECHNICAL NOTES.

By Dr. J. H. T. ROBERTS, F.Inst.P.

MAINS SET DESIGN.

SOME PRACTICAL CONSIDERATIONS THAT WILL ASSIST MANY HOME CONSTRUCTORS.

UNDOUBTEDLY the trend in the design of radio receiving sets is towards the entirely mains-operated set, the set which draws the whole of its motive power from the electric light and therefore does away entirely with the unkeep and attention of electric batteries.

Until comparatively recently the only way to do away with the batteries in connection with a receiving set was to substitute one or more mains-supply units, and, in fact, such units were originally called in the United States "battery substitutes," or battery eliminators. These are, of course, still in considerable use, and they have the advantage that the valves used in the receiving set may still be of the "ordinary" type.

But it is usually a good point in design to have as much as possible of an apparatus entirely enclosed, and on this principle totally self-enclosed receiving sets working straight from the mains are, as already

mentioned, coming more and more into favour and there is no doubt that their popularity will increase as time goes on.

Types of Valves.

Now, in building up a totally enclosed all-from-the-mains receiver we have the choice of three principal methods of dealing with the valve circuits. The first method is to use "ordinary" valves in the receiving circuit and virtually to build into the cabinet the components which, if assembled outside into a separate unit, would go to make up a "mains unit." In other words, the receiving set contains its own mains unit (or units) within the cabinet.

Direct Heating.

The second method is to employ valves in which the filament is directly heated by alternating current, this current being supplied at a low voltage (generally about

(Continued on page 300.)



PROBABLY all of you know that in a wireless set one of two different types of amplification may be employed, and you are familiar with the expressions, "high-frequency amplification" and "low-frequency amplification." Beginners, however, are apt to find it difficult to see why these two types should be necessary, and may easily waste time and money upon a circuit quite unsuited to their requirements.

Think for a moment of the very simplest possible receiving set, a pictorial diagram of which is shown in Fig. 1. Here you can see that signals, which are always in the

A practical chat about various kinds of circuits that will help the constructor both in the selection and construction of sets.

By C. E. FIELD, B.Sc.

If these two portions of the signals are not separated, the speech or music cannot be heard, and so you find that a detector which may be either a valve or a crystal, is essential to every receiving set.

We may therefore regard the detector as a portion of the receiver which turns signals into music.

If we wish to make our results louder, we must obviously magnify, or amplify them, for which purpose we employ valves; but when we come to consider how this should be carried out, we see that there are two methods, for we can either magnify the signals before they are turned into music by the detector, or we can magnify the music currents which would otherwise pass through the 'phones.

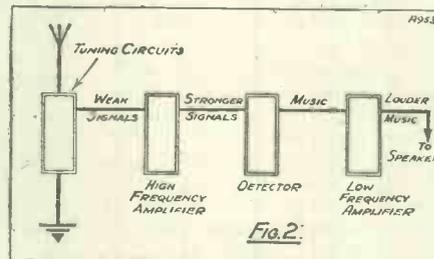
The first process is known as high-frequency or radio-frequency amplification, and the second as low-frequency or voice-frequency amplification, and very often both systems are employed in the same receiver. In such a case, weak signals are received from the aerial and magnified by one or more valves, then turned by the detector into music, which is still further magnified before being passed into the 'phones. You can see this shown diagrammatically in Fig. 2.

The question then arises, what determines whether you should employ low- or high-frequency amplification, and why should you ever need both?

Well, we may say

that the detector, although often not given the same amount of consideration as other portions of a receiver, is really a very critical part of the circuit, for two reasons.

Firstly, it will not give a sufficiently great power output to operate a loud speaker

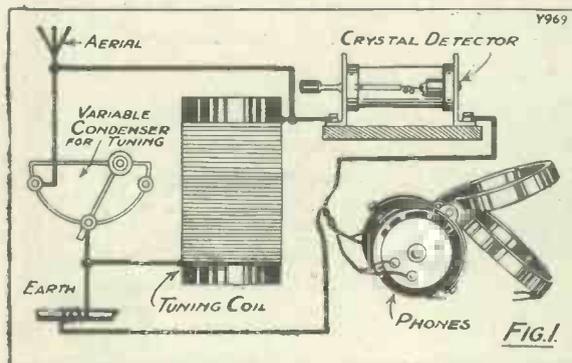


satisfactorily, and so, unless headphones only are being used, at least one valve is normally required to magnify the music from the detector, i.e. at least one stage of low-frequency amplification is necessary.

Increasing Signal Strength.

Secondly, a detector cannot easily separate out high- and low-frequency currents if they are very small, and so very weak signals must be strengthened before being detected. For instance, if the circuit shown in Fig. 1 were tuned in to an American station, nothing would be heard. Moreover, there would still be nothing heard if half a dozen valves were added to magnify the music from the detector, simply because

(Continued on page 259.)



form of very rapidly reversing electric currents, trying to flow between aerial and earth, encounter two alternative paths, one through a coil of wire (the tuning coil) and the other through a crystal detector and a pair of headphones.

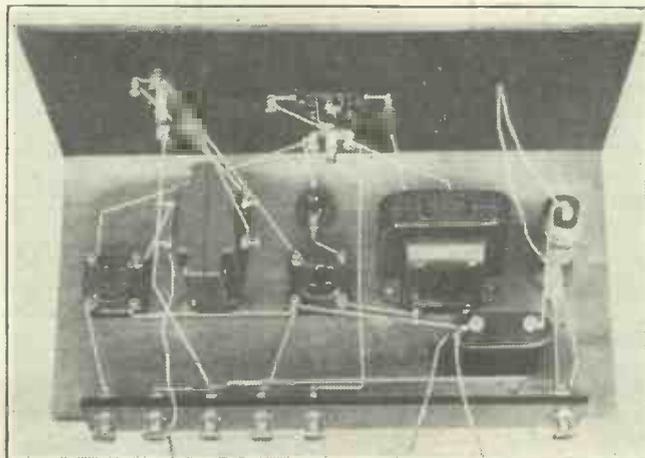
When the coil is "tuned," which is accomplished by varying the condenser connected across it, it opposes the flow of signal currents, which are therefore compelled to pass through the crystal and the 'phones.

The "Sorting-Out" Process.

The purpose of the crystal detector is to rectify the signal currents, but we will not consider in detail what this means, or why it is necessary.

We may say, briefly, however, that signals consist of very rapidly changing currents, combined with others which change much less frequently.

It is these latter, known as low-frequency currents, which give rise to music or speech when passed through the 'phones, and the purpose of the detector is to separate these from the others, which are known as high-frequency currents.



A two-valve amplifier using two L.F. transformers.

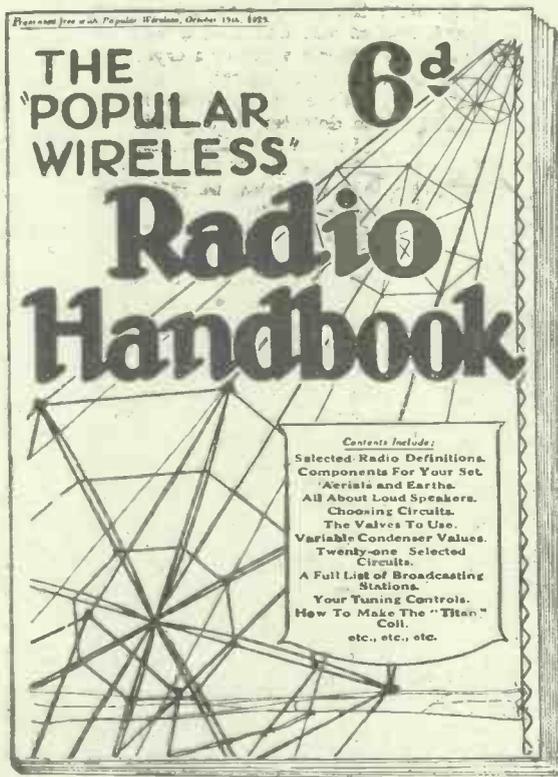
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H.F. AND L.F.

(Continued from page 257.)

the latter would be working so inefficiently that there would be no music to magnify.

As a general rule, therefore, if loud-speaker results are required, or if it is desired to make existing speech or music louder, additional low-frequency amplification is required, whereas high-frequency amplification is necessary for the reception of weak signals, such as are obtained in the case of Fig. (1) from a B.B.C. station at a distance of twenty miles or more.

There are other considerations, however, besides the shortcomings of the detector, which sometimes make it necessary to employ high-frequency amplification, and these are concerned with the tuning arrangements.

You have no doubt, at some time or another, heard some station other than that to which you are listening, faintly in the background—an indication that your set is not sufficiently selective.

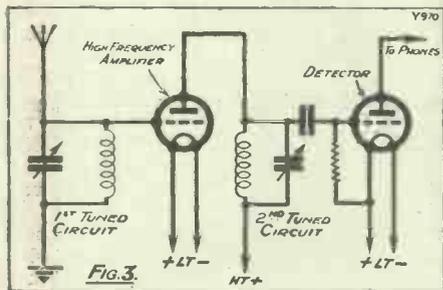
H.F. Amplification.

Now, by using additional stages of amplification before the detector, it is possible to improve a receiver considerably in this respect.

Let us take a very simple example to show how this is brought about, and consider the circuit shown in Fig. 3, which comprises a high-frequency amplifying valve and a detector.

Signals from the aerial are first tuned by means of the aerial tuning condenser and passed into the first valve. Much stronger than before, they leave this valve, and are again tuned by a circuit similar to the aerial circuit, and enter the detector, where they are converted into speech and music and handed on to the 'phones.

Now, let us suppose that we live midway between two broadcasting stations, of which we wish to hear one and cut out the other. This is accomplished partly by means of the aerial tuning condenser which we adjust until the desired station is at its loudest.



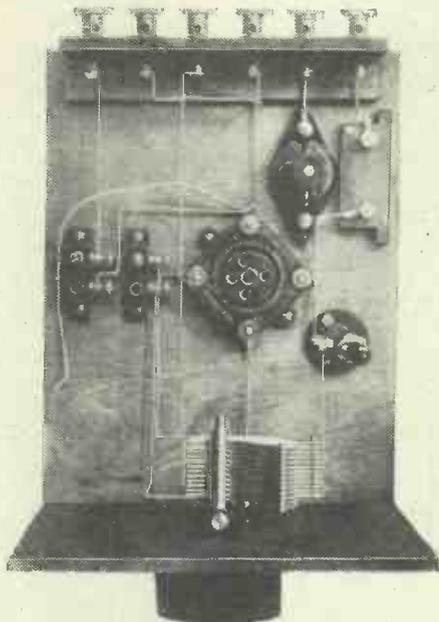
We might suppose, for the sake of argument that by adjustment of this condenser, the wanted signals are made ten times as loud as those from the other station, so that if we passed them straight to the detector, the loudness of the results from the two stations would be in the ratio of ten to one.

Actually we are not doing this, but we are magnifying the signals in the first valve and then tuning them again before they enter the detector. The tuning operation will have the same effect as before, and weaken the signals from one station, say, ten times as

much as those from the other. As those signals have already been made ten times as weak as the others, however, the result is a ratio of 100 to 1 between the strengths of the results from the two stations.

Better Selectivity.

So you see that by adding another valve and tuned circuit, not only have the signals been made stronger for satisfactory operation of the detector, but unwanted signals have been made relatively very much weaker, i.e. the set has been rendered more selective.



A simple one-valve set in which the valve acts as a detector and amplifier.

It is possible to make a set very sensitive and selective without the use of a high-frequency amplifying valve by means of reaction, which allows some of the output from the detector to be magnified by that valve over and over again; but this method gives rise to poor quality of reception, and produces interference, unless used with great care.

Although we have not considered the many different methods of carrying out high- and low-frequency amplification, the foregoing will perhaps serve to give a general idea of the essential difference between the two types and the conditions under which each should be employed.

TELEPHONE RECEIVERS.

THE magnets in a telephone receiver are of a permanent type, with the result that the diaphragm is constantly under a strain and tends to slightly bend towards the magnets.

The operation of telephones is partly permanent and partly electro-magnetic. The strength of an electro-magnet depends on two factors.

- (1) The number of turns of wire.
- (2) The current flowing.

The product of 1 and 2 are spoken of as ampere turns.

It will be readily grasped that the current flowing will be solely dependent on the strength of the signals received, therefore, the strength of current is more or less fixed.

The number of turns is, however, a variable factor. The greater the number of turns with any given current, the larger the increase in the strength of the magnets and the louder the signal.

Necessary Features.

When the telephones are to be joined in the plate circuit of a valve, it is essential that:

- (1) The wire must be of sufficient gauge to carry the plate current of this valve. (Joining 'phones directly in the plate circuit is, in any case, a bad practice.)
- (2) The phones must have a reasonably low resistance or a large voltage drop will take place across the windings. (This applies not only to valve but to crystal circuits as well.)
- (3) The telephone receivers must be of such a size and weight as to be practicable for wearing.

It must be clearly understood therefore that we are forced to employ 'phones with a fairly high resistance whether we wish to or not, if we are going to connect the 'phones directly in the plate circuit of a valve, or in series with a crystal.

PRACTICAL TIPS.

Testing the specific gravity of the accumulator by means of a hydrometer is one of the best ways of keeping an eye upon its exact condition, and ensuring that it has a long life.

The top of the plates of an accumulator should always be below the level of the liquid.

For short-wave working it is essential to use a good quality slow-motion tuning condenser.

Never alter the grid-bias adjustment of a power-valve unless you switch off the set.

It does not matter which way round you connect an H.F. choke.

Spring contacts such as afforded by split pins can often be greatly improved by being gently opened a little with a penknife.

Don't pull a valve out of its holder by tugging at its glass bulb or you may loosen this from its base.

Don't run a covered H.T. + wire through a screening box without giving it extra protection, as such a box is nearly always joined to H.T.—, and contact is liable to spoil your battery, or do other damage.

One of the commonest causes of poor results is bad contact between pins and sockets, caused by dirt, dust, etc.

Coil and valve contacts can often be greatly improved by cleaning the pins with metal polish, and finishing off thoroughly with a dry soft cloth.

Do not expect a grid-bias battery to last more than six months.

"MISERABLE" POETRY - WITH A WORD ABOUT LICENCES.

By THE EDITOR.

THERE have been two unusual cases in the papers during the last few days which have had a close link with broadcasting. One dealt with the unfortunate experience of a woman wireless listener when visited by a Post Office official for using a set without a licence, and the other case was that of a woman living in Bromley who was said to have been so depressed by the broadcasting of certain poems that she committed suicide by gas poisoning.

Listeners who have good memories will remember that, in the early days of broadcasting, several cases cropped up in the papers of people who attributed a good deal of bad luck, and many evils, to broadcasting.

An "Isolated Instance."

We have received, in the past, letters from readers complaining that they are slowly being murdered by wireless; and the complainant who suggests that bad weather is due to wireless is known to nearly all of us! But the case of somebody committing suicide because of broadcasting is quite a new one.

In short, the case was this: at an inquest held in Bromley recently the husband of a wife who had committed suicide stated that the lady was depressed by the "miserable" poetry broadcast. And, although a verdict of suicide while of unsound mind was returned, considerable publicity was given to this link between suicide and broadcasting.

An official of the B.B.C. was probably right when he said: "This case must be an isolated instance. Since the series of poetry readings was inaugurated, about a year ago, there has been a steady growth in the correspondence expressing appreciation. As a matter of fact, we undertook the series with some trepidation. We did not know whether it would 'go down' with the ordinary listener. Judging by the letters we receive, however, people, as a result, are acquiring a taste for poetry. We do not ban sad poetry from the readings."

Too Much Publicity.

"We make the selections in the same way as one would choose an anthology of an author's work. Nevertheless, there has not been a single complaint of the poems inducing depression. If they had that effect generally, we should soon hear about it, especially when one considers the number of hospital patients among our listeners."

Nevertheless, such an authority as Mr. Bernard Shaw holds the opposite view. But then, of course, he is very much given to paradoxical remarks, especially in connection with broadcasting. Mr. Shaw stated: "I wonder there are not more suicides. At the same time, it is so very easy to turn off the loud speaker that I think I should prefer that course!"

Of course, there is no doubt that in this particular case under review it was a

question of depression, probably heightened by listening in to some rather sad poems. But we do think it is unfortunate that so much publicity should be given to the remark made at the inquest that the suicide was due to the "miserable" poetry broadcast.

B.B.C. Discretion.

The B.B.C., in selecting items for poetical broadcasts have shown extraordinary discretion. They might, for instance, have chosen many poems which would have had deleterious effects upon certain kinds of listeners but, as usual, a considerable amount of tact and good taste has been shown at Savoy Hill in the choice of poems for broadcasting, and any reader who imagines that the B.B.C. can be blamed because some unfortunate person commits

people. I do not agree with broadcasting 'miserable' poetry, but I do not believe in 'miserable' poetry, anyway.

"Of course, there is tragic poetry, and that should not be excluded from broadcasting. Tragic poetry braces people and does not make them miserable. I do not know the circumstances of this pathetic case, but I cannot imagine what there is to make people miserable in reading the poetry referred to."

The Licence Case.

The second case, which has also received considerable publicity, is due to an allegation that a Post Office official "browbeat" a woman wireless listener for using a wireless set without a licence.

The official in question, a Mr. Benjamin Lane, said that the woman wireless listener produced a licence which was marked as having been renewed, and said that she had not got the old licence. In cross-examination, it was alleged that Mr. Lane talked imprisonment and penalties, and his reply was that that was in order under the Act.

It appears that, although the defendant had shown that she was not in default about the licence, Mr. Lane started to talk about extreme penalties of the law. Mr. Lane explained in the witness-box that there was no record of a previous licence.

It was further alleged that when the defendant's licence was renewed a Post Office official came along and browbeat her, although she produced her licence, that he used high-handed and almost third-degree methods.

Two Fines.

The result was that the woman defendant was fined 2s. on each of the two summonses issued against her!

But here again so much publicity was given to this Post Office prosecution in connection with a radio listener, and so much is still said about people being sent to gaol because they haven't got a licence, that a good many people who have recently purchased wireless sets may be unduly perturbed at the responsibilities they think they may be incurring by installing a wireless receiver.

We hope that all readers of POPULAR WIRELESS who have friends who have just decided to install wireless sets will make the necessary facts clear to them; a licence is necessary for any wireless set, whether portable or otherwise, and this licence must be obtained and renewed yearly.

RADIO AND ART.

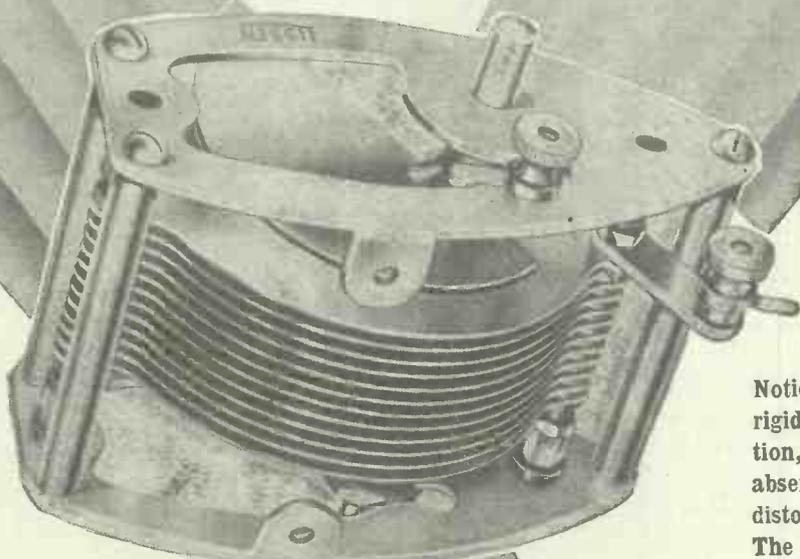


A German artist's idea of Radio encompassing the World—shown at the recent Berlin Radio Exhibition.

suicide after listening in to a broadcast reading of poetry is very much mistaken.

A serious authority like Mr. John Drinkwater says: "I think that the broadcasting of poetry is a very good thing. The spoken word over the radio is one of the best ways in which poetry can be brought to the

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FRENCH POLISHING.

The Editor, POPULAR WIRELESS.

Dear Sir,—May I draw your attention to the instructions given in a recent issue on French polishing.

I quite agree with the hints given in smoothing and preparing the wood, but do not advocate the use of glue even in diluted form to raise the grain.

Water will do just as well and will leave the work nice and clean. Just damp the wood and take the grain down with not too rough a glass paper.

When this is done and the work has dried thoroughly, if it is a good class wood such as mahogany, walnut, oak, a dressing of raw linseed oil should be given (red alkanet oil preferred for mahogany), after which it should be put on one side to dry.

You may then fill in the grain by mixing whiting and turpentine to a paste colouring to suit the wood as under.

Mahogany	..	Rose pink powder.
Oak	..	Burnt amber.
Walnut	..	Vandyck brown.

Or better still, purchase at any paint shop a filler which will suit any of these woods and mix as above. You may add a little raw linseed oil.

This paste should be smeared across the grain and, after standing for fifteen minutes, wiped off the same way. This will fill the grain and save a big lot of bodying up.

A brush coat may then be given to the work and allowed to dry, after which papering must be again resorted to, this time with a drop of raw linseed oil on the paper to prevent scratching, and always use a bit of worn 0 glass paper.

When this is done, dip your pad in polish (shellac and meth.), and after squeezing same out place a piece of unstarched linen around same, forming it for preference into a pear shape.

It is essential that the linen has no starch whatever in same. Then apply a spot or two of raw linseed oil on the rubber by dipping the finger in the oil and smearing it on same, and commence the rubbing process in the form of the letter eight.

An indication of correct French polishing is a broad dull smear which will begin to brighten as the rubber dries out.

The first one or two rubbers need not be worked to a standstill, but may be replenished before they are dry, but a rubber should never be soaking but just wet enough to be able to squeeze the polish on to the surface.

After the work has been boiled up as described above and the rubber marks removed, it is put on one side until the next day, or at any rate for several hours, and the process of sandpapering is again gone through with very worn 0 glass paper, and raw linseed oil to prevent scratching the wood.

THAT VELVETY SMOOTHNESS.

You then sprinkle a few drops of polish on your rubber and an equal quantity of methylated spirit, and after placing a new linen cover on same put just the tiniest drop of oil on, always remembering that oil is not an essential part of the process, but is only for lubricating the rubber and enabling it to travel over the work smoothly, and if you use too much oil in the process, then you are going to have difficulty in spiriting out later and the work will feel clammy and show dull marks when touched.

Work the new rubber the same way as the old, adding a few drops only of spirit from time to time until it becomes mostly spirit that you are using, and when the rubber marks have dried out you may finish off in straight strokes with the grain. If this rubber should at any time be a little too damp, wait thirty seconds before applying same again, and do not use it continuously until you feel it travelling over the surface with a velvety smoothness.

ALTHOUGH I have seen several abridged lists of the various wave-length allocations made by the Washington Conference in connection with the shorter wave-lengths, I have only just recently seen the complete manner in which the whole spectrum from 5 to 100 metres is filled up.

I had never previously been able to spot the exact bands allocated for short-wave broadcasting, but these were given on this chart, and were as follows:

50-48.8 metres; 31.6-31.2 metres; 25.6-25.2 metres; 19.85-19.55 metres; 16.9-16.85 metres; 14-13.9 metres.

Thus my recent remarks on the two groups of broadcasting stations on 32 metres and 25 metres were not far wrong; although my prophecy was!

Check Your Wavelengths.

The bands are rather narrow, particularly that near 16 metres, but each will accommodate quite a number of stations provided that some good form of frequency stabilisation is employed. Incidentally, it is inter-

CORRESPONDENCE.

FRENCH POLISHING.

WORKING ACCUMULATORS FROM D.C. MAINS—BROOKMAN'S PARK—"JUDY" HAS PUNCH!

Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

The second it feels tacky remove it at once and wait until you may safely apply it again or you will tear up the polish and undo all your work.

The polish is made as described by you—a small particle of gum benzoin may be added, but this is not essential. Polish should never be thick but about the consistency of strong tea.

The staining advocated by you is quite O.K., but it should be made clear to your readers that unless they are polishing oak, the polish should always be slightly tinted with the tiniest spot of Bismarck brown, otherwise mahogany, walnut and other similar woods will look muddy with the brown shellac polish, but remember only the tiniest bit, otherwise all your wood will be a mahogany colour.

Yours faithfully,
A. B. L.

Ashton-on-Mersey.

WORKING ACCUMULATORS FROM D.C. MAINS.

The Editor, POPULAR WIRELESS.

Dear Sir,—In order to do away with the handling of low-tension accumulators, I devised the following scheme for working off D.C. mains.

Two accumulators, each capable of running the set, are connected in series. The mains are connected across the accumulators through a double-pole switch—a suitable lamp resistance being placed in the positive lead, for passing a charging current.

A double-throw double-pole switch is arranged near the accumulators. The centre or blade terminals of the D.P.D.T. switch are connected to the accumulator leads of the set, as shown in the enclosed diagram. Connect two diagonally opposite contact terminals (the top right and bottom left) together, and further connect them to the centre terminal of the two accumulators. Connect the top left contact terminal of the D.P.D.T. to the negative terminal of the battery—the remaining bottom right terminal to the positive side of the accumulator.

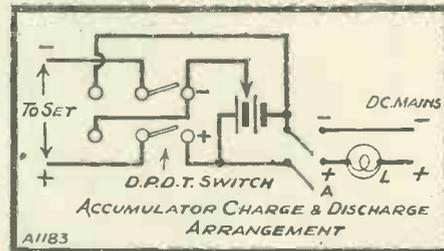
To operate the arrangement for running the set, open the double-pole switch A. Either accumulator can then be connected to the set, by closing the D.P.D.T. switch into one or the other of its positions. When this accumulator is discharged, the other one can then be connected to the set by throwing over the D.P.D.T. switch into its alternative position. To recharge the accumulators put the D.P.D.T. switch in its mid position and close switch A, when a charging current, controlled by lamp resistance L, will flow through the two accumulators. When charging is complete open switch A and then throw

the D.P.D.T. switch into either position for connecting one of the accumulators to the set.

The arrangement eliminates any handling of the accumulator terminals, and while the accumulators are being used the set is entirely disconnected from the mains.

It is of course essential when wiring up the arrangement to maintain correct polarity as indicated by the sketch.

It is more desirable, instead of completely dis-



charging each accumulator, to alternate between them over a given time interval, say one week. By this means the condition of the cells is kept fairly even, and the chance of being left without L.T. supply is greatly reduced.

Yours faithfully,

A. A. HALCROW.

Dalston, E.S.

BROOKMAN'S PARK.

The Editor, POPULAR WIRELESS.

Dear Sir,—As a reader of your paper I must write to tell you about the reception of the Regional Station at Brookman's Park. On Sunday morning at 12.15 I was chasing stations round the dial on my two-valve Reinartz, when a terrific oscillation nearly deafened me. I had been working from the top of the scale, and my reaction had just crossed the line when I reached that station. The volume surprised me, as I could make out every word with the 'phones a good two feet from my ears. This means a lot to me as it will bring four programmes when the Glasgow Regional is built.

Wishing your paper every success.

Glasgow.

W. GRANT.

"JUDY" HAS PUNCH!

The Editor, POPULAR WIRELESS.

Dear Sir,—Having built the "Judy" one-valver, let me congratulate the staff of your paper on designing such a splendid set.

Being just the set I had been looking for, I built it up out of spare parts, and tested it out on an indoor aerial consisting of 30 feet of wire stretched across the attic. To my surprise, 5 X X came roaring in on headphones, also 5 G B and 2 L O (which is 90 miles away), and Cardiff.

Encouraged by my success, I tried the set on foreigners, and brought in several, amounting to ten. Upon testing on an outdoor aerial, the range was greatly increased, and I got about 20 stations.

I am very pleased with this set, and shall recommend it to my friends.

Thanking you for a very good set, and also for an excellent paper.

Yours faithfully,

G. BALDWIN.

Gloucestershire.

obvious that the amateur transmitter was really very lucky to be given a place on the earth at all.

It is fully realised that the pioneer efforts of amateurs have made short-wave working to-day what it is; but, at the same time, one could hardly expect the various Governments to admit this, and the fact that the amateurs have been granted four or five wave-bands, all in harmonic relation, to facilitate work on crystal-control, shows that they are recognised, if not fully appreciated.

Our Place in the Ether.

The only point is that if the amateur transmitter, particularly in this country, does not live up to the name he has made for himself, he will soon be deemed a nuisance, and at the next wave-length shuffle (may it be many years hence!) he will find himself without a place in the ether at all.

The "phone-hound" with mike in earth-lead, and the wobbly, chirpy C.W. station out after QSL cards, are the curses of amateur work.

SHORT-WAVE NOTES.

By W. L. S.

esting to note that at the present time quite a number of broadcasting stations are outside these bands, not only by wave-meter measurements, but also by their published wave-lengths!

I also give below, for the benefit of those wishing to calibrate wave-meters, the exact wave-lengths of some of the more frequently heard commercial stations:

W I Z, 43 metres; G L Q, 27.45 metres; G B H, 25.906 metres; S U W, 25.17 metres; C F, 24.793 metres; G L L, 21.962 metres; S U Z, 21.70 metres; W E Q Y, 21.63 metres; W I K, 21.54 metres.

When we come to look back at the Washington Conference of 1927, and the careful way in which every available kilocycle was handed out to someone, it is

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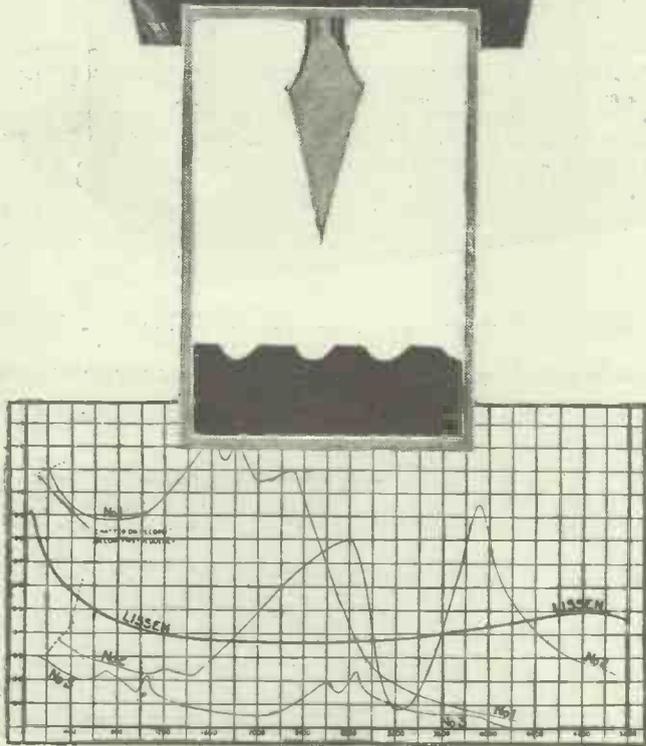
If you want every single record to sound much better than those you hear at demonstrations—if you want radio-gramophone reproduction that comes so near to reality that in a darkened room you would suspect the presence of the artist—get this new Lissen Pickup and learn what perfection means. Any Lissen radio dealer will demonstrate it for you.

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THE SIGNIFICANCE OF THE CURVE.

Look at Curve 1. A particularly fine response for part of its curve, but notice the peaks and depressions and the very serious falling off in output after 2,800 cycles—after 200 cycles it would not remain on the record. In Curves 2 and 3 the same deficiencies exist. Now look at the Lissen Curve. It is the only even curve. These are actual-tests under ordinary conditions. The real significance of the Lissen curve is that you get true musical values from one end of the scale to the other.

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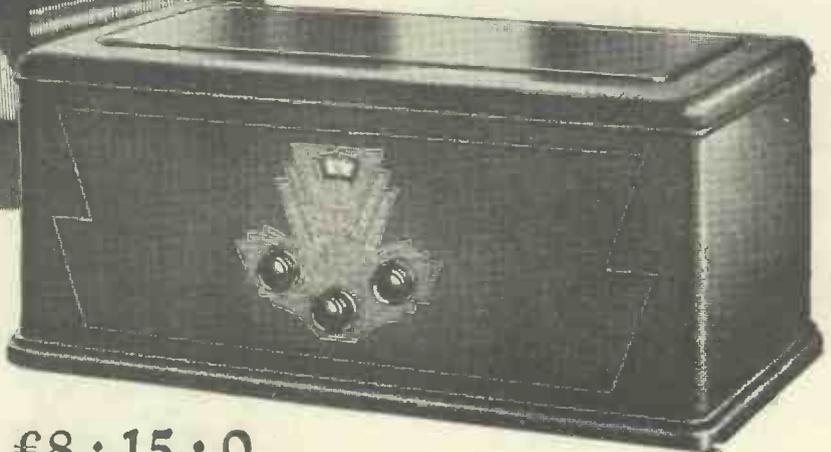
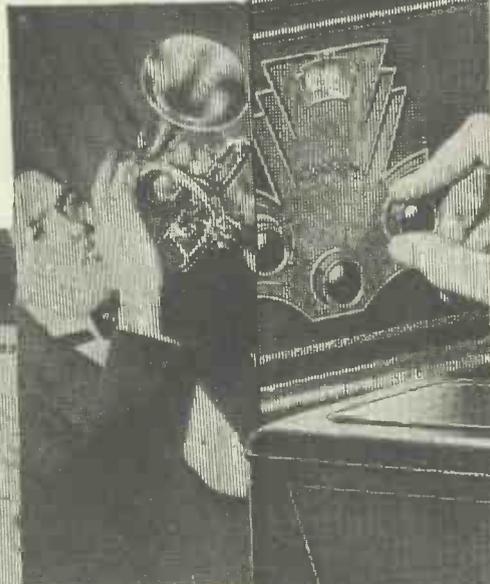
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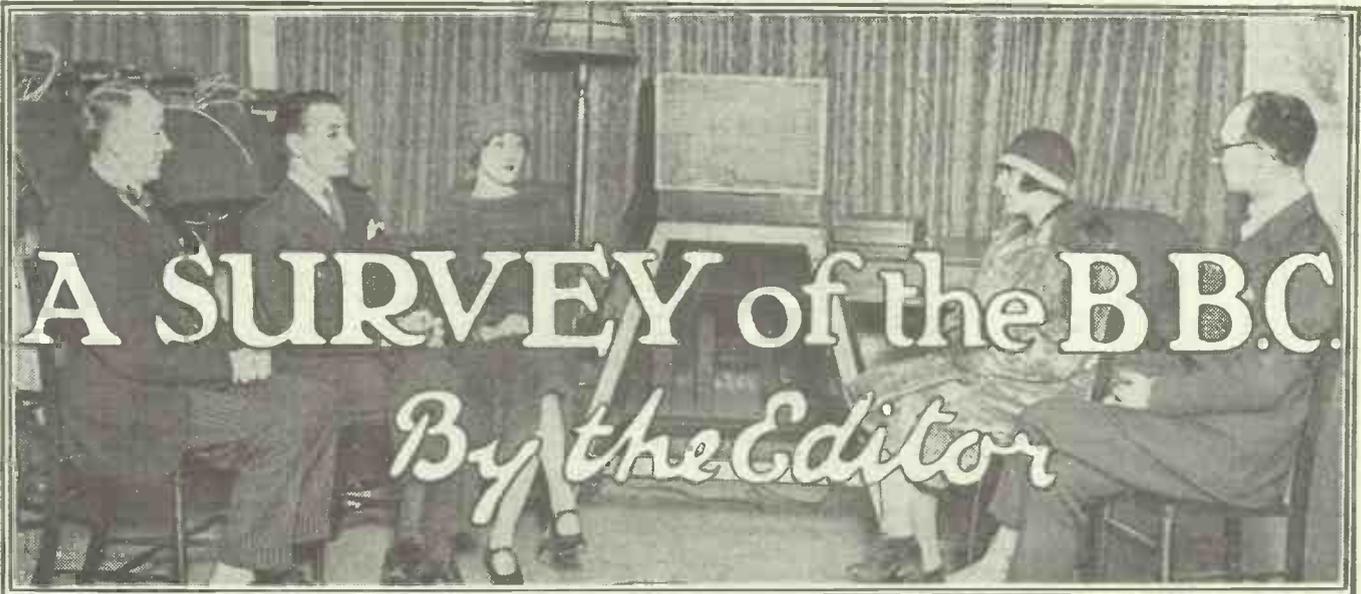
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P

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WHEN Sir William Mitchell-Thomson, then Postmaster-General, was explaining to Parliament in 1926 the new constitution of British Broadcasting, he made it clear that the normal period of office for Governors would be five years, although the new B.B.C. was to run from January 1st, 1927, to January 1st, 1936.

He added that he hoped the first set of Governors would acquit themselves so well that they would be automatically invited to stay in office for another term of five years, thus seeing through the ten-year Licence.

If, however, we regard five years as the probable duration of tenure of the Governors, they reached the



The Earl of Clarendon, Chairman of the B.B.C.

half-time on June 30th last. As the Governors are the trustees of the public and are accountable to Parliament for the well-being of the broadcasting service, it is only right that their attitude should be closely and continuously scrutinised.

Who Are The Governors ?

First of all then, who are the Governors ? The Chairman is the Earl of Clarendon, formerly Under-Secretary at the Dominions Office. The Vice-Chairman is Lord Gainford, formerly Chairman of the Broadcasting Company. The other Governors are Mrs. Philip Snowden, wife of the Labour Chancellor of the Exchequer ; Sir Gordon Nairne, a Governor of the Bank of England ; and Dr. Rendall, until recently Headmaster of Winchester.

The Chairman draws £3,000 a year, the Vice-Chairman £1,500, and the others £700 each, a salary total of £6,600. Allowing for expenses, it is unlikely that the Governors cost listeners less than £7,500 a year. These emoluments are, of course, much larger than the fees ordinarily paid to the Directors of a Limited Public Company. The old B.B.C. Board cost less than £2,000 a year including expenses, or about £5,500 less

* * * * *

This is the first article of a short series in which the machinery of the British Broadcasting Corporation is candidly criticised. It is the best-informed series of articles that has been published, and discloses behind-the-scenes details that are seldom, if ever, made known to the public.

1. HALF-TIME FOR THE GOVERNORS.

* * * * *

than the new Board. What was the theoretical reason for the difference, and its justification in public policy ?

This point was carefully explained by Sir William Mitchell-Thomson in 1926. To be a Governor of the B.B.C. was to have no sinecure. Here was to be no ordinary Board of Directors. Governors were to "work"; they were to be clear of political and financial entanglements. They were to make broadcasting a full-time job in every sense. This justification was readily



Sir John Reith, Director-General.

accepted by Parliament, the opinion being that for full-time service the emoluments were anything but excessive presuming the competence of those concerned.

Now let us examine what happened with this "working Board." It has to be noted, first of all, that they were not taking over a new business; they were joining a smoothly running, well established, and fully organised public service. And another thing, they had to deal with a chief executive whose whole experience had been with Boards that functioned on the normal business lines. That is, they dealt with large aspects of policy at quarterly meetings, accepted responsibility to shareholders, and barely had their expenses covered for these tasks.



Sir Gordon Nairne, Governor.

The "Working Board."

A "working board" of the kind contemplated by the Parliament of 1926 was a "new one" on Sir John Reith, whose natural tendency was to treat it on the same lines as he treated the old one, that is, with consistent firmness modified with a measure of mild tolerance when things went well.

The old Board was made up of business men, with numerous preoccupations, and they were only too glad to be able to rely to a great extent on their chief executive so far as the B.B.C. was concerned. Now, even if the new Board felt they could rely on Sir John Reith as much as the old one did, the circumstances of their appointment were so different that they would not be able to follow the policy of their predecessors for long. But apparently they began in this way. Lord Clarendon, Lord Gainford, Sir Gordon Nairne and Dr. Rendall would have been ready to leave much to Sir John.

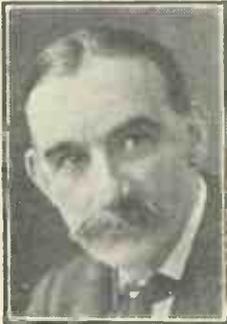
(Continued on next page.)

A SURVEY OF THE B.B.C.

(Continued from previous page.)

Not so Mrs. Snowden, however. The wife of the Labour Chancellor was a great admirer of and believer in Sir John and his staff; but it was in her nature to take a more active part and to ensure that what she considered to be the clearly expressed intentions of Parliament were carried out.

So early in 1926 Mrs. Snowden made it clear that she would not carry on unless she did the work she believed was her duty. She declared that the Governors should acquire first-hand knowledge of the whole business, and should be at liberty to go and come as they liked, it being understood that the authority of the Chief Executive and the discipline of the service should be sedulously protected. But her doctrine was not accepted. There ensued a



Dr. Montague Rendall.

period of controversy, at the end of which Mrs. Snowden found herself in a minority of one on the new Board. Her colleagues were for leaving well alone and taking a chance on the intentions of Parliament.

Need of More Humanity.

The situation became extremely critical in the early part of 1928, when it seemed probable that Mrs. Snowden would retire from the B.B.C. Board and tell the newspapers why. But she decided to "stick it"; and quite apart from whether her views were right or wrong, it speaks well for her character and determination that she declined either to retire or to be pushed out.

The controversy tended to lose some of its bitterness. By degrees a better spirit came over the relations between the Board and the Chief Executive; but the main issue was merely in suspense. Mrs. Snowden did not yield an inch. She proceeded to do a job on her own, and by the end of last spring she had converted all her colleagues to her way of thinking, although not necessarily to her methods of practical interpretation. But, anyway, the theory of a working Board has now been accepted with its connotation that the Governors are to mingle freely with the staff of the B.B.C.



Lord Gainford.

Apparently, the decisive argument was the growing certainty that there was urgent need of more "humanity" in the treatment of B.B.C. staff generally.

What is to happen now? All that the Governors have done so far is to make it clear to as many of the staff as they can

(that the Board is now a final court of appeal in all matters of grievance or alleged injustice. They have also announced their intention to begin going round Savoy Hill in order to study all the departments of the work, and to get to know even the most junior members of staff. I believe this will start in the late autumn.

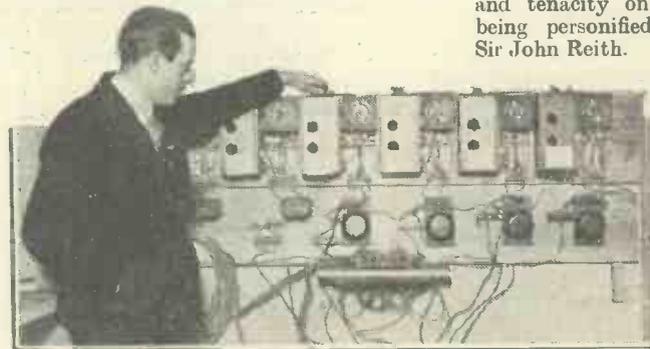
I imagine that Lord Clarendon and his colleagues are not anxious to have an open break with Sir John Reith. They recognise that he has performed tremendous services for British Broadcasting and that "outside" he might be a formidable danger. But they cannot evade their constitutional responsibilities. They must either get busy or get out. They have gone too far to withdraw. They are desperately anxious to see things through and keep their Director-General.

The Constitutional Position.

It is known that the position has become so serious that the Prime Minister himself has given the problem some thought. The Board, of course, could not be described as excessively strong. Nor is it a



An energetic Governor—Mrs. Philip Snowden.



Capt. P. P. Eckersley, M.I.E.E., who, until he joined the staff of "P.W." was Chief Engineer of the British Broadcasting Corporation.

Board calculated to inspire public confidence as competent to run a great entertainment. But this does not diminish the unassailability of its constitutional position.

Various solutions are being canvassed in official circles. One is that Sir John Reith should be put on the Board. If he were now included he would become more of a colleague and less of a competitive element in the deliberations on policy. After all, he was a full member of the old Board, and this was probably one of the reasons why things ran so smoothly in the Company's days.

Vacancies on the Board.

Another solution is to add to the Governors. There are two vacant places. These might be filled by persons skilled and experienced in the actual job of entertainment. Their appointment would direct the discussions of the B.B.C. Board towards broadcasting and away from administrative personalities. Then, perhaps, the constitution might work roughly as intended.

The third solution, and the one which will become inevitable in the face of long-continued deadlock is another public

inquiry into the working of the B.B.C. It would be a very great pity if this were forced.

By far the best course, and the only really enlightened one, is simultaneously to add to the Board two experts in entertainment and to make a fresh start to implement the constitution. An era of open diplomacy should be begun at Savoy Hill. The policy of exclusion and water-tight compartments should be banished. Let the Governors and the Director-General join hands in open sympathetic co-operation.

There is the Regional Scheme, sadly neglected and lamentably late. There is the threatened debacle of the National Orchestra. There is the absence of the long view in policy interpretation; there is the repeated failure to take the public into confidence. Surely enough and to spare for the material of careful thought and hard work.

The Score To-day.

I called this article "Half-time for the Governors." To apply the metaphor: the score in the first quarter was Sir John Reith 6: Governors 0. In the second quarter the Governors scored 2 and Sir John 2. Which, being interpreted, means that *Broadcasting* was beaten in the first half by a total of 8 to 2. And this is really serious. One last point. If all attempts to reach settlement fail, the strife will develop. There will be terrific sincerity and tenacity on both sides, the causes being personified in Mrs. Snowden and Sir John Reith. It would be of inestimable value to broadcasting if their unbounded energy and ability were to be combined instead of being largely dissipated in arguments and controversies.

FOR YOUR NOTEBOOK

Insulators which are used in towns, particularly near chimneys or factories, require cleaning much oftener than similar insulators used in the country.

Poor contact is often caused in an earth connection by the junction of dissimilar metals, so that where copper wire is employed it is advisable to use a copper earth-plate if possible.

The golden rule in radio is: "Never interfere with the wiring of a set until the H.T. negative plug has been removed from the battery."

When your aerial is not in use it should be connected direct to earth outside the house.

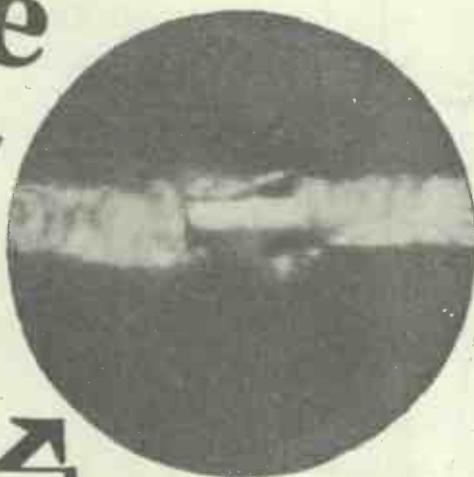
Never connect an old H.T. battery in series with a new H.T. battery.

Not only do different valves require different grid bias, but the bias varies according to the position in which the valve is employed in the receiver, and how much H.T. is being used.

A rough-and-ready rule for finding the approximate grid-bias volts required by an L.F. valve (not a pentode) is to divide the high-tension voltage by twice the amplification factor



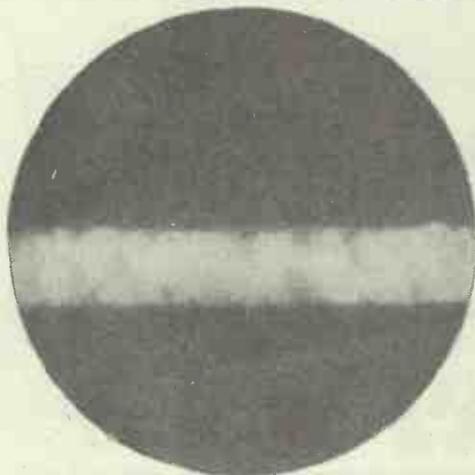
What the eye
cannot see -
**THE EAR
CAN DETECT**



**A BAD Filament
WITHOUT**

"TENACIOUS COATING"

Reproduction from an untouched microphotograph showing part of the filament of a badly coated valve before use, showing a serious gap in the coating. A gap such as this starts the valve off in its life with a poor performance. The valve then prematurely fails.



**A GOOD Filament
WITH**

"TENACIOUS COATING"

This reproduction shows the coating typical of all OSRAM VALVES: Notice the absolute evenness of the coating. There are no gaps, the coating clings, so that the full benefit of the coating is maintained. The secret is the startling discovery of the scientific process of "TENACIOUS COATING."

WRITE for booklet, "OSRAM WIRELESS GUIDE" (1929 edition). Sent post free.

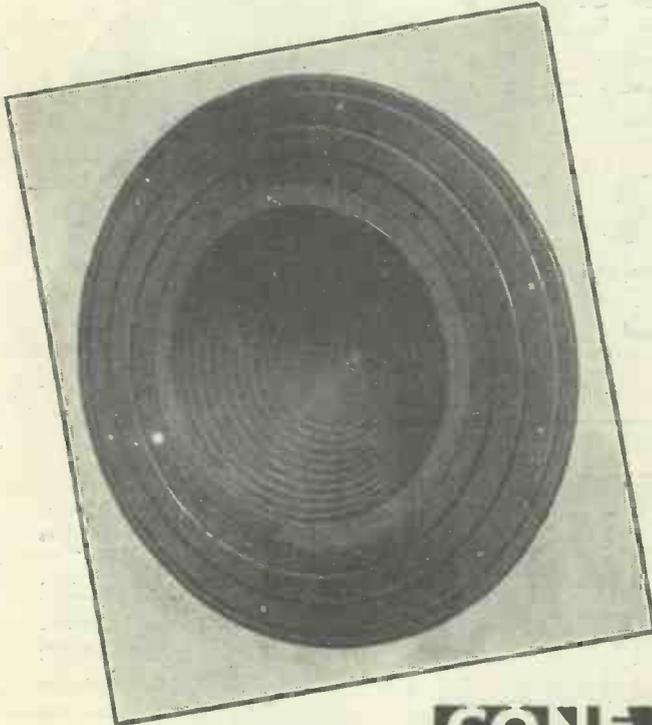
**WHAT
THE
MICRO-
SCOPE
REVEALS**

**Osram
Valves**
with the

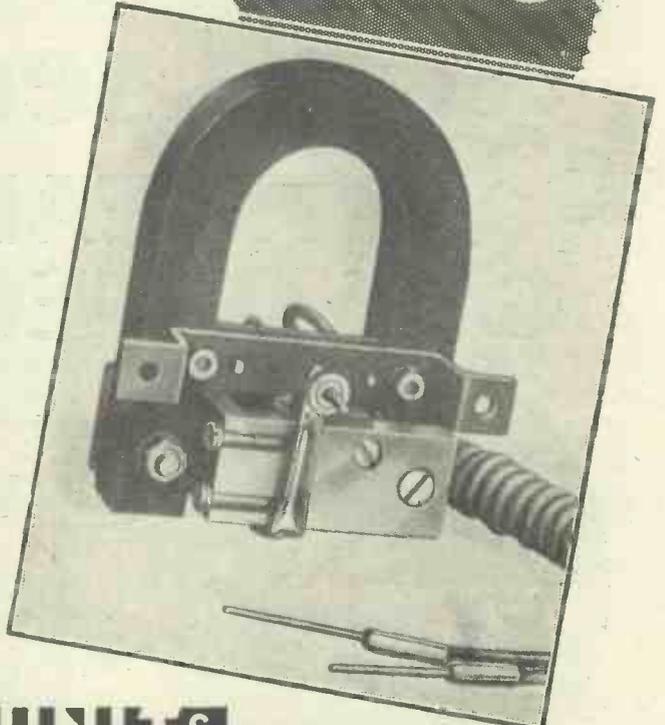
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**ASSEMBLY
PRICE 12'6**



**CONE UNIT &
ASSEMBLY**

**CONE UNIT
PRICE 15'**

If you want unusually good reproduction from your home constructed loudspeaker then build with the Ediswan Cone Unit and Assembly. This wonderful unit gives faithful reproduction over the whole range of musical frequencies and is built on the balanced armature principle. The Cone Assembly, which is drilled ready for baffle board mounting, although designed primarily for use in conjunction with the Ediswan Cone Unit, is equally effective with other Cone units upon the market.

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EDISWAN RADIO PRODUCTS

YOUR S.G. VALVES



In this interesting and informative article D. Young deals with vital points concerning the operation of these modern H.F. amplifiers.

YOU can get enormous amplification with screened-grid H.F. valves, but to do so obviously you must use them properly. In the first place, they have to be given their proper H.T. This is very important, and probably more so than is the case with most other types. Even with proper H.T. the S.G.'s will not do their work efficiently unless they are employed in conjunction with correct circuit conditions.

S.G. valves have very high impedances, there is one with an impedance as high as 200,000 ohms, and the amount of energy which is passed on to a subsequent valve from an S.G., or any other valve for that matter, will depend to a great extent upon the relation of its impedance to the impedance of the coupling device in its anode circuit.

That sounds very formidable, but it is quite easily explained. First of all a word or two about impedance. Impedance is expressed in ohms and it is the resistance

handed on from the aerial, cause variations in the flow of this H.T. current.

These are transmitted to the next valve via the coupling condenser C. The more energy that is passed on in this way the greater the effective amplification, and how much is passed on depends primarily upon the impedance of the S.G. valve and the impedance of the coupling choke L.

You will notice that I have said effective amplification, and I did so in order to embrace all the appropriate conditions. Indeed the S.G. valve has done its work as an amplifier when it has produced large anode current variations from small grid input voltage variations, and it is then the duty of the coupling arrangement to see that as much as possible of the magnified current impulses are passed on to the next valve.

Simplifying the Circuit.

The impedance of a valve will consist mainly of ohmic resistance, and this can be shown in the conventional way as in Fig. 2. The impedance of the H.F. choke L (Fig. 1) is mostly composed of inductance (so many microhenries), but this, too can be shown as a conventional resistance at Y in Fig. 2.

The H.T. battery is connected to earth and its resistance is negligible in comparison with the other ingredients in the circuit, so our Fig. 1 can be resolved into nothing more than a pair of resistances in series. Through these resistances is passing a varying current. If the resistance of Y were exactly equal to that of X the voltage difference across the filament and grid of the second valve would be half of that in the total anode circuit of the first.

If the resistance Y were very small in comparison with X there would be a proportionally small transmission of energy to the second grid. Looked at in another way you can consider X and Y as forming a sort of potentiometer, A, the point of connection of the grid of the second valve, constituting the slider. Obviously with X at 200,000 ohms as it might be with one type of S.G., a value of 20,000 or 30,000 at Y would result in the passing of but a small proportion of the energy to the second valve.

The object is to obtain as great a difference of potential between the grid and filament of the second valve as possible, and this is achieved within limits by making Y at least as great in impedance as X. Reverting to Fig. 1, an H.F. choke of adequate inductance and very low self-capacity will fulfil the conditions.

It is only a first-class H.F. choke that will have the necessary very low self-capacity. But, you might say, impedance

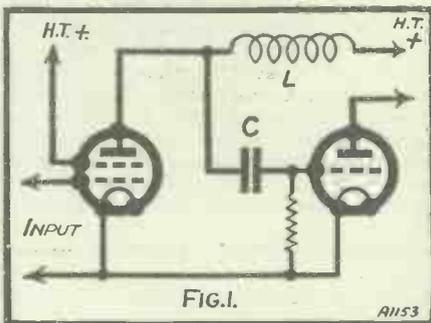
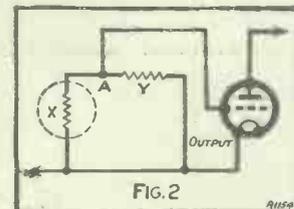
can be made up of capacity as well as inductance, so that a little capacity should help to increase the A.C. resistance of components. And so it would, were it in series with L, but, by placing it in series, that is, in the form of a fixed condenser, you would not permit the H.T. current to flow. In the form of self capacity, the condenser effect is in parallel with L, and resistances of any kind in parallel provide a reduced effective resistance.

Sometimes S.G. valves are coupled by means of a tuned anode circuit, in which case L in Fig. 1 could be an ordinary tuning coil across which was connected a variable condenser. The impedance of such a circuit, a variable condenser and a coil, would be the greatest for any one frequency when that circuit was tuned to that frequency. It would then be in resonance. The highest impedance and the most effective coupling conditions result when a tuned-anode circuit is tuned to the frequency of the station being received.

Ohmic Resistance.

L could also be the primary of an H.F. transformer, and to this the same remarks would apply, but, whether it be a tuned anode or transformer, or H.F. choke, it must be of an efficient nature or it will not achieve that high impedance necessary for successful coupling.

I have endeavoured to compress a long story into a small space, but I hope readers



offered to an alternating current. Impedance comprises those factors which will tend to impede the progress of alternating current whatever its frequency, high or low, and they are ordinary ohmic resistance, capacity and inductance.

H.F. Choke Coupling.

Accepting that as an electrical law into which we need not go too deeply on this occasion, let us examine Fig. 1, which shows the elements of the circuit coupling of an S.G.-H.F. valve to a detector. It is a simple H.F. choke coupling such as figures in the famous "Titan" Three.

When the filament of the S.G. valve is heated, a stream of electrons is emitted and forms a bridge between the filament and the plate. A current then flows from the H.T. battery through the H.F. choke and the valve. Voltage variations on the main grid of the S.G. valve, such as may be

will at least have gathered that when they see the statement that because an S.G. valve has a high impedance a high impedance coupling circuit is necessary, they will not look for ohmic resistance. Indeed, I hope that I have shown that ohmic resistance is only one of the factors concerned. In the case of an H.F. choke or coil its contribution is so small as to be inappreciable.

FROM THE TECHNICAL EDITOR'S NOTE BOOK

Tested and Found-?



WESTINGHOUSE METAL RECTIFIERS.

THE reason for the enormous popularity of Westinghouse metal rectifiers is not far to seek. Other types of rectifiers' valves, liquids, etc., may have their advantages, but the metal rectifier has a unique point in its favour. It is completely "non-dynamic" in appearance, and even when it is in operation there are no lights, fizzlings, bubblings, or anything else of this nature to indicate that an important electrical process is in operation.

Psychologically, this must have a very great effect on the less technical purchaser who, in the apparent immutability of the metal rectifier would see a safe and everlasting existence. The Westinghouse Brake and Saxby Signal Co., Ltd., have now added to their range of units with two new rectifiers, and these are types H.T.3 and H.T.4. The H.T.3 unit gives half-wave rectification and its D.C. output voltage is of the order of 120 at 20 milliamps.

The corresponding A.C. input is 135 volts.

The H.T.4 is designed to give up to 60 milliamps at 150 volts, and this unit can be used either in an H.T. eliminator or in an H.T. charger. It enables full-wave rectification to be obtained. The figures quoted in regard to the type H.T.3 and also those of the H.T.4 give an insight into the electrical efficiency common to all Westinghouse metal rectifiers. They involve remarkably little loss.



The H.T.4 type Rectifier.

Both these new Westinghouse units have been very thoroughly tested, and found to be perfectly satisfactory. In due course they will be embodied in mains units designs described in "P.W.," and readers will have opportunities of examining the circuits in which they are used.

Several of the new Westinghouse rectifier units for use with mains H.T. and L.T. units are illustrated in the photograph at the foot of col. 3 on this page.

IMPORTANT PRICE REDUCTION.

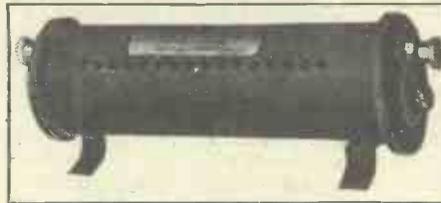
Messrs. Ferranti, Ltd., inform us that the Ferranti metal rectifier unit type R.80, incorporating the Westinghouse metal rectifier, has been reduced in price from four guineas to £3 15s. This rectifier is capable of a D.C. output of 200 volts at 100 milliamps.

"INSIDE KNOWLEDGE."

This is the title of a book published by the Siemens' people. It is packed with tips on the use of radio batteries, and "P.W." readers should make a point of adding it to their collection of radio literature.

A BATTERY ELECTROLYTE.

The Radiumite Company have sent us a supply of "Radiumite," a fluid designed to take the place of sulphuric acid solution in accumulators. It is claimed that it is of a



The single-wave Westinghouse Rectifier, type H.T.3.

non-sulphating character and that, moreover, it will remove existing sulphate deposits. Further, it is said that it will not freeze, and that it improves the battery's efficiency and lengthens its life.

As with other productions of a like nature, it is impossible to carry out any complete tests in a short period of time. It is not fair to judge of its merits unless one can take a battery of known history and watch it closely over some length of time, the battery being used and "misused" in a manner similar to one employed for normal household reception purposes. Indeed, two or three batteries should be taken and varying treatments imposed upon them.

In the case of "Radiumite," we took two batteries, one that was new and another that was badly sulphated. With the latter we noticed an immediate improvement in condition, while the new battery has risen to a high order of efficiency. And as far as we can see in the time which has elapsed, "Radiumite" is quite a successful preparation.

EDISWAN RADIO APPARATUS.

We have now received the first copy of the radio catalogue produced in the name of Ediswan, and covering the products of B.T.H., Metro-Vick Supplies and the Edison Swan Electric Co. This catalogue deals with loud speakers and other sound-reproducing equipment, and it is interesting to note that the range of R.K. loud-speaker units has been increased to three, and that a separate rectifier unit for the excitation of such units is being placed upon the market.

Easy mathematical formula and a chart dealing with the question of output transformer ratios for moving-coil loud speakers are included in this excellently produced catalogue.

Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

NEW OSRAM "MUSIC MAGNET."

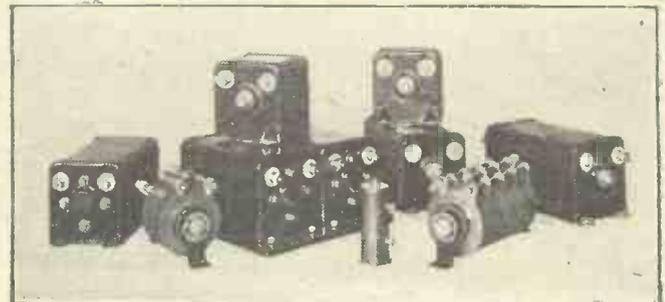
The G.E.C. people have now introduced a new Osram "Music Magnet" Kit. They say of this that it is fundamentally similar to the original model, and that only in the perfection of details and the inclusion of a cabinet does the new Osram "Music Magnet" differ from its forerunner. It is because the old "Music Magnet" is so good that the new model shows so little difference in its appearance or layout.

NEW W.B. PRODUCT.

One of the special features of the new W.B. five-pin A.C. Universal valve holder is that it can be mounted either horizontally or vertically, a point that will commend itself to practical constructors. This valve holder can, as its name implies, take either the new five-pin A.C. mains valves or ordinary valves, as the additional socket is centrally disposed while the others take up the original four point positions.

The device is fitted with W.B. patent nickel silver expanding leg sockets, and these ensure efficient contact for the whole five of the valve pins.

A further good point is that the sockets and soldering tags are formed of one continuous piece of metal and, although five terminals are fitted in addition, the price of the device is a mere 1s. 3d. The workmanship and finish are decidedly good.



A group of Westinghouse Radio Rectifier Units (established models).

A NEW TRANSFORMER

ANOTHER LEAD BY FERRANTI



Recent developments in Radio have created a demand for a new transformer of the same quality and reliability as the AF5, but capable of greater L.F. amplification. In their class of medium ratio, the Ferranti AF3, AF4 and AF5 are still supreme: but changed conditions— notably the advent of the Screened Grid Valve—have rendered this a necessary addition to the standard range.

THE AF5, RATIO 1/7

Designed to ensure the maximum volume where only ONE L.F. stage is employed with Grid Leak Rectification. It is particularly suitable for sets of the S.G.3 type, where greater amplification is desired than is usually obtained from one L.F. stage. The new ratio is not intended for use in receivers employing more than ONE stage of L.F.

PRICE
30/-

FERRANTI

FERRANTI LTD.

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For best results
with
"MAGIC THREE"

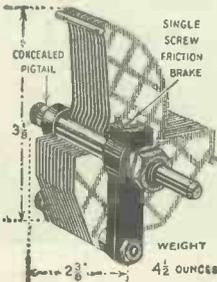
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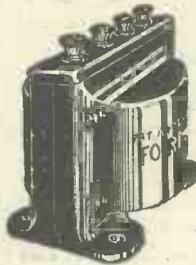


In four Capacities:

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Baseboard Neutralising
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Type "F," Price **2/-**

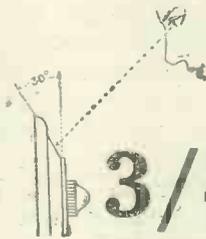
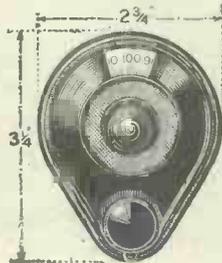
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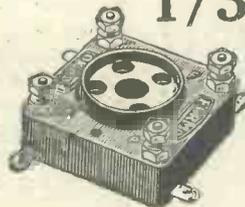
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CRICKLEWOOD LANE, LONDON, N.W.2

VERNIER
DIAL



VALVE
HOLDER

1/3



**BOTH LOOK
ALIKE
BUT ONE LASTS
LONGER**



Two sweetmeats — both good to eat, both chocolate covered. But one contains a caramel, the other a cream filling. One lasts longer.

Special chemicals contained in the new Dubilier H.T. Battery make it far more than just another good battery — they make its working life materially longer than that of any other make of similar type. This claim is unquestionable. Read chapter and verse for it in the booklet—"A Bit about a Battery" — obtainable free from your dealer. Prove it by using a Dubilier Battery in your set now.

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SUPERIOR	
(Single Capacity)	
9 volt	1/6
63 "	7/6
66 " (with C.B. Tappings)	7/11
99 volt	11/9
108 "	12/9
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60 volt	13/6
63 "	14/3
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**BRITISH
MADE**



**THE LONGER LIFE AT LOWER COST
DUBILIER
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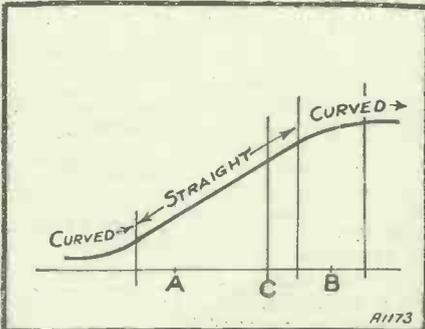
DUBILIER CONDENSER CO. (1925), LTD., Ducon Works,
Victoria Road, North Acton, London, W.3. B6



Tracking Overloading.

C. S. A. (Carshalton).—"When the needle of a milliammeter in the plate circuit of the last valve of my set kicks upwards, does it indicate the same sort of distortion as if it kicks down? If so, why does it not always move in the same direction?"

A valve has a certain part of its characteristic straight and a part curved. We assume that the curve I have drawn is for the dynamic characteristic—that is, how the valve behaves under working conditions.



The dynamic characteristic may be different for different circuit constants. Thus if the impedance of the anode circuit is too low at low frequencies, the characteristic will be different from that at higher frequencies. I assume in this case that the characteristic is the same for all frequencies.

A little consideration will show that, in this case, if the grid bias is set effectively at A, the modulations set up an increase in anode current, the milliammeter kicks upwards; if at B, then modulations set up a decrease of anode current, the milliammeter kicks downwards. The distortion is made the same, and is got rid of by adjusting the grid bias to C, and not overloading.

Perfect Quality.

A J. (Eltham).—"I am endeavouring to obtain perfect quality on local broadcast reception. I have noticed, however, that there is a pronounced 'jarring' noise on certain piano notes for 2 L O, particularly during the interludes between the news items.

"Can you tell me whether it is possible for this effect to take place at the trans-

Capt ECKERSLEY'S QUERY CORNER

Below some varied and representative questions from "P.W." readers are answered in detail by Britain's greatest authority on broadcasting.

mitting end, because even when I reduce the volume the 'blasting' is still audible."

There will have to be perfect quality in transmission before you can get perfect quality in reception. While the "quality radiated" is nearly always better than that produced by the receiver, nevertheless there are certain types of item which go wrong in transmission. The B.B.C. have had a lot of trouble with piano reproduction, but research showed that this might be due to transmission.

Under the above title, week by week, Capt. P. P. Eckersley, M.I.E.E., late Chief Engineer of the B.B.C., and now our Chief Radio Consultant, will comment upon radio queries submitted by "P.W." readers. But don't address your queries to Capt. Eckersley—a selection of those coming to the Query Department in the ordinary way will be dealt with by him.

I think it is likely to be transmission in your case, particularly if you get it well on piano concertos, etc.—i.e. when listening to the pre-programme items—and particularly as you get it when reducing volume, if that volume is reduced before or just after a good detector.

One Cause of Distortion.

L. J. M. (London, E.C.).—"My super-power valve seems to overload very easily, and my milliammeter kicks violently (mostly downwards) on anything more than very moderate volume.

"An experienced friend tells me that it is because I have only a 1-mfd. reservoir or by-pass condenser from the H.T. positive terminal on my mains unit which supplies the valve. Is this likely to be the cause?"

Very likely. But can you see if the kicks are mostly on low notes? If so, it is certainly the cause.

Effect of Brookman's Park.

S. T. D. (London).—"At present I am situated about eight miles from the London station, and my Det. and 2 L.F. set, with three plug-in coils, is capable of cutting out London sufficiently well for me to get 5 G B and a few Continental stations.

"When the new Regional scheme starts my local station will only be five miles away. Will my present set, with a wave-trap, be sufficiently selective, or shall I have to build a new set altogether? My set incorporates a semi-a-periodic aerial circuit."

If you are eight miles from 2 L O to the northward you will definitely be unable to receive 5 G B unless you shorten your aerial and play tricks to get a greater selectivity. But you will get an alternative programme from Brookman's Park in time.

So your service will not be worse. I think, if you live eight miles to the north, you will have great difficulty in receiving foreign programmes.

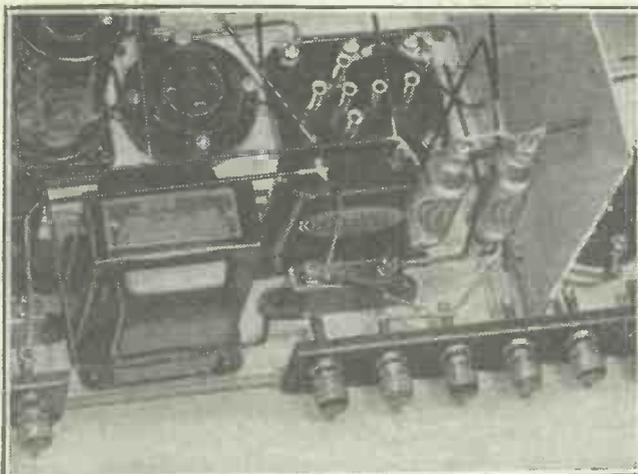
Those who live to the south will be just about the same as they are now as regards conditions; eight miles east and west, and they will have greater difficulty than now; intermediate conditions in intermediate positions.

Parallel or Push-Pull?

C. P. B. (Sheffield).—"I understand that by paralleling two power valves I can increase volume with the same output. I am also informed that by using push-pull amplification I can use a larger input without distortion.

"I have a Det. and 2 L.F. set and wish to increase volume without getting distortion. Which of the above schemes do you advise? The paralleling method appeals to me more because I can avoid the expense of special transformers by using it."

Certainly push-pull is the better method of increasing volume without distortion. Paralleling valves in the last stage does very little good. A proper connection of push-pull does wonders.



Large by-pass condensers and anti-motor-boating devices are advisable in all sets operating from mains units. (See above).

WHAT would you really like in the ideal receiver of your dreams? No doubt you have asked yourself this question many times, and the answer has probably called for something with umpteen screened-grid H.F. stages, beautifully balanced gang tuning, and L.F. stages powerful enough to work a moving-coil loud speaker. After which rosy vision, of course, most of us remember the £ s. d. question, sigh regretfully, and come down to something practical.

But need we be so disappointed when we realise that the cost question cuts out the possibility of such a giant among sets? Why not try enumerating the things you really want in the performance of your set, and see whether they cannot be got with something less elaborate than the super outfit you generally dream of? Probably if you made a list of the things you really want, it would read something like this:

Is This Your Ideal?

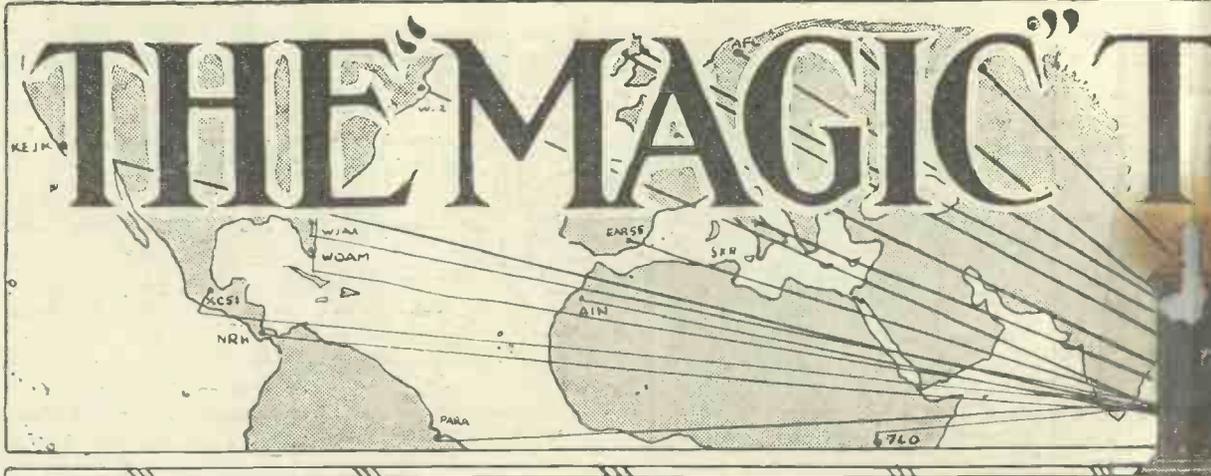
(1) A circuit sufficiently powerful to give you really good volume, so that by using

A WHOLE HORDE OF NEW BROADCASTING STATIONS. GIVING YOU PROGRAMMES.

suitable valves you could get enough power for even a moving-coil speaker if you desired.

(2) High sensitivity to even the weakest signals, to ensure a really good performance on the foreign stations.

(3) The highest selectivity that the question of cost will permit.



A GREAT TRIUMPH OF THE "POPULAR WIRELESS"

(4) All-wave working, with really high efficiency on short waves, medium broadcast waves, and the long waves. This particular item you will no doubt consider one of very great and growing importance, for the interest in short-wave work is now becoming so considerable as to bring it within the scope of the average listener.

(5) A circuit so arranged that if necessary you can use only moderate-sized valves and so cut down the H.T. consumption. Further, the circuit should be such that if you are compelled to use only a moderate H.T. voltage, such as 90 or 100 volts, the actual long-distance results will not fall off heavily, but you will merely be limited in the amount of power you can handle without distortion.

Need It Be So Big?

(6) Simplicity of operation comes last on this list, but it really deserves a place of honour nearer the top. For domestic reasons one might almost say that the set should be limited to one tuning dial.

Now just look over that list again and ask yourself whether to meet its requirements you really and truly do need such a very big

set after all. Is it not possible that it might be done with a receiver with no H.F. stages at all, but merely a super-sensitive and efficient detector circuit, and a very powerful L.F. amplifying side?

The gain in simplicity and cheapness would be tremendous if this were so. Within the limits of cost permissible in the case of the average home constructor we believe that it is possible to answer "yes" to this question.

We believe that in the "Magic" Three we have produced a receiver which will go a very long way towards meeting your ideas of such an ideal outfit, if you will only judge it on the basis of its performance and forget how few valves it contains, and how simple its circuit is to a superficial examination.

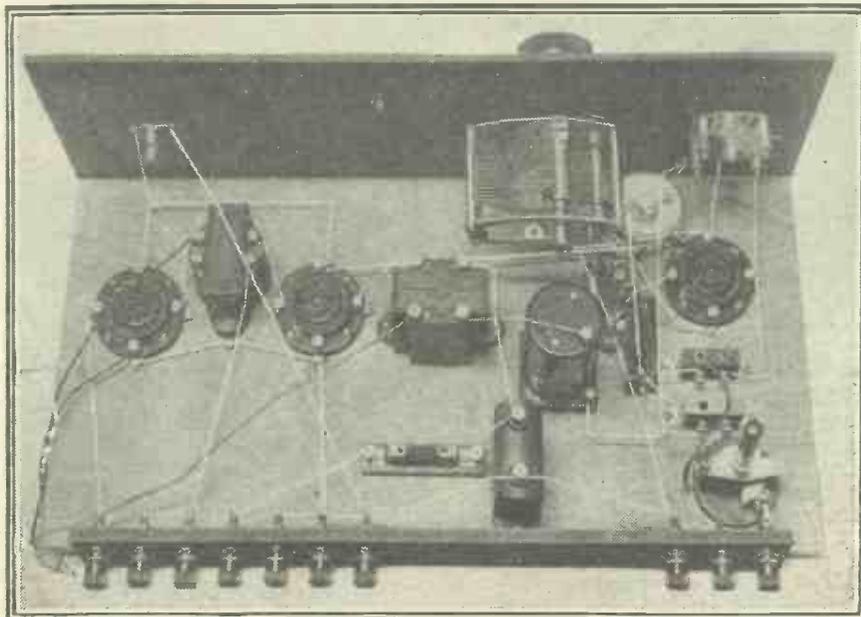
This design, we must tell you, is not the result of a sudden inspiration on anybody's part, but rather of a long period of planning, paring costs, working out details for the utmost simplicity of construction and operation, and actual experimental work. We began upon this design as long ago as last June, and we feel that we can say in all modesty that we believe the result is worthy of the time and care we have spent upon it.

How Can It Be Done?

Now take a look at the photographs and the circuit diagram. You will see that the set has only three valves, and actually contains no H.F. stage. It is simply a detector valve and two powerful low-frequency stages, and you may naturally be tempted to enquire how such a combination can possibly be expected to give so good a performance as to come anywhere near the ideal at which we have aimed. Wait, and you will see that there is indeed a very great deal more in this set than meets the eye at the first glance.

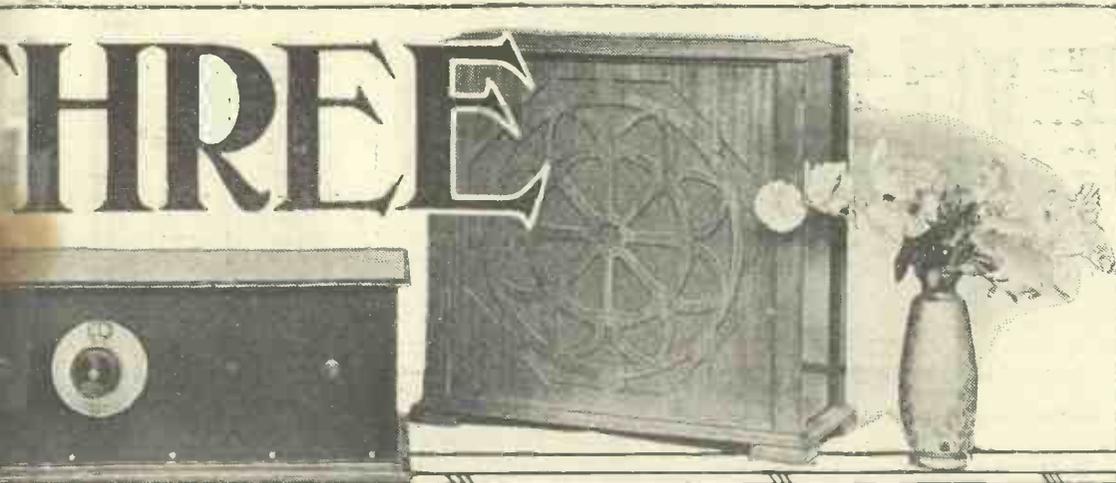
WHAT THIS SET DOES

1. Brings short-wave reception to the reach of the average listener.
2. Works with the highest efficiency to over 2,000 metres.
3. Sets a standard of ease of tuning.
4. Gives tremendous volume and clarity.
5. Brings in foreign stations with a clarity hitherto associated with very expensive sets.



It is hard to believe that so simple-looking a set can give the results of the "Magic" Three, but you try it and see!

SHORT WAVES, LONG WAVE



RESEARCH AND CONSTRUCTION DEPARTMENT.

First, what about that detector valve? Is it true that a detector by itself and without H.F. stages is incapable of giving you the performance that you want? Have you ever seen a detector valve with reaction being operated by a real expert? If you have you must surely have been amazed at the way, in his hands, it would bring in foreign station after foreign station, many of them stations which you yourself would have great difficulty in tuning in on a good H.F. stage.

ET DOES

for the first time within
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ing never before attained.
d superlative quality.
th the power and clarity
big outfits.

Suppose you had a detector valve so arranged that you could obtain for yourself just those same results without any need for the skill of the expert, would you not begin to think that there might be something in it after all?

That, in sober fact, is what we are giving you in

the "Magic" Three, and at this point we must ask you to take our word for it that it does really and truly "deliver the goods" when called upon to bring in foreign stations. Now, granted that it will bring in the signals you want, what about bringing them up to the ample loud-speaker volume demanded by modern standards?

Getting Real Power.

Take another look at the circuit and you will see that following after the super-efficient detector arrangement there are two ultra-powerful L.F. stages arranged in the up-to-date fashion with two transformer couplings, properly laid out for stability and safeguarded against the possibilities of howling and motor-boating due to battery coupling. This combination is one upon which we have worked for a long time, and the final result comes, we believe, very near indeed to the average constructor's ideal receiver in actual performance.

Having got by now a general idea of the way we have tried to achieve our ends with

such extreme economy and simplicity in the "Magic" Three, let us take another look at our list of requirements and see how it fulfils them. First, there is the question of real power, and you can see for yourself that this powerful L.F. amplifying side, so long as it gets anything like a signal from the detector stage, can if you desire, bring it up to such a strength as to load up very fully even quite a large super-power valve, and so you can take it that the receiver is capable of giving you the very big volume which many of us desire to work the modern types of loud speaker.

Extreme Sensitivity.

Do not think, however, that the fact that this potential power is available means that you are compelled to use large and greedy valves. On the contrary, you can, if you wish, use smaller and more economical ones, and keep down to the more moderate domestic volume which suffices for many people's needs, by the simple expedient of refraining from running the set "all out." Our second requirement of sensitivity to the weakest signals is again met, the efficiency of our detector valve circuit

answering to every reasonable call which may be made upon it.

Next we come to the question of selectivity, third in our list. This is met in two ways, which have a cumulative effect. First, there is the fact that the detector circuit is decidedly above its normal selectivity, by virtue of certain features we shall be going into later in greater detail. Secondly, there is the fact that we have an extremely powerful L.F. side, so that we can afford to cut down the coupling of the aerial to the set and so get greater selectivity and still have a good strong signal by virtue of the great power of the L.F. side.

Now we come to our fourth requirement of high efficiency on all wave-lengths, even including the short waves.

Short Waves as Well!

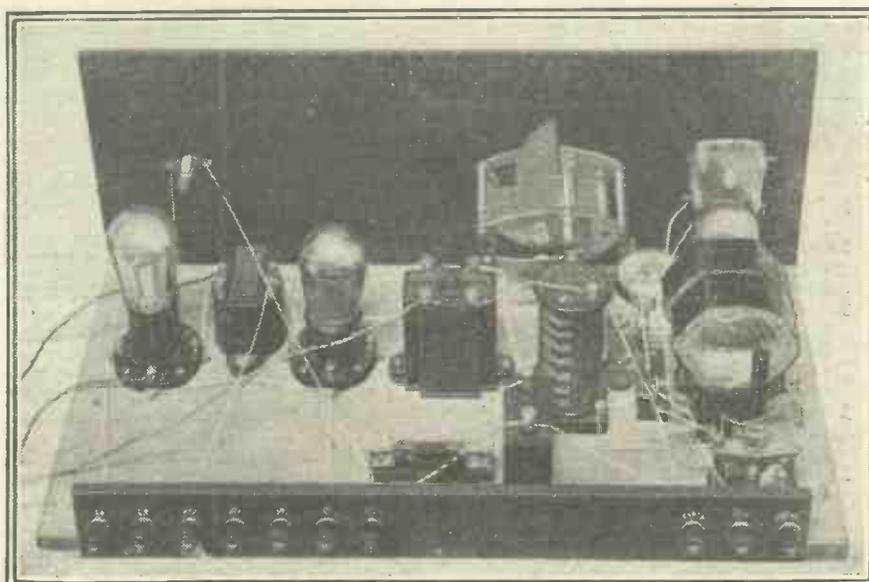
Probably most readers have realised by now that this is a most desirable feature in a modern set, for the short-wave band is becoming of tremendous interest.

This was one of the most difficult of all the problems we set out to overcome, for we wished to bring short-wave

THE WHOLE WIDE
WORLD BROUGHT
TO
YOUR FIRESIDE.

reception really within the scope of the average listener for the first time. We had to combat the very considerable difficulty of operation on short waves which is noticeable in even the best of short-wave receivers of the older type and also

(Continued on next page.)

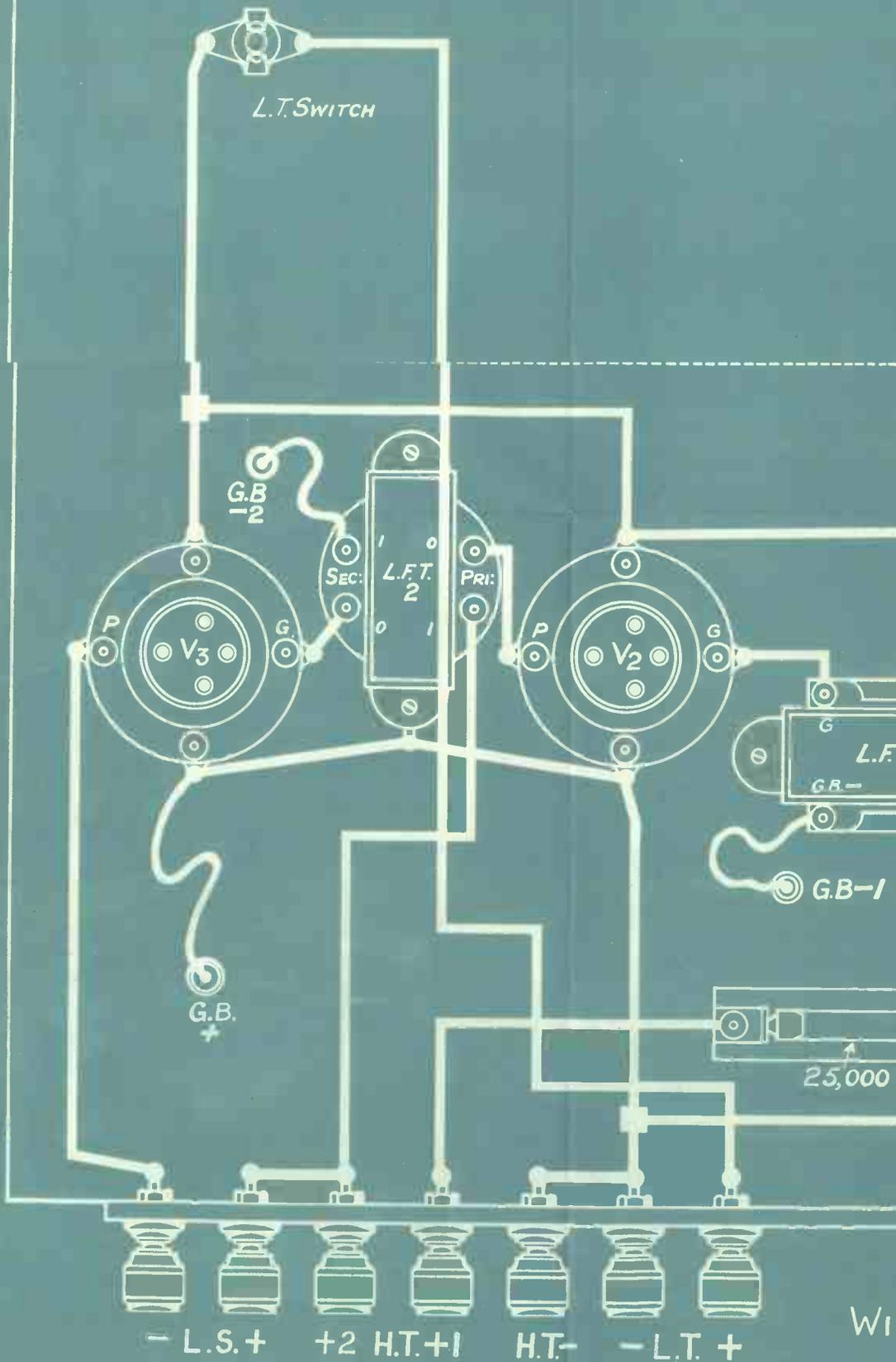


With coils and valves in place, all ready for work, the "Magic" Three is a particularly workmanlike-looking receiver.

POWER AND PURITY

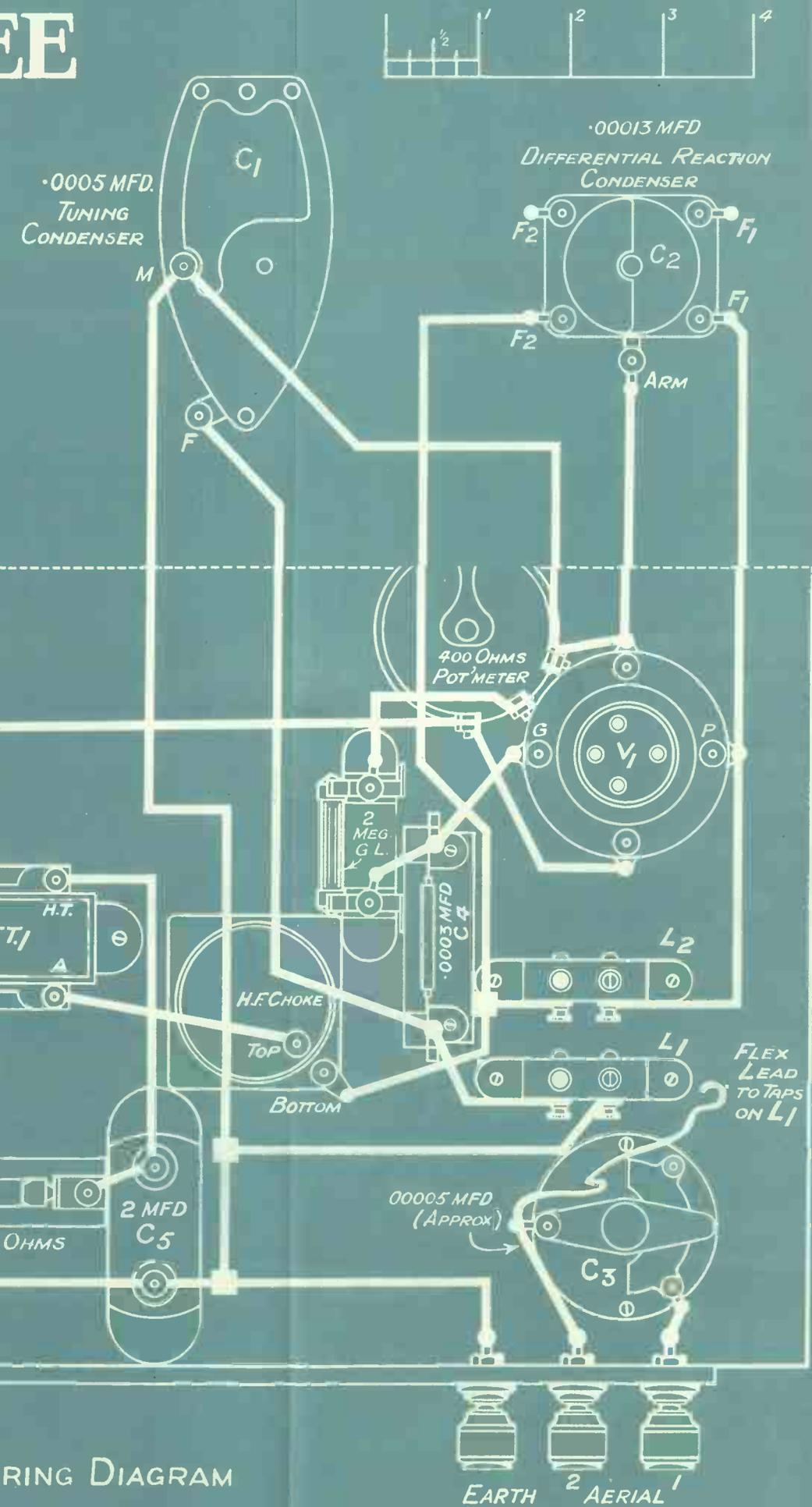
THE "MAGIC" THREE

PRICE 1/-



Wi

EE



WIRING DIAGRAM

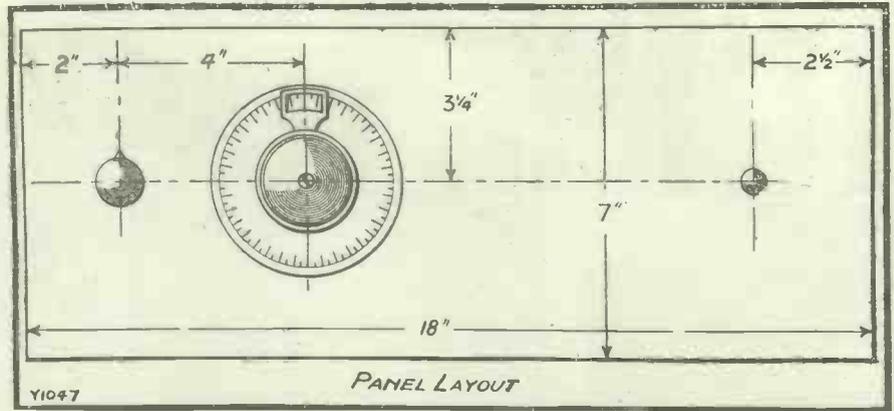
THE "MAGIC" THREE.

(Continued from previous page.)

preserve all the good features of a normal broadcast set. We believe that we have done it, but of that we must leave you to judge for yourself.

Efficiency and Economy.

The fifth requirement in our list, as you will probably be able to see for yourself by now, is amply met by the "Magic" Three. The whole point here is this: a set with H.F. stages of the modern screened-grid type inevitably calls for a fairly high H.T. voltage, usually not less than 120 volts, before anything like its full efficiency can be obtained. If you come down to something like 90 volts H.T. you know that you are throwing away a great part of the efficiency of the set for long-distance work. With a detector and L.F. combination, on the other hand, the sensitivity lies chiefly in the detector circuit, which normally works with a comparatively low value of H.T.



The panel has been laid out to leave space for the later addition of such refinements as a volume control.

moderate, if desired, by the choice of only reasonable sized valves. This, again, is purely a question of the amount of volume you wish to handle without distortion. If you are content with normal volume you can use just an ordinary power valve in the last stage and keep your consumption

and the one which calls for the most skill, namely the reaction control.

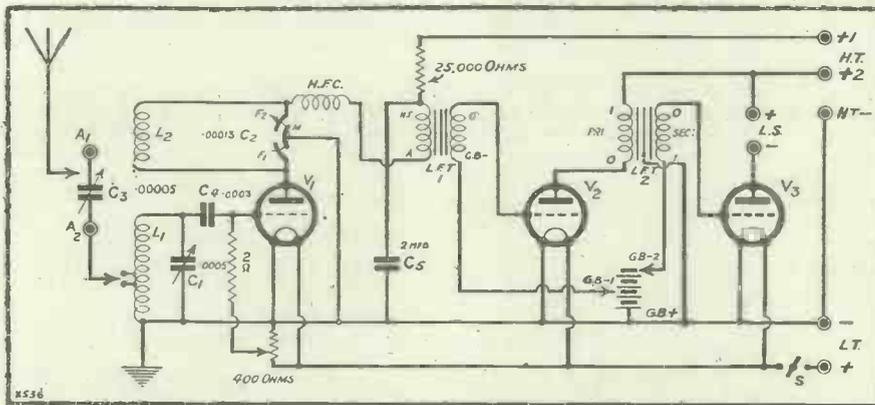
The "Magic" Three uses a very special system of reaction control, which makes it literally child's play to find the exact correct setting for even a weak station, such a setting as it usually takes an expert to find on the normal type of receiver. Here we have a reaction control which is beautifully smooth and progressive, and above all does not upset the tuning when operated. This last you will see in a moment is a most important feature, and does more than almost anything else to make the "Magic" Three a wonderfully simple set to operate.

How It Is Done.

Probably by now you will be wondering how all this is done in so simple-looking a circuit, so we will just run over some of the more important features in a simple fashion. The L.F. side is a matter which we can dismiss fairly briefly, since you will see that it is merely a good example of the modern carefully laid out high-power amplifying arrangement with two transformer stages well arranged to ensure stability and provided with an efficient form of anti-motor-boating filter at the detector stage, consisting of the usual resistance and large by-pass condenser.

The real secrets of the "Magic" Three are to be found in the detector circuit, where we have some special devices which are simple in themselves, but have never before, we believe, been used in this combination, and so their full possibilities have not been realised. First of all, there is the

(Continued on page 278.)



For all its remarkable powers, the circuit is decidedly simple, and there is nothing freakish about it.

Consequently, if you are compelled for reasons of economy or otherwise to work with a fairly moderate amount of H.T., you know that you are getting very nearly the full sensitivity of the set, and are merely limiting its power of handling very strong signals, consequently all that it means is that you must be careful not to work at very full volume for fear of overloading your last valve. The actual consumption of H.T. current, too, can be made very

down to the limits of quite a moderate sized H.T. battery.

Simplicity of operation is one of the strongest features of the "Magic" Three, and so we satisfy our sixth and last requirement. Tuning is obviously a one-dial affair, by virtue of the fact that we are depending upon simply a detector circuit. Far more important than this, however, is the fact that we have tamed the most obstinate of all the controls on a simple set

COMPONENTS AND MATERIALS.

- 1 Panel, 18 in. x 7 in. (Resiston, Becol, "Kay-Ray," Ripault, etc.).
- 1 Cabinet to fit, and baseboard 9 in. or 10 in. deep (Pickett, Raymond, Cameo, Osborn, Ready Radio, etc.).
- 1 .0005-mfd. variable condenser, slow-motion type or with vernier dial (Lissen, J.B., Igranic, Raymond, Pye, Gecophone, Ormond, Utility, Dubilier, Bowyer-Lowe, Cyldon, Formo, Colvern, etc.).
- 1 Vernier dial, if condenser not of slow-motion type (Utility, Igranic, J.B., Lissen, Lotus, Brownie, Formo, Ormond, etc.).
- 1 .0001 to .00015-mfd. differential reaction condenser (Lotus, Pye, Utility, Magnum, etc.).
- 1 L.T. on-off switch (Benjamin, Lissen, Igranic, Lotus, Bulgin, Wearite, Magnum, Keystone, Burton, Raymond, etc.).

- 3 Sprung valve holders (Lotus, Igranic, Benjamin, Precision, Formo, Magnum, Wearite, Pye, Burton, Burndep, Ashley, Bowyer-Lowe, etc.).
- 2 Single coil sockets (Lotus, Raymond, Wearite, Keystone, etc.).
- 1 200- or 400-ohm baseboard-mounting potentiometer (Igranic, Lissen, etc.).
- 1 Baseboard-mounting neutrodyne type condenser (for use as series aerial condenser on short waves, not for neutralising). (Magnum, J.B., Lissen, etc.).
- 1 H.F. choke (Varley, Leweos, Ready Radio, Dubilier, Igranic, Lissen, R.I., Climax, Raymond, Bowyer-Lowe, Precision, Magnum, Wearite, Colvern, etc.).
- 2 L.F. transformers of low ratio, preferably of different types or makes (R.I. "Hypermu" and Igranic "J" in set).

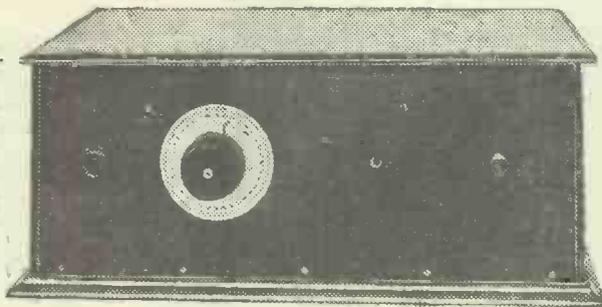
Any good makes. A few other examples are these: Ferranti, Lissen, Brown, Cossor, Varley, Lotus, Philips, Mullard, etc.).

- 1 .0003-mfd. fixed condenser (Igranic, T.C.C., Dubilier, Lissen, Clarke, Goltone, etc.).
 - 1 2-mfd. Mansbridge type condenser Lissen, Ferranti, Dubilier, T.C.C., Hydra, Mullard, etc.).
 - 1 2-megohm grid leak and holder (Ediswan, Lissen, Dubilier, Igranic, Cosmos, Carborundum, Loewe, Mullard, etc.).
 - 1 25,000-ohm resistance and holder (any resistance from 25,000 to 60,000 will serve). (Cosmos, Dubilier, Ferranti, Lissen, Varley, Ready Radio, Precision, R.I., Mullard, etc.).
 - 1 Terminal strip, 16 in. x 2 in. x 1/4 in.
 - 10 Terminals (Igranic, Belling & Lee, Eelex, Clix, etc.).
- Wire, screws, G.B. plugs, etc.

BUILD The MAGIC 3

and listen to the
Whole Wide World

*Cheap &
Easy to
Build*



Ready Radio
FOR
SERVICE
AND
SATISFACTION

AVAILABLE IN COMPLETE KITS OF PARTS

READY FOR IMMEDIATE DESPATCH

LIST OF SPECIFIED PARTS

	£	s.	d.
1 Panel 18 in X 7 in. drilled (Resiston)	1	10	0
1 Cabinet to fit, with baseboard 10 in. (Ready Radio)	1	10	0
1 .0005 mfd. variable condenser (Lissen)	6	6	6
1 Vernier dial (Jackson)	5	6	6
1 .00015 mfd. differential reaction condenser (Lotus)	5	0	3
1 L.T. on-off switch	1	3	3
3 Sprung valve holders	3	9	9
2 Single-coil sockets (Lotus)	1	4	4
1 400-ohm baseboard mounting potentiometer (Igranic)	2	6	6
1 Baseboard-mounting neutrodyne type condenser (Magnum)	5	6	6
1 H.F. choke (Varley)	9	6	6
1 L.F. transformer (R.I. "Hypermu")	1	0	0
1 L.F. transformer (Igranic J.)	17	6	6
1 .0003 mfd. fixed condenser (Igranic)	1	3	3
1 2-mfd. Mansbridge type condenser (Lissen)	3	6	6
1 2-megohm grid leak and holder (Ediswan)	2	0	0
1 50,000-ohm resistance and holder (Cosmos)	2	5	5
1 Terminal strip, 18 in. X 2 in. (drilled)	2	0	0
10 Terminals (Belling & Lee)	2	6	6
1 Set of valves as specified	1	13	6
1 Lewcos No. 60 X coil	4	9	9
1 " No. 40 coil	3	6	6
1 " No 250 X coil	6	6	6
1 " No. 100 coil	4	6	6
1 Set of short-wave coils (2 : 4 : 6 : 9)	10	6	6
1 Set of MAGIC insulated connecting links	2	0	0
Screws, nuts, etc.			3
TOTAL (INCLUDING VALVES)	29	18	6

Any of the above components can be supplied separately if desired.

KIT A less valves and cabinet	£6	: 13	: 0
KIT B with valves less cabinet	£8	: 6	: 6
KIT C with valves and cabinet	£9	: 16	: 6

All Kits include special Ready Radio connecting links.

NO SOLDERING REQUIRED!

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Ready Hop 5555
London.

159, BOROUGH HIGH STREET, LONDON BRIDGE, S.E.1

(Three minutes from London Bridge Station.)

THE "MAGIC" THREE.

(Continued from page 276.)

very simple device of a potentiometer to adjust the working point of the detector valve grid, which is a great help in obtaining the super results from our detector valve at which we are aiming. It enables one to obtain super-smooth reaction with practically any valve and so gives us our first step in the direction of real long-distance results.

A Very Special Scheme.

Next we come to our special reaction arrangement, which in combination with the previous device really gives the set its remarkable powers. This special reaction circuit is one which we have developed from the comparatively well-known "differential" scheme, in which the reaction condenser has two sets of fixed plates and one set of moving ones. When these moving plates engage with one set of fixed plates reaction is produced, and when they engage with the other we get no reaction, but instead a by-passing effect for H.F. impulses straight from the plate to filament of the detector valve. This effect, as you probably know from previous articles in "P.W.," greatly improves the sensitivity of the detector valve and is also some help in the direction of selectivity.

These two effects are perfectly balanced in the scheme we have used, and are automatically compensated one against the other as the control is operated, and the result is a great increase in sensitivity, and above all a reaction control which does not upset the tuning to any degree you can discover in ordinary broadcast work. Thus you can tune in a station, take your hand off the tuning dial, and adjust reaction to the exact point you want, and know that there is no need to go back to the tuning dial and check up the tuning unless the station you are after is so weak that you can scarcely hear it. In all normal operation the tuning of this set is truly a one-handed affair.

Why It Is Selective.

Selectivity, you will have realised, is obtained to a high degree by the fact that the very powerful L.F. side permits us to weaken the aerial coupling, and by the fact that our detector valve is operating under specially favourable conditions. To get the desired effect we have found that we can use a perfectly standard form of coil, itself a great advantage in a design such as this. The coils which we have found suit our purpose admirably are those known as X coils, which you will probably know are simply standard plug-in coils with some tapping points to which the aerial lead goes by way of a short flex lead in the set itself.

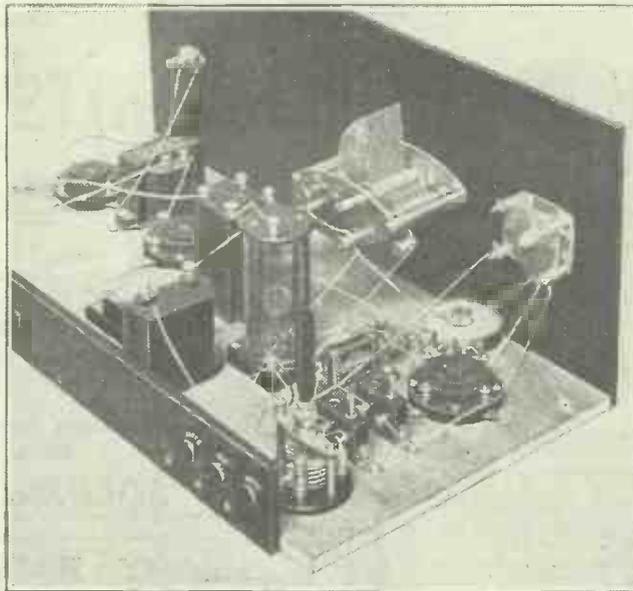
By placing this flex lead on one or other of the tapping points on the coil varying degrees of selectivity can be obtained, and

so widely different conditions can be suited. The use of this type of coil also enables us to reduce the number of coils required in the set to only two, and so coil changing, when going over from one wave-band to another, is a much less tiresome process. Furthermore, by the use of a coil of this kind, we are enabled to arrange in a very simple manner for highly efficient operation on the very short waves, where the ordinary special short-wave plug-in coils are employed. The reaction coil, of course, is simply an ordinary plain coil without tappings.

For short-wave work, by the way, there is another aerial terminal which brings in a very small series aerial condenser, actually of the neutrodyne type, which can be adjusted to various capacities to suit your own particular conditions, a matter about which we shall have more to say later.

Now you have a general idea of the layout of the circuit and how it works, and you will probably be able to appreciate that, simple as the combination really is, it is yet

A DEMON FOR DISTANCE.



Here you see all the important details of the detector end which mean so much in the performance of this remarkable set. Note the special type of reaction condenser, the detector potentiometer and the little series condenser for short waves.

capable of truly remarkable results. There we must leave general considerations so far as this week is concerned, and give you some brief constructional points, so that you can make a start upon the set.

First of all you will note that the list of components mentions a baseboard of either 9 in. or 10 in. deep. The original set was actually 9 in., which gives you quite sufficient space, but some cabinet makers only produce cabinets of 10 in. deep to take this particular panel size, and so we give you the alternative. The deeper cabinet is quite suitable, and the extra space makes little or no difference to the actual layout. It is perhaps a slight advantage, since it provides you with more accommodation for the grid-bias battery. This battery, by the way, can be placed upon the baseboard in any one of several convenient positions, or it can be attached to the back of the cabinet inside, a position we somewhat prefer ourselves.

The original panel was secured to the baseboard by means of the usual row of screws along the lower edge, and no panel brackets were used. If, however, you would like to make it an extra rigid job or distrust your ability to get the necessary small screws in firmly in the exact positions, you can quite easily fit a pair of panel brackets and work them into the layout at two points you will be able to decide upon quite easily from the photos. (Fairly near to each end of the panel is a good position.)

Making A Start.

Panel drilling is one of the simplest operations of this set, since as you will see there are extremely few holes. We should just like to give one tip in this connection, and that is that you should mark out the panel carefully from the diagram, and then run quite a small drill through each of the various holes (only three for actual components are required at this stage of the proceedings), you will then find it quite easy to run a larger drill through each and bring them up to the correct size of hole for each component. The laying out and screwing in place of all the components on the baseboard you will find presents no difficulties whatever, with the aid of the full-sized blue print given away with this issue, and there is nothing which need be said here.

Wiring up can be done with any material you prefer, such as bare wire, a special covered material such as Glazite, or wire enclosed in Systoflex sleeving, and there are no particular "catches" here, and we merely suggest that you take the blue print and work over the connections carefully, crossing out each one upon the print as you insert it in the wiring.

Just one hint; if you make soldered joints make sure that your iron is really hot and that every joint is a good one, while if you prefer the screw-down method of securing the wires under the various terminals and nuts, do not forget to go over the whole set when it is finished with a pair of pliers and give every nut an extra twist to make sure that it is really tight. There we must leave you for the week, but we shall be going on with the description of the use and operation of the receiver in our next issue.

Just one more little point must be mentioned before we go, however, and that is about the reaction condenser. You will find that several makes of differential reaction condensers are provided with quite a number of terminals, and you may be a little puzzled as to the connections unless you reason things out.

Checking the Reaction Connections.

First of all, identify the terminal which makes contact with the moving plates of your particular reaction condenser. This is the one marked "arm" on the blue print. Now see if you can spot the terminals for the two separate sets of fixed plates.

You want one wire to each set of fixed plates, and you must be careful not to get both wires going to one set only, so examine the condenser and the blue print and compare them in detail.

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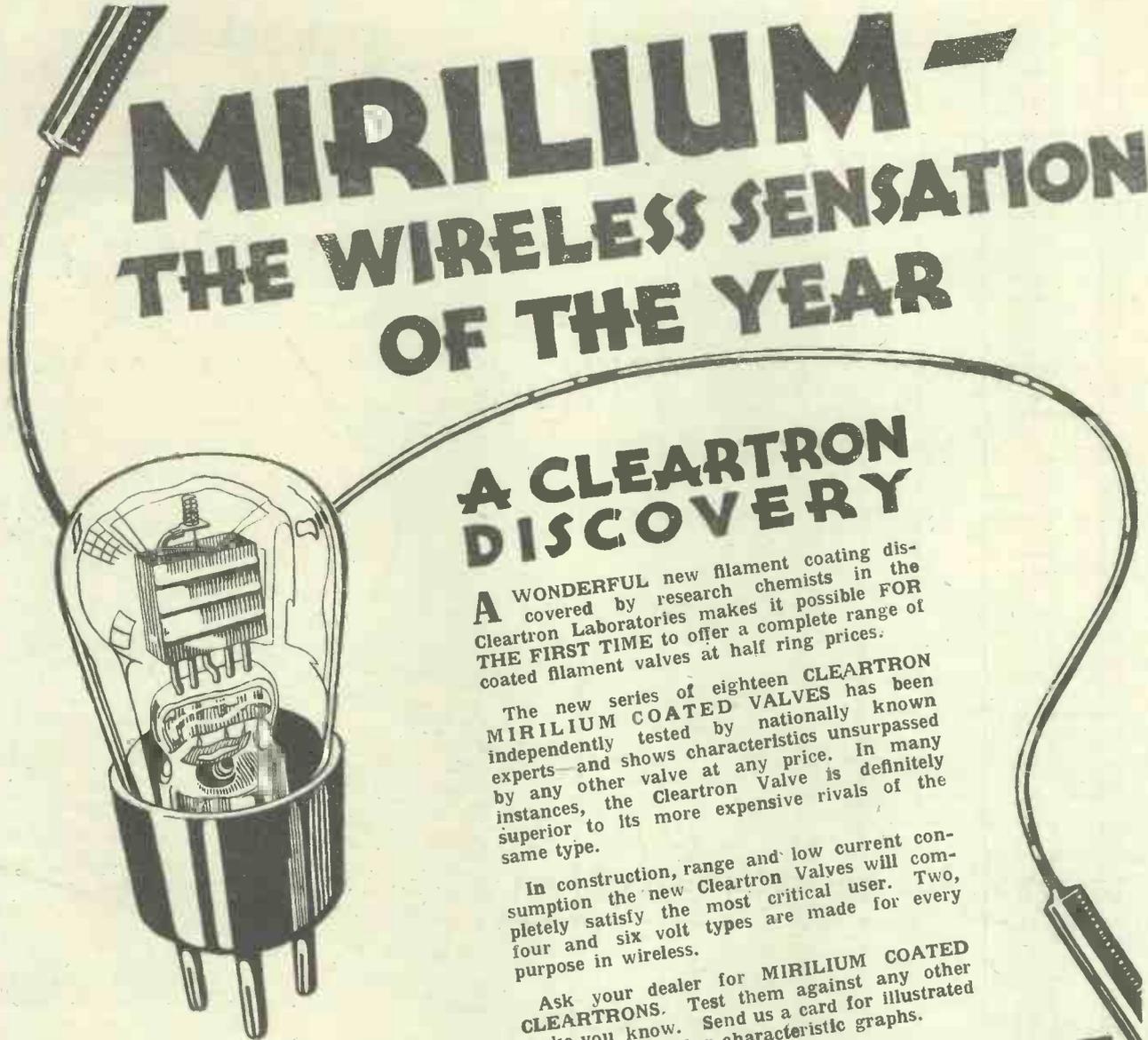
5 1/2 = Mirilium Coated VALVES

6 6

POWER
(S.G. type 12/6)

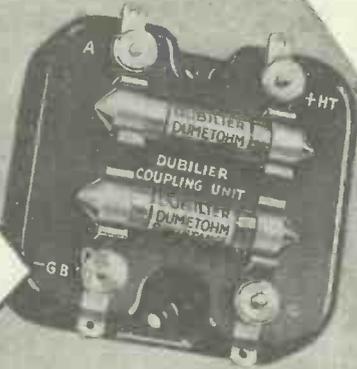
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FULLY GUARANTEED
5'6 SUPER POWER 7'6

Universal	1 amp. 5/6	Resistron	.075 amp. 5/6
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Super H.F.	.15 amp. 7/6	Super-Power	1 amp. 9/6
Super-Power	.18 amp. 9/6	Hyper-Power	15 amp. 18/6
Hyper-Power	3 amp. 18/6	Pentodion	15 amp. 18/6

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The New Dario Valves are even better! New non-microphonic filaments of greater strength, longer life and higher emission! New bulbs together with the special milled base—for an easier grip! New internal construction! New low prices! Because of these improvements and because of these low prices Dario Valves have come to be known as the low-priced guaranteed favourites. When next you require a valve—change to Dario!

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GREAT COMPETITION

£100 in PRIZES

FROM September 23rd to November 30th, every purchaser from Selfridge's of Components for the Mullard "ORGOLA" Receivers, or of the Mullard Pure Music Speaker or Mullard H.T. Supply Unit, will become automatically entitled to enter a free competition for which prizes to the value of £100 are offered. See below for details.

The Mullard "ORGOLA" brings the World's Best Programmes to you



The Mullard "Orgola" Receiver brings all Europe to your fireside. Because it is skilfully designed round three special valves it gives nearly double the range and volume of a normal three valve receiver.

ONE DIAL TUNING—The Orgola is a family set. Tuning is on one dial only—Mother and the Kiddies can do it easily.
SUPER-SELECTIVE—With the touch of a finger you can adjust the selectivity of your Orgola to suit local requirements.
It is the most selective, efficient receiver ever designed.

LIFE-LIKE REPRODUCTION—Speech and music from half the world away come in loud and clear—under normal conditions.
BUILD THIS GREAT SET YOURSELF—Anyone can build the Mullard Orgola. There is **NO DRILLING** and **NO SOLDERING**. You only need a pair of pliers and a screwdriver.

Read these very simple Rules

1. This competition is open to every purchaser from Selfridge's of Components for the Mullard Orgola Receiver or MULLARD Pure Music Speaker (Models "C" or "N") or Mullard H.T. supply unit. This applies to Hire Purchase, Cash or Enter Transactions.
2. The purchaser of any of the above-mentioned goods will be supplied with an entry form—free, of course. He or she will send to Selfridge's a letter (which must be accompanied by the entry form) of not more than 100 words headed "Why I bought a Mullard Orgola" (or a Mullard Speaker, or a Mullard H.T. Supply Unit, as the case may be).

3. These letters will be judged on their merits, and prizes awarded to the writers of the best letters giving the most clearly defined reasons (See rule 2). The decision of the Judge will be absolutely final. *No correspondence can be entered into regarding this competition.*

4. The winners will have refunded to them **IN CASH**, the amount paid by them for such Mullard products. In the case of purchases made on the Hire Purchase systems, the deposits paid will be refunded in full, the agreement will be cancelled—a receipt given for the balance due.

5. Entries should be addressed to Selfridge & Co., Ltd., Radio Dept., 1st floor, Oxford St., W.1, and marked "Mullard Letter" on top left-hand corner of envelope.

The Competition will close at noon on November 30th, 1929, and the winners' names will be published in the "Sunday Express."

"RADIO FOR THE MILLION" Price 3d. (Postage 1½d.). This gives a complete circuit diagram and blue print layout of the wonderful "ORGOLA" Receivers. *Order it at once from: SELFRIDGE'S RADIO DEPT.*

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HIGH NOTES FROM LOUDSPEAKERS

Has the desire for bass robbed us of brilliance in reproduction? A practical article of interest to all listeners.

By F. E. COX, B.Sc.

A HIGH degree of efficiency in reproduction has been reached by modern loud speakers of the cone reed-driven type now that more suitable sizes, materials, and mountings have been chosen for the cone itself, and the whole used with a baffle-board. Yet the writer has many times listened to pleasing music from such loud speakers, only to be astounded at the end of the piece by the poor quality of speech. Surely this is wrong?

If speech does not come through distinctly and naturally, then the loud speaker is to that extent faulty and deficient; for speech, like other sounds, is made up of notes of many different frequencies. In the days of horn loud speakers many of us managed to get very distinct speech without difficulty, although sets were far

from being so well designed and adjusted as they are to-day.

Syllables were heard and hadn't to be guessed at, as is often the case to-day. Of course, one does not include the moving-coil type, though bad specimens exist amongst them; but many of us do not wish to sustain the expense of buying and maintaining moving-coil loudspeakers in the exacting way they need to be used.

Deficient in High Notes.

The writer is convinced that cone loud speakers tend to be deficient in the highest notes, and this is the cause of lack of brilliancy in music and indistinctness of speech. The bass produced is usually fairly good; indeed, often there appears

a "boom" in voices that probably do not possess it.

Now the cure of the trouble is to use two loud speakers, one for the bass and one for the highest notes; for remember that the frequency range extends from 30 to over 6,000, and it seems, and is, unreasonable to expect one piece of apparatus to treat this range of notes with equal efficiency.

There are signs that the gramophone designers are taking this point of view. Even the logarithmic (or exponential) horns which they use are not necessarily perfect. The writer possesses one which, though excellent otherwise, yet neglects the sibilants, which are notes of the highest

(Continued on page 284.)

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Centre Tapped.

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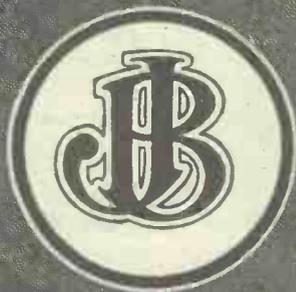
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HIGH NOTES FROM LOUD SPEAKERS.

(Continued from page 282.)

frequency, for reasons at the moment not very clear. Yet a small horn no greater than 14 in. long, of no particular design, driven by a telephone earpiece, supplies high notes with gusto.

When the two horns, the big and the small, were worked together in parallel, high and low notes were alike good and the difficulty solved. Using a cone and a small horn together, the result is similar.

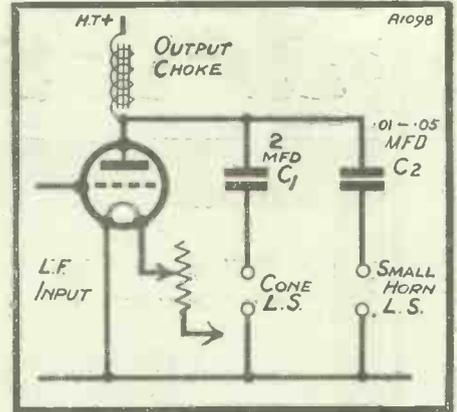
Splitting-up the Sounds.

We need to find some way of supplying the horn with impulses of the higher frequencies without giving it those of the lower, for two reasons. Firstly, the cone must not be robbed of its power on the lower notes, for it may reproduce them moderately well. Secondly, the small horn cannot, in any case, reproduce low notes, a fact which is common knowledge and easily proved conclusively by the writer by experiment.

In the figure showing the power valve output stage, the usual choke-condenser filter output is shown, the cone being in series with a 2-mfd. condenser (or larger) through which the audio frequencies are bypassed. The small horn is placed in series with C_2 , a .01-mfd. condenser, and the two are together in parallel with the cone loud speaker.

The low note impulses will be satisfactorily passed to the cone via C_1 , but

will be stopped by C_2 and not reach the horn, for the impedance of .01 mfd. at 100 cycles is 160,000 ohms, whereas that of C_2 is 800 ohms at 100 cycles.



Now turn to the higher frequencies. The impedance of .01 mfd. at 1,000 cycles is 16,000 ohms, and at 10,000 cycles is 1,600 ohms, which is much smaller, and small, too, compared with the horn impedance at the higher frequencies. The latter will have a much higher impedance than its nominal resistance rating.

The figure may be well over 10,000 ohms, though unfortunately reliable data is not furnished by manufacturers. Thus the impedance of C_2 at 5,000 cycles would be 3,000 ohms, and the unit's impedance four times as much, so that C_2 will efficiently pass the high notes and reject the low notes.

Player's please



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NO PEAKS IN THE VARLEY CURVE



Look at the impedance frequency curve of practically any other H.F. Choke. What do you see?—a series of small peaks pointing to the presence of minor resonances.

This means that, suitable as they may be for use in the anode circuit of a reacting detector valve, they cannot be considered for a parallel feed circuit.

Not so the VARLEY H.F. Choke. A glance at the curve will show that, whilst resonance occurs at 2,500 metres, it is entirely free from subsidiary resonance. And the resonant frequency is well outside normal broadcast wavelengths so that self-oscillation is impossible.

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The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

WATER-PIPE OR BURIED EARTH?

"CRYSTAL SET" (Bellingham).—"I do not know quite where to make the earth connection. Two are available, as per the enclosed sketch. One method would be to take the lead through the wall into the kitchen, and thus to the water-pipe, where it rises through the floor. The other way would be to run it outside the door marked, and then

on to my neighbour's earth plate, which is buried almost underneath the fence between the two gardens. I am rather inclined to the water-pipe, but if you think the outside earth would be better I have my neighbour's permission to join up there."

In the circumstances, we should certainly use the water-pipe, employing one of the usual earth-clips to make the connection to it and making sure that the pipe is thoroughly cleaned with a file or emery cloth before the clip is placed in position.

If you make a thoroughly good clean job of the electrical connections, and then coat the whole of the clip with petroleum jelly, to protect the joint from the effects of the atmosphere, you can be sure that the water-pipe connection will give you an excellent earth. It is sometimes thought that an outside

earth is always better than a water-pipe, but this is not true, and very often the water-pipe is far more satisfactory.

This is particularly likely to be so in your own case, since it not infrequently happens that the sharing of an earth wire with a neighbour means that the operation of one set will interfere with the other to some extent; so that, for instance, every time he adjusted his crystal you could hear the scratching in your 'phones, or possibly you would be able to hear speech or any loud noise which affected his tele-phones, and caused interaction with your own receiver.

Interaction of this kind is always undesirable. We should certainly employ a separate earth, because your aerials are necessarily placed somewhat close to one another, which exposes them to risk of interference with one another, unless all precautions are taken to avoid this.

PREVENTING L.F. HOWL.

"L.F. HOWL" (Cheltenham).—"My only trouble seems to be low-frequency howling. How can I prevent this?"

Low-frequency howling is very liable to occur unless the set is properly designed, and the components, etc., are in the correct relative positions. As you do not give details of your receiver we are unable to help you here without further details, but if you are using a "home construction" from a satisfactory design, make sure that the wiring is in correct position, and that all leads are as short as possible. Failure to observe these precautions is a common cause of low-frequency feed-back.

Remember, too, that the loud-speaker leads should be kept well away from the high-frequency and detector portion of the set, and should on no account be allowed to run close to the earth wire or to the lead-in wire. Yet another possible cause of low-frequency feed-back is the use of run-down H.T. batteries, or of a mains unit which is incapable of supplying the current demanded of it.

If you think the design of your set may be the cause, or if you have packed the parts into rather a small compass, you should forward a sketch of the arrangement (with full details) to the Query Department for advice as to the best method of overcoming the trouble. (See notice re Technical Queries on Page 290.)

THOSE NEW VALVES

"SIMPLE SIMON" (Blackpool).—"Every year, about this time, I buy the wireless papers—and every year I ask myself what is it all

(Continued on page 288.)

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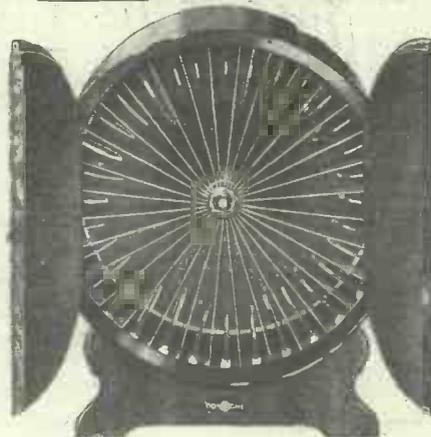
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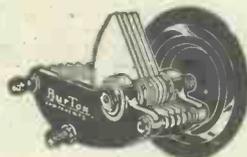
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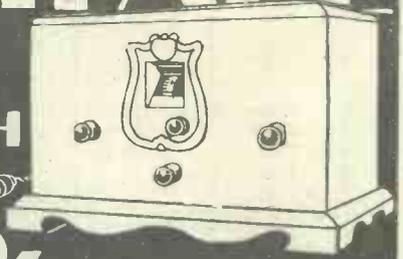
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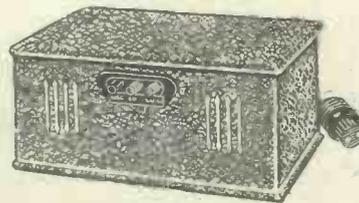
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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 286.)

about? I am a busy man with neither the time nor inclination to study the technicalities of wireless, but I do find it so interesting, and I do wish you could tell me something about it without hieroglyphics, curves and circuits. For instance, ought I to get a screened-grid valve, or a pentode? What's the difference, anyway? And why these new types, anyway? What was the matter with the old valves which always seemed pretty hot stuff to me?"

The old valves were hot stuff, as you say; but, nevertheless, the valve designers were not completely satisfied with them; nor will they be until perfection is reached. Consequently, each season sees new attempts at higher efficiency.

The ordinary valves, as you know, had four pins—two connected to the filament, one to the grid, and one to the plate. The grid, filament and plate are termed electrodes, the whole being called a three-electrode valve. Wonderful as these valves were, they could not be used for high-frequency amplification without a certain amount of trouble.

High-frequency amplification is the magnifying of very weak signals, by a valve or valves preceding the detector, and the difficulty was that the valves capable of increasing these tiny incoming impulses were always liable to "spill over" and go into oscillation unless held down by special neutralising arrangements.

Fundamentally, the trouble was due to the fact that the grid and the plate of the valve were so close together that its output invariably found its way back to the input, and thus, by increasing the output, the input was increased again, and so on, until oscillation occurred.

In the screened-grid valve, however, a screen is interposed between grid and plate, so that there is no inter-electrode feed-back like that which happened with the old three-electrode valves. The screen (which incidentally is usually connected to the "plate" leg of the valve holder) requires a certain amount of H.T. positive potential from the H.T. battery, and the valve's output is taken from a special new terminal placed on the top of the bulb, and usually connected to the rest of the circuit by means of a flexible lead.

So great was the success of the screened-grid valve that the idea of an internal screen between the elements was applied to low-frequency amplification, as well as to high frequency (though the idea in this case was not to render the valve more stable). The result is the pentode valve, which contains certain additional electrodes so arranged that the valve is rendered more efficient in operation and is, in fact, capable of giving results up to about 50 per cent greater than a corresponding valve not of the pentode class. In the case of the pentode, also, a terminal on the top of the bulb carries an additional connection, in this case, to the screen, the external circuit being suitably arranged for this.

It will be seen that both the screened-grid valve and the pentode were specially designed for certain circuits, so that the question of whether to buy one of these types, or one of the old-fashioned type, hardly arises, considering that screened-grid valves and pentodes are only used in those circuits for which they are specifically indicated.

Both types are interesting, if only from the fact that they indicate that technical progress is continuing apace, and we hope that even those who are not versed in the technicalities of the matter will be able to appreciate that the coming of these valves indicates that radio is getting better and better.

ARE PLUG-IN CONTACTS EFFICIENT?

F. N. (Sittingbourne, Kent).—"For the sake of convenience, I should much prefer to have the aerial and earth leads mounted on one of those little plugs that push into sockets which can be used instead of terminals. But what I am wondering about is—will this be as efficient as the proper screw-down terminals?"

A well-made plug and socket joint affords excellent contact, and we do not think you need have any fear on this point, providing you buy really good components of sound design.

WINDING YOUR OWN COILS.

D. M. (Birmingham).—"When winding your own coils, what is the proper way to tell exactly how long a certain number of turns will be, and how much room they will take up on the former?"

You can easily calculate this by the aid of an electrician's handbook or table. This will tell you the exact diameter of the various types of wire; and,

(Continued on page 290.)

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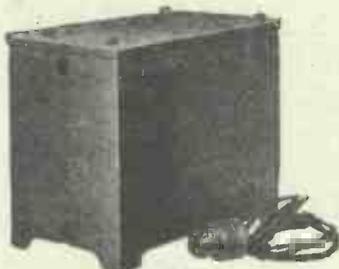
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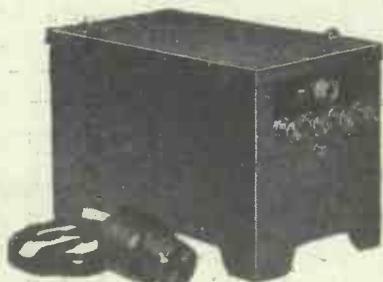
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Your modern super-power valve needs a Burndept Ethopower H.T. Unit to bear heavy currents at a high voltage; to eliminate hum, shrillness and "motor-boating"; to overcome variable voltage; and to do it efficiently and economically, consuming only 1 unit of electricity per 60 hours.

Let the Burndept L.T. Battery Charger renew your accumulator after every performance without removing it from its position. Economical, too—it uses only 1/7th the electricity of an ordinary light, and necessitates only a single small accumulator instead of two large ones. Both the above units incorporate Westinghouse Metal Rectifiers.

Connect your receiver to the nearest lighting socket with the Burndept Automatic Power Control. With this labour-saving device the H.T. Unit is automatically started when the set is switched on, and the L.T. charger is brought into operation when the set is switched off.

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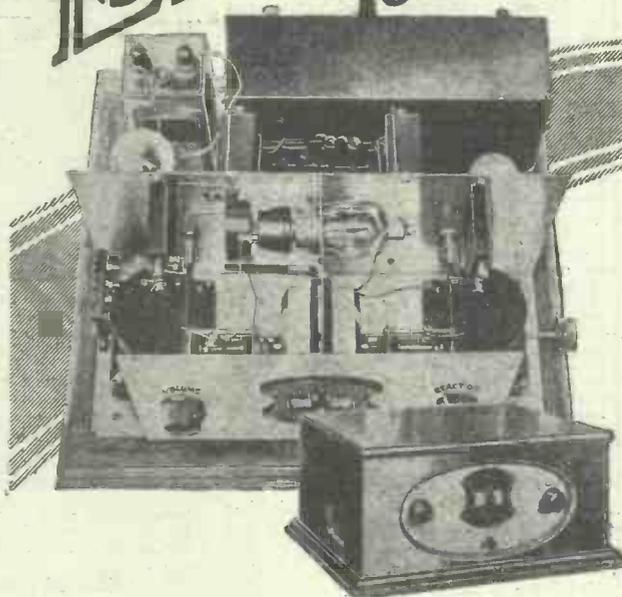
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Set builders—build and own the very latest radio development, the new 3-valve Lotus S.G.P. set. You can buy the kit for it complete, assemble it in a few hours and demonstrate to your friends the greatest range, power and selectivity of any set of the season.

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Name.....

Address.....

P.W. 12/10/29

Caution

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 288.)

when once the exact diameter is known, it can be multiplied by the number of turns you are putting on and the result is the length which will be occupied by the complete winding.

You should, however, allow a small margin for fixing-off; and, also, you will not be able to wind on the wire so exactly that each turn will lie perfectly side by side. If, however, you allow a small margin, and add this to the theoretical calculation of the length of the winding, you can tell exactly how long your former should be to accommodate any given number of turns for any given size of wire.

GRID BIAS FROM A MAINS UNIT.

B. R. N. (Hatfield).—"Is it possible to alter an ordinary H.T. unit so that you can take grid bias from it as well—and, if so, what are the connections?"

The connections are simplicity itself, all that is necessary being to break the lead from H.T.—on the unit to H.T.—on the set. At this point a variable resistance of suitable value (generally about 1,000 ohms) is inserted, a large fixed condenser being connected across it.

A negative grid-bias lead is then taken from the H.T.—terminal on the unit, the negative voltage available being varied by adjustment of the slider of the resistance. Tappings at different points on the resistance can be taken to provide other grid-bias voltages smaller than the maximum, and full details of the scheme will be found in an article called "G.B. and Your Unit," which was published in the September 7th issue of "P.W." (No. 379).

FIXING A PICK-UP.

R. W. R. (Hampstead).—"I am thinking of buying a pick-up so that I could play my gramophone electrically and make my own programmes if I get fed-up with the B.B.C.'s. One point I am not certain about and that is: Can the pick-up be pushed straight into the detector stage or must it be in one of the low-frequency amplifiers—one resistance and one transformer coupled?"

You can use the pick-up in either the detector valve or one of the L.F. stages, whichever gives the best volume for your purpose. All you have to do is to remove the valve in question from the set, plug in the pick-up adaptor in place of it, and then replace the valve into the valve socket of the pick-up adaptor.

Naturally, if it is placed in a detector stage, results will be much louder than in the first L.F., and the

filter output the whole question of battery supply has been more satisfactory. In fact, it is now so good that I am adding the extra valve I have always aimed for, bringing it up to four valves, with real loud-speaker reproduction.

"I suppose I shall need a larger battery in this case—and, apart from the choke, is there anything you can suggest to improve the life of the batteries, as to me the constant H.T. renewal is the one bugbear of wireless?"

When buying the new battery, be sure that you get one of adequate size to supply the current required by the four-valve set. If you get too small a battery it is always being overrun and, consequently, its life is invariably much shorter than it should be. You can ascertain from the maker how many millamps the battery will usefully give, and your valve curves will tell you exactly how much anode current the set requires if you have no milliammeter in the negative lead to measure the anode current.

The filter output and the adequate capacity of the battery are the main safeguards in economical running and, apart from these, the chief points to watch are to keep the battery cool, dust free and, of course, protected from metal, wires, scissors, etc., which, if carelessly laid upon it, will ruin it!

EXACT H.T. VOLTS ON THE SCREEN.

S. W. (Watford, Herts).—"My mains unit has not got a suitable voltage for supplying to the screen of the H.F. valve. Can I use an ordinary H.T.B. for this, and whilst I am about it could this be made to give negative grid bias to the other valves?"

There are no objections whatever to using a separate H.T. battery for the screen, in fact it is a very common practice in cases where there is difficulty in getting the exact voltage from the mains.

All you have to do is to mount the H.T. battery inside the set at some convenient point where a lead can be clipped on to join its negative end to L.T.—or to the negative filament of the H.F. valve, and take a suitable flexible lead with red plug from the appropriate tapping for supplying the screen.

It is necessary to keep the leads as short as possible, and for this reason we do not recommend as a general rule that the battery supplying the screened grid's positive voltage should also be employed to supply

(Continued on page 292.)

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers an *unrivalled* service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: On receipt of this an Application Form will be sent to you free and post free immediately. This application will place you under no obligation whatever, but having the form you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS PLEASE NOTE: Applications should NOT be made in person at Fleetway House or Tallis House.

best position for it will depend upon the amount of volume required, the efficiency of your volume control, etc. It can easily be found by trial.

CARE OF THE H.T. BATTERY.

P. B. S. (Nr. Swindon).—"As you suggested, I found out the real trouble was the long loud-speaker leads which seemed to be wasting H.T. battery current, and since I put in the choke



BEYOND COMPARISON

Prove for yourself by comparative demonstrations at any radio dealer's. Write for an interesting and informative book on sound reproduction.

Write to:

CELESTION, LTD.,
Dept. B, KINGSTON - ON - THAMES.
London Showrooms:
106, Victoria Street, S.W.1.
Telephone: Victoria 3955.

CELESTION

The Very Soul of Music

LOUD-SPEAKERS

MODELS
from
£3.15.0

A noisy crackle is the only way your set can say "Please solder all my joins with FLUXITE"



FLUXITE

FLUXITE is sold in tins, **SOLDERING** price 8d., 1/4 and 2/8. **SET Complete**

Another use for Fluxite: **Hardening Tools and Case Hardening.** Ask for leaflet on improved methods.

FLUXITE LTD., (Dept. 324), Rotherhithe, S.E. 16.



7/6
or LAMP only 2/6

SIMPLIFIES ALL SOLDERING



P.G.5. Non-Indicating (as illustrated). 20 a.h., 2-v., 9/-

P.G.7. Non-Indicating, 30 a.h., 2-v., 11/-

P.G.9. Non-Indicating, 40 a.h., 2-v., 13/-

P.G.F.5. Indicating, 20 a.h., 2-v., 11/9

P.G.F.7. Indicating, 30 a.h., 2-v., 13/9

Guaranteed service —wonderful value

NINE shillings for a 20-amp.-hour accumulator guaranteed for six months of perfect service—that is the Peto & Radford P.G.5.

Consider these features. The capacity—20 amp.-hours—is the real, valve-working capacity.

The plates are sturdy with interlocking grids to hold the paste. Terminals have acid-proof glands and cannot be reversed. Plates are held in place by glass key-ways. Vent is large, splash-proof and spray-tight and screws in. The lid is made of crack-proof Dagenite and is hermetically sealed to the box. There's no better value than this—and the battery is guaranteed for six months. It can be supplied with our patent indicating floats—they tell you at a glance whether the cell is charged, half-charged or run down—for 2/9 extra.

Send a postcard for particulars of these and other P. & R. Batteries (L.T. and H.T.) to:—

Peto & Radford, 93, Great Portland Street, London, W.1.

(Telephone: Langham 1473).

Glasgow Depot: 45, Clyde Place.

P AND R

London Sales & Repair Depot: 70a, Pimlico Rd., S.W.1.

PETO & RADFORD

ACCUMULATORS

The beginning and the end in

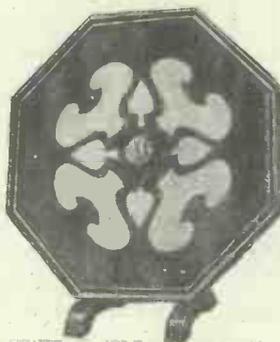
POWER

w.t.6

This announcement is issued by
THE NATIONAL ACCUMULATOR CO., LTD.

TAKE YOUR CHOICE

M.P.A. RESEARCH DEPARTMENT OFFERS YOU THESE 3 NEW M.P.A. SPEAKERS. SCIENTIFIC MASTERPIECES! EACH ONE A TRIUMPH OF GOOD LOOKS, TONAL PERFECTION AND VALUE! HEAR AND COMPARE!



THE NEW M.P.A. POPULAR PLAQUE

A BETTER INSTRUMENT THAN EVER BEFORE—and AT A LOWER PRICE! Fitted with the wonderful new Mark VI unit; with new robust protecting grille a' back; mounted on wooden base. Remarkably sensitive, clear and loud! Even response over wide range of frequencies, attractive mahogany or oak finish. **25/-** And look at the price!

★ Don't forget also to hear the new Mark VI Speaker Unit. It is only 12/6, chassis with 14" wood baffle and 9" cone costs 10/-; full mounting instructions are given.

THE NEW M.P.A. POPULAR CABINET

ANOTHER EXAMPLE OF M.P.A. VALUE! An attractive speaker with a first rate performance. Yet low in cost! Like the Popular Plaque, it has the unique Mark VI movement. Extremely sensitive. Splendid reproduction. Exceptionally wide range. Handsome polished oak cabinet. Box resonance eliminated. Hear **45/-** it and you'll buy it! Price

Mahogany Cabinet 47/6



THE NEW M.P.A. MOVING COIL SPEAKER

SEE AND HEAR THIS AMAZING NEW SPEAKER! Whatever price you are prepared to pay, you will not get anything better! Here indeed is "Hearing that is almost seeing!" Built on entirely new principles. Permanent magnet. No separate energising current required. Patent baffling system eliminates box resonances. Glorious tone! Dignified design in polished oak. A delight for the eye and the **15 GNS.** Complete ear!

Unit only on base, 12 Gns.



MANCHESTER RADIO EXHIBITION
Stands 21 & 22

and Demonstration Rooms, 49, Liverpool Road.



Hearing With Almost Seeing

M.P.A. products above £5 may be purchased on deferred terms.

M.P.A. Wireless Ltd., Dept. 3, Radio Works, High Road, Chiswick, London. W4

BROWNIE

WIRELESS



9'6

POPULAR TRANSFORMER

When planning your new set ensure perfect amplification by including a BROWNIE POPULAR TRANSFORMER. The core iron and the windings which are the very finest obtainable are assembled in the famous Brownie Factory; while all the delicate parts are protected by an attractive moulded casing which seals the whole transformer against any atmospheric interference. Send P.C. to Dept. 22 at address below for free booklet, "Wireless Without Worry."

BROWNIE WIRELESS Co. (G.B.), Ltd.
Nelson Street Works,
Morningson Crescent,
London, N.W.1.

BROWNIE

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 290.)

negative voltage to the rest of the set. It can be done, of course, by making the L.T. connection not at the end of the battery, but so as to leave the requisite number of negative volts free for tappings at that end of the battery, but usually a separate negative grid-bias battery is far more satisfactory.

THE NEAT LEAD-IN.

T. T. W. (Maidenhead).—"It is a crystal set with permanent crystal and tapped coil of the type shown in the sketch, and I have made a very neat job of this, but results are very poor indeed. In fact, the 'phones have to be pressed into the head to hear anything. A friend who lives in the same street uses a crystal set no different, but he hears very clearly without any trouble, and his wiring is not so neat as mine, and the aerial is, if anything, not quite so good. Why should my signals be much weaker than his?"

Fortunately your sketch shows the fault at a glance and we are afraid that you have been misled by the desire for neatness. If you have taken the aerial and the earth leads side by side along the picture rail as indicated in this sketch, much of the energy from the aerial is flowing direct into the earth wire and is not passing along to the set at all.

These two wires, the aerial lead-in and the earth lead-out, should be separated by at least a foot, and if at the same time you can prevent the lead-in from passing too close to walls, by means of stand-out insulators, or by bringing the set nearer to the point at which the lead-in enters the room, you will gain still greater efficiency. The present arrangement is about as bad as it can be.

MAKING AN L.F. CHOKE FOR FILTER CIRCUIT.

R. G. (Brierley Hill).—"Is it possible to make a good L.F. choke (for the output circuit for a three-valve set) at home? I can get stalloy stampings easily and I should very much like to try it as I think I would

meet with success if you can give me the full instructions."

We think you would have no difficulty in making one at home from a full how-to-make description, but as we can hardly give this in letter form we think the best thing you could do is to refer to the article, "Making L.F. Chokes," which appeared in "P.W." No. 378 (August 31st, 1929).

This article gives a full description and illustration.

OH!

What

a

Surprise



YOU'LL get if you

BUILD THE

'MAGIC' THREE

DESCRIBED THIS WEEK.

f a choke of the kind you require, and we think you would not have the slightest difficulty in making a successful job of the construction if you get these particulars. (Note.—If you have mislaid your copy of this date remember that back numbers of "P.W." which are still in print can be obtained from The Amalgamated Press, Ltd., Back No. Dept., Bear Alley, Farringdon Street, London, E.C.4, price 4d. per copy.)

INSIST ON P.R.

THE ONLY VALVE WITH A WRITTEN GUARANTEE AS TO PERFORMANCE AND LIFE.

If you have not already tried P.R. Valves send remittance as per list—we will post you a valve or a set of valves, for seven days' trial. If you are not fully satisfied, return parcel for full refund. You take no risk whatever. We replace all breakages and execute orders by return of post. No delay—the promptest service in the country.

We don't want you to keep anything you buy from us—as you can easily understand it **PAYS US BETTER** for you to return the goods that harbour spleen. We want you to be satisfied and give us the **CHEAPEST ADVERTISEMENT**—tell your friends we play the game.



.ASK
YOUR
DEALER
FOR THEM.
ACCEPT NO
OTHER.

We have sold more goods through people telling each other they were satisfied than by all the advertisements we have paid hundreds for

All orders executed by return of post. Sent C.O.D. if desired.

Telephone: City 3788.

P.R. PRODUCTS,

10, P.R. HOUSE, NEWGATE STREET, LONDON, E.C.4
(Opposite G.P.O. Tube Station.)

LIST OF DULL EMITTERS.						
3/6	Type	Fil. Volts	Amp.	Imp. Ohms.	Amp. Fac.	
EACH. Postage 4d.	PR 2	2	-095	28,000	13	H.F. Det.
	PR 3	2	-095	15,000	8	L.F.
	PR 4	2	-095	120,000	32	R.C.
	PR 9	3-5-4	-063	18,000	14	H.F. Det.
	PR10	3-5-4	-063	10,000	8-7	L.F.
POWER 6/6 Each Postage 4d.	PR11	3-5-4	-063	88,000	40	R.C.
	PR17	5-6	-1	18,000	17	H.F. Det.
	PR18	5-6	-1	9,500	9	L.F.
	PR19	5-6	-1	80,000	40	R.C.
SUPER-POWER 10/6 Each Postage 4d.	PR20	2	-15	7,000	6	Power
	PR40	4	-15	7,000	6	"
	PR60	6	-1	5,000	6	"
	PR120	2	-3	2,750	4	S.P.
	PR140	4	-2	2,500	4	S.P.

2 Valves or more POST FREE.

GUARANTEE: All valves despatched under guarantee of 7 days. Money Back in Full if not satisfied within 7 days. All valves carefully packed and breakages replaced free.

LIST OF P.R. SUPER GOLDEN SERIES.						
4/6	Type	Fil. Volts	Amp.	Imp. Ohms.	Amp. Fac.	
EACH. Postage 4d.	GPR 2	2	-095	24,000	13-5	H.F. Det.
	GPR 3	2	-095	12,000	9	L.F.
	GPR 4	2	-095	40,000	32	R.C.
	GPR 9	3-5-4	-09	22,000	14-5	H.F. Det.
	GPR 10	3-5-4	-09	10,000	9	L.F.
POWER 7/6 Each Postage 4d.	GPR 11	3-5-4	-09	44,000	41	R.C.
	GPR 17	5-6	-14	20,000	17-5	H.F. Det.
	GPR 18	5-6	-14	11,000	9-5	L.F.
	GPR 19	5-6	-14	15,000	41	R.C.
SUPER-POWER 12/6 Each Postage 4d.	GPR 20	2	-15	6,000	7	Power
	GPR 40	4	-15	6,000	7	"
	GPR 60	6	-15	6,000	7	"
SCREENED GRID 15/- Each Postage 4d.	GPR 120	2	-3	3,000	4-5	Super Power
	GPR 140	4	-2	3,500	4-5	"
	8G25	2	-2	220,000	150	S.G.

Tell us your set—we will send correct valves. Matched Valves 1/- extra. All orders executed by return of post.

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were
the Great Attraction
at Olympia.

THE NEW WONDER BULLPHONE CONE UNIT

Duplex Reed, 4 pole,
three impedances available

15' -
EACH

Adjustable
tone, in a dust-
proof bakelite
case.



Hearing is Believing!



NEW
**DUAL
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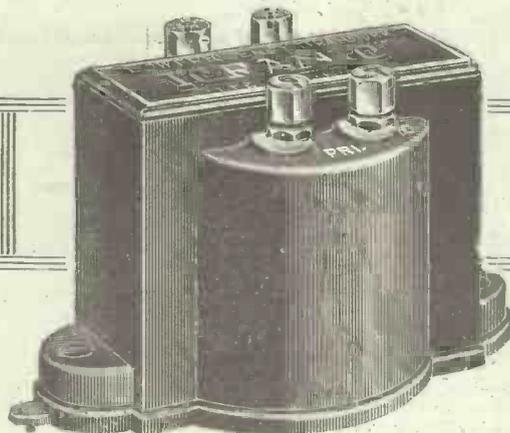
12' 6
EACH

Suitable for any and
every circuit.

BULLPHONE Ltd.,
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Phone: Bishopgate 9180.

THE LITTLE TRANSFORMER WITH THE GREAT CURVE



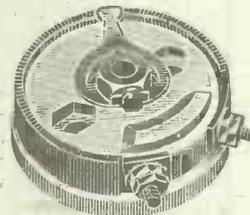
Type "J"

PRICE 17' 6

BUT WORTH MORE

IGRANIC POTENTIOMETER

Baseboard
Fixing.



400
Ohms.

PRICE **1/8**

SPECIFIED FOR

The "MAGIC" THREE

Write for Leaflets No. R131.



Works BEDFORD

THE MODERN MODE IN HOME MUSIC

YOUR EXISTING RADIO RECEIVER GOES HERE

The ADAPTAGRAM

RADIO OR GRAMOPHONE MUSIC AT THE TOUCH OF A SWITCH!

The Instrument which converts your existing Radio Receiver into a modern Radio Gramophone

PRICE £12 19s. 6d.

The Adaptagram is also supplied as a complete RADIO GRAMOPHONE in the following models:—
MODEL BD—Complete battery model (ready for operation) £27 15 0
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Write for Details.

THE BRITISH RADIO GRAMOPHONE CO., LTD.,
 77, City Road, LONDON, E.C. 1.

EUREKA



THE L.F. TRANSFORMER
 for perfection in wireless reception combined with full scale amplification and pure tonal quality.

CONCERT GRAND,
 1st stage, 10/6
CONCERT GRAND,
 2nd stage, 9/6
BABY GRAND,
 1st or 2nd stage, 8/6
 Model "A" Chokes for output or eliminator, 10/6
 All post paid and supplied with money-back guarantee if dissatisfied within 7 days.
 Sole Manufacturers:
L. PERSON & SON
 (Dept. 2), 63, Shaftesbury St., London, N.1.
 Clerks. 7139.

PLEASE MENTION "POPULAR WIRELESS" WHEN REPLYING TO ADVERTISEMENTS.

AERIAL INSULATORS.
 A short chat on a small but essential part of your radio installation.
 From A CORRESPONDENT.

MOST aerial insulators used nowadays are made of porcelain. Not that porcelain is really the best insulating material to use for that purpose—certain kinds of glass being rather better in this respect—but on account of the fact that when you strike a compromise between the insulating power of a material, its tensile strength, resistance to atmospheric deterior-

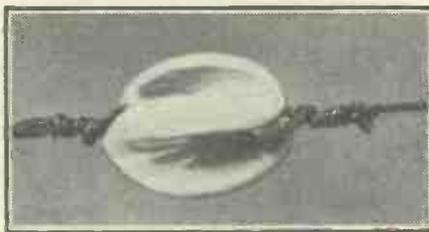


Fig. 1. The ordinary "egg" insulator.

ration, relative cost, and so on, porcelain comes out the best for all ordinary purposes. Hence the almost universality of the porcelain insulator in modern times.

The photographs, Figs. 1, 2 and 3, depict types of porcelain insulators which are much used at the present day, particularly the egg and the shell varieties of insulator. The reel type of insulator is equally efficient in properties as the two former varieties, if not even more so. Nevertheless, for one reason or another, its popularity has waned considerably within the past year or two.

An Interesting Type.

An interesting type of porcelain insulator is that illustrated at Fig. 4. This we may term the ribbed type of insulator, its peculiar features being good mechanical strength combined with a high resistance path for aerial currents. Nevertheless, despite the efficiency of this type of insulator, the average radio amateur pins his faith to the egg type of insulator (Fig. 1), a product which is now turned out in its hundreds of thousands.

Provided that the porcelain material of which the insulator is composed is of good (Continued on page 296.)

PRICE REDUCTION OF THE MULTI-RANGE DIX-ONEMETER

The extensive sale and increased use has enabled a reduced price to be offered below the already exceptionally low price.

DIX-ONEMETERS are now 50/- only, a remarkably small price for a meter worth £10 in comparison with others.

Latest Model. To 1st Grade Brit. Eng. Standard. Mirror Double Scale. Moulded Base. The finest Precision Multi-measuring instrument is the **DIX-ONEMETER**, the acknowledged Radio standard beloved by Expert and Amateur Imitations of its Bakelite case and mirror scale are inferior. They lack the 50 Multiplier Ranges, the Precision, the Duplex Scales, Knife-Edge Needle, Accurate Bearings and High Figure of Merit. Remember that the **DIX-ONEMETER** is as nearly electro-static in its tiny load and can be used at 2,500 ohms per volt. On 100 volts the high value of 250,000 ohms can be used. Micro-Amps., Milli-Amps., and Amps. to 20A. Milli-Volts and Volt. to 2000 V. Resistances from 50 ohms to 50 million ohms. All these are measured with ease on the versatile and finely made **DIX-ONEMETER**.

DIX-ONEMETER 50/- ONLY

Range Multipliers 6/6 each
 Electrical and Radio Test Booklet Free

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 Apparatus Depot

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 City 0191.

ASK FOR LAKER STEEL MASTS

AND OUTDOOR EQUIPMENT

The most efficient Aerial Supports. As supplied to B.B.C., MARCONI, H.M. GOVERNMENT, etc.

Ask your Dealer for details, or write direct for illustrated catalogue to:

J. & J. LAKER CO., LTD.,
 Kent House Lane, Beckenham, Kent

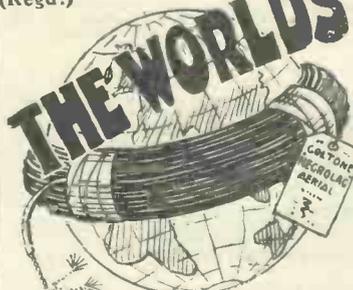
ANYTHING RADIO on EASY PAYMENTS.

Send list of requirements for quotations. Satisfaction guaranteed.

SHIEL'S RADIO,
 4, Freeman's Court, London, E.C.2.

WHEN REPLYING TO ADVERTISEMENTS PLEASE MENTION "POPULAR WIRELESS."

"GOLSTONE" NEGROLAC (Regd.) THE WORLDS BEST AERIAL



Do you wish to increase the efficiency of your receiving set 25%? Bring in long-distance stations hitherto unobtainable without the aid of extra valves? Add volume, clarity and selectivity to your set? This is the experience of users of "NEGROLAC" Aerial. Your set is capable of far better results. Let us send you pamphlets giving extracts from technical reports, testimonials, and full particulars with sample.

PRICES: Coils of 50 ft. 9/-
 " 80 ft. 15/-
 " 100 ft. 18/-

NEGROLAC INDOOR AERIAL
 Extraordinarily efficient. Full particulars on request. Prices from 3/-

WHAT USERS SAY—

Mr. W.W.R., Crook, Kendal, writes:—
 "The results are marvellous. I never thought it possible to get such excellent results. The volume is increased and tone improved beyond words."

Mr. S. H. H., Trowbridge, writes:—
 "Really the result is simply marvellous, and all that have heard my set since putting the aerial up think it splendid."

Mr. J. E. M., Pentre, nr. Wrexham, writes:—
 "I think it is just wonderful—the results are simply amazing. It has improved my 3-valve set 100 per cent. All stations come in now so much purer, and certainly they are nearer to one."

Mr. A. B. Benderloch, Scotland, writes:—
 "A customer states that he received 20 extra foreign stations with your famous aerial wire."





AT THE SHOW!

WATES

STAR

SPEAKER UNIT

Judging from the tremendous public interest displayed in the Wates STAR at the show, and the favourable impression created by its astonishing superiority of performance over any other reproducing unit, regardless of price, the Wates STAR has surely won the laurel of distinction as the star of all loud-speaker units

Immediately you HEAR it—as note of liquid beauty succeeds note—the magic of its performance CONVINCES you.

We firmly believe that on hearing it you will never consider any other unit, and we seriously ask all listeners about to purchase a speaker, to hear the Wates Star first!

The higher cost is due to expensive improvements in design and material, which is reflected in vastly improved RESULTS.

THESE CLAIMS ARE BACKED BY PROVED PERFORMANCE.

THE
SHAFTESBURY RADIO CO.
(Dept. P.W.), 184-188, Shaftesbury Avenue,
LONDON, W.C.2.

36/-

If your dealer does not stock — sent against cash on 7 days appro.

4 Coils. Double Magnets of special steel. Condenser. Upper adjustment for magnets. Lower adjustment for armature. Operates on principle of "Parallel movement in a magnetic field."

"Your set is only as good as its speaker."

M.B.

The **SET FOR THE MILLION!**
LOEWE RADIO REACTION RECEIVER

Type R.O.433.

70/- The Set for YOU!

Including Royalty and two coils for the lower waveband



For reception of local and distant stations the NEW LOEWE RADIO REACTION RECEIVER with the Triple Valve is unsurpassed. Even under the most unfavourable conditions with a small temporary aerial, this wonderful set has given fine and clear reception. The triple valve Type RNF7 incorporated in the set makes it possible to work with reaction. With a 50-volt battery, the set works splendidly, but extra power naturally follows if higher voltages (up to 150 v.) are employed. Send to-day for further particulars of

RADIO'S NEW WONDER

THE LOEWE RADIO Co., Ltd.

4, Fountayne Road, Tottenham, N.15
Tottenham 3911/3912.

When loud speakers speak too much play your gramophone. MELTROPE N^o III The Wonder Sound Box makes the oldest gramophone up to date!

Made by
AMPLIFIERS LTD.,
Billet Road,
Walthamstow, E.17
and sold by all good dealers.



Price 12/6.

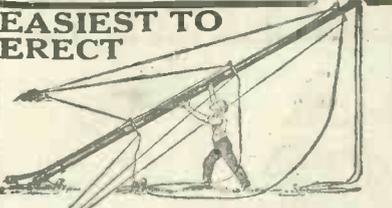
CABINETS CAMCO CASEWORK CHICO CABINETS
REG. TRADE MARK
for the
MULLARD ORGOLA RECEIVER

18/-

Oak. For Panel 18" x 7" complete with 10" Baseboard.

Obtainable everywhere, or from
CARRINGTON MFG. CO., LTD., "Camco" Works, Sanderstead Rd., South Croydon
Telephone: Croydon 0623.

EASIEST TO ERECT



C. P. STEEL MAST CO.

26ft.	STEEL MAST, tapering 1 1/2" to 1". Carriage: London, 1/6; Midlands, 2/6; Elsewhere, 3/6. Weighs 28 lbs.	10/-
30ft.	Tapering 1 1/2" to 1". Carriage: London, 2/-; Midlands, 3/-; Elsewhere, 4/-; Weighs 36 lbs.	12/-
34ft.	Tapering 1 1/2" to 1". Carriage: London, 2/-; Midlands, 3/-; Elsewhere, 4/-; Weighs 40 lbs.	15/-
40ft.	Tapering 1 1/2" to 1". Carriage: London, 2/6; Midlands, 3/6; Elsewhere, 4 6. Weighs 50 lbs. Asuper mast	24/-

These Steel Masts are offered direct from factory to user. Order now and save dealers' and merchants' profits.

Outfit includes complete equipment, viz.: Best British Steel Tubes in sections, Mast Rings, ample galvanised Stay Wire cut to convenient lengths, Pulley, Cleat, solid Metal Foot Rest and strong galvanised Stay Fasteners. Our masts are stayed at 4 ground points (not 3) which ensures permanent stability.

Accessories: Best MANILLA Rope Halyards (will not rot) 60 ft., 1/3; 100 ft., 2/6. Special anti-rust paint (sufficient for one mast), 1/6. Coppered Earthing Tube, 1/6. Aerial Wire, 12 strand, 28 g. pure copper, 100 ft., 3/-.

Money refunded if upon examination you are not completely satisfied and return the mast within 7 days.

C. P. MAST Co.
48, HIGH STREET, PENGE, S.E.20

AERIAL INSULATORS.

(Continued from page 294.)

quality, one may state that one type of porcelain insulator is as good as another when an aerial is first erected. Owing, however, to peculiarities of construction, insulators behave differently when exposed to wind and rain and to the smoky atmospheres of industrial cities for a few months.

A good insulator, that is, one which has been correctly designed and which is made

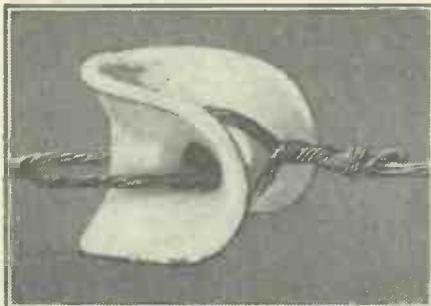


Fig. 2. An example of "shell" insulator.

of good-quality porcelain, will go on functioning in an effective manner, despite its exposure to the elements. It will, of course, require to be cleaned periodically in order to remove the layer of conducting grime which will be found adhering to its surface after long use, but, nevertheless, in other respects, it will remain in satisfactory condition.

Not so, however, an insulator of the cheap and nasty imported type. Such insulators, in the first place, have a very low insulating power. A "flash-over" voltage of two or three thousand volts will generally break them down, whereas an aerial insulator composed of good grade porcelain composition will stand up against a flash-over voltage of 20,000 volts and upwards.

Again, many low-grade porcelain insulators absorb considerable amounts of moisture from the air. They are acted upon, also, by atmospheric impurities, and

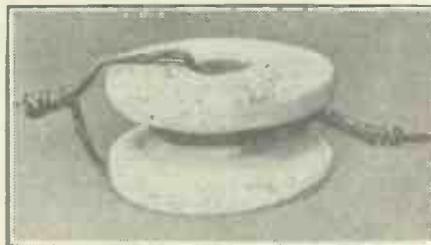


Fig. 3. The "reel" type is often employed.

thus they quickly deteriorate—to the detriment of any long-distance reception which the owner of the receiver may wish to accomplish.

The Best Test.

Unfortunately, it is difficult for the amateur to distinguish between a good and a bad insulator at sight, although, of course, one may find safety in this respect in purchasing only the products of reputable firms. Nevertheless, insulators whose surfaces are full of flaws, cracks, and other foreign markings should be regarded with suspicion. So, also, ought insulators which show roughened and porous surfaces.

(Continued on next page.)

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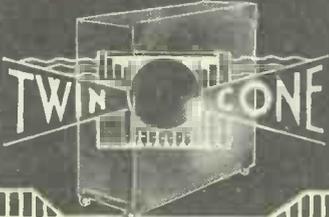
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AERIAL INSULATORS.

(Continued from previous page.)

Probably the best test to put an aerial insulator to is one which can be conducted by any amateur who possesses an induction coil capable of giving, say, a 1/4-in. spark.

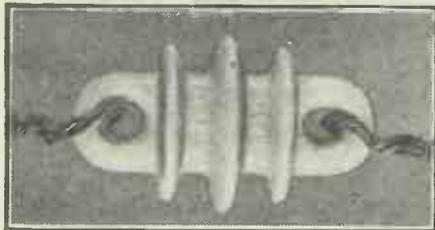


Fig. 4. The ribbed pattern has high resistance and tensile strength.

Connect the insulator in series with the secondary terminals of the spark coil.

In a darkened room, the entire insulator will be seen to glow more or less in a manner similar to the insulator in the photograph, Fig. 5. This glow, in the case of a good insulator, should not be very intense. And, of course, if actual sparks pass across the insulator it should be discarded.

Practical Illustrations.

This induction coil test for insulators can be made to be very instructive, for if the surface of the insulator is slightly moistened, sparks will pass across the surface, thus giving a practical illustration of the surface-conductivity of a wet insulator. Similarly, the rubbing of soot or dirt on the surface of the insulator will effect a like result.

Without a doubt, the best types of aerial insulators were those which were more or less popular some years ago, and which were specially designed in order to keep at least half of the insulator perfectly dry, even in the wettest of weathers.

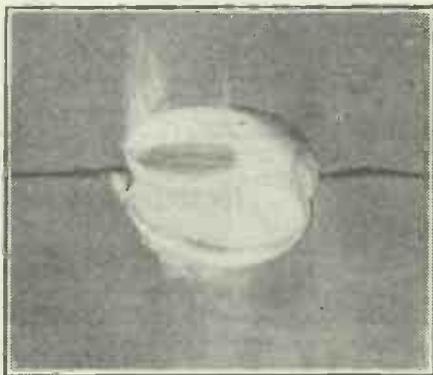


Fig. 5. The effect of applying high voltage H.F. across an egg insulator.

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AIR laws, although not well-known to the general public, are nevertheless extremely rigid and bind all types of aircraft.

They prevent the crime of smuggling by regulations compelling all aircraft reaching a country from abroad to land at certain specified airports, where customs officials can examine them, and heavy penalties are provided for delinquents.

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1 25 mfd. Paper condenser, type BB (Dubilier) ..	2	5	
1 Kit of condensers (Jackson Bros.) ..	1	9	6
1 Differential reaction condenser, type 926 ('0003 mfd.) (Pye) ..	1	5	0
1 Trimmer condenser, type 929 ('00005 mfd.) (Pye) ..	4	0	
1 H.F. Choke (Climax) ..	7	6	
1 Set of terminals, A, E, LS+LS—Pick-up, Pick-up (Belling-Lee) ..	3	0	
1 Seven-way battery cord fitted with engraved wander plugs and spade tags (Belling-Lee) ..	5	9	
1 Safety Anode Connector (Belling-Lee) ..	6	6	
1 Pair of panel brackets ..	2	6	
1 Set of Junit switches (1 with blue and 2 with black knobs) (Junit) 1s. 6d. each ..	4	6	
3 Junit indicating washers, 1d. each ..	3		
3 Terminal Mounts (Junit) 8d. each ..	2	6	
(Say) 8 oz. 18 gauge copper wire (approx.) ..	1	3	
Length of sleeving, screws ..			6
Total	£6	11	5

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1 H.T. dry battery, 100-v. type 1206 (Siemens) ..	1	2	6
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YOUR MAINS UNIT.

Some valuable advice to the non-constructor.

By G. P. KENDALL, B.Sc.

THE object of this article is to discuss very briefly some of those odd points about mains units which sometimes perplex the user, and are not as a rule covered in descriptions of actual designs. For example, a correspondent recently asked, quite naturally, "What happens if a D.C. unit is connected to A.C. mains? Does it blow up or merely cease to function?"

That kind of question, you know, can only be answered with the aid of a certain knowledge of general electrical engineering, and there are plenty more like it. Let us get down to business and consider some of them (I have little space to do it in!)

On the Wrong Mains.

This first question is quite an interesting one, so let us see what the answer will be. Well, it really depends on the exact nature of the circuit of the D.C. unit. In many cases nothing untoward would happen, but the unit would just cease to give out any juice. Probably a hum would be heard, but very little actual alternating current would get through to the valves because the smoothing circuits of the unit would stop it. Just how much would get through obviously depends on the thoroughness of the smoothing in the unit.

The converse case of an A.C. unit accidentally connected to D.C. mains is also interesting. More serious trouble is to be expected here, because in some cases we may draw a considerable current from the mains and burn out the primary winding of the power transformer in the unit.

You see, when such a unit is supplied in normal working with alternating current the effective impedance of the primary winding limits the current which flows through it, but on direct current only the resistance of this winding governs the current, and if this resistance is comparatively low, as it may be in a good transformer, the current will be quite large and may be actually big enough to burn out the winding and so put your transformer on the retired list.

Changing Over To A.C.

This reminds me of another problem which sometimes puzzles users of mains sets, i.e. what to do when the mains are changed over from direct to alternating current. Such changes are taking place from time to time in various districts as the standardisation scheme proceeds, and will no doubt go on for many years to come.

Now, there is no need to scrap your old D.C. unit and start all over again to build another one of the A.C. type. After all, ordinary A.C. and D.C. H.T. units have a great deal in common. Indeed, the alternating-current unit is really only a typical D.C. type with the addition of a rectifier and power transformer, with perhaps some slight differences in parts of the smoothing circuit. These differences, however, are usually quite unimportant and do not affect the main fact, which is that an

(Continued on next page.)

ASSEMBLE HT IN A MINUTE

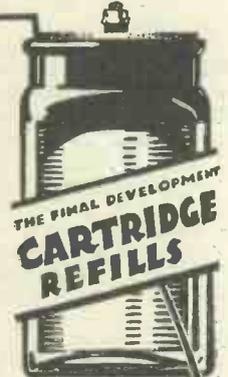
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YOUR MAINS UNIT.

(Continued from previous page.)

alternating unit is really the same as a direct current model with the addition of certain parts.

To convert a D.C. unit for alternating current working, therefore, all we really need to do is to add a separate rectifier unit to it, and interpose this new gadget between the unit and the mains. This additional instrument then takes the alternating current and converts it into uni-directional current, which you can regard as D.C. of a very rough type ready for smoothing. This rough output from the rectifier is fed into the old mains point on the D.C. unit, which then smooths it and delivers current through the various positive tappings to your set just as it used to do from the D.C. mains.

Cheaper Than New Unit.

Such a rectifier unit can be very simple, consisting merely of a power transformer, a rectifier valve with its socket, and a reservoir condenser, and you will see that it is a very easy job to make up and not particularly expensive.

Another interesting question, and a very puzzling one to many people, is this: why is a unit often quite quiet on light and moderate loads but begins to hum badly when heavy currents are drawn from it? In the case of a D.C. unit this is to be put down to only one main cause. When too heavy a current is passed through a smoothing choke the iron core tends to saturate and so the choke loses inductance. Hence we lose smoothing and hum begins to appear. As a matter of fact, quite apart from saturation, most chokes have what I may call a falling characteristic, that is to say, their inductance falls heavily as the current through them is increased.

In an A.C. unit the same thing may happen, and in some cases the trouble is accentuated by the power transformer and rectifying valve beginning to misbehave as the result of the overloading. Evidently, then, it is quite a natural thing for a unit to begin to give a bad hum when it is overloaded, in itself a strong argument in favour of building a unit capable of giving considerably more current than you are likely to need.

Cause of Motor-boating.

A further question which really follows from the last one concerns the reason for the appearance of motor-boating when a mains unit is overloaded. What usually happens this time is something like this; there are always resistances and inductances in a mains unit which are common to the anode circuits of all the valves in the set, although their effects are usually wiped out pretty thoroughly by means of large bypass condensers.

When the load is increased the voltage drop across these various points in the circuit may become so great that the bypasses are no longer effective, and so they cause motor boating by virtue of their coupling effects between the various valves in the set.

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TECHNICAL NOTES.

(Continued from page 256)

0.8 volt) from the output side of a stepdown transformer. As I remarked when I mentioned this matter in these Notes some little time back, the filament in this case must be fairly robust in order to consume a sufficient amount of energy at this very low voltage. It will be obvious that inasmuch as the voltage is very low, the current will have to be proportionately heavier to obtain a sufficient electron emission.

The third method involves the use of what are known as "indirectly heated" valves, in which the incandescent filament is heated by current from the electric light mains but does not act directly as the electron emitter; instead, it is enclosed within, but not touching, a long, narrow cylinder, this cylinder becoming heated by the radiation from the internal filament and then acting as the electron emitter and so taking the place of the filament proper in an ordinary 3-electrode valve.

These indirectly heated valves take a little time—up to thirty seconds—to heat up, and so when the set is first switched on there is a little wait before anything is heard from the loud speaker:

Valve Peculiarities.

Now I want to say one or two things about some of the peculiarities of these valves. Those with the low-voltage filaments which are heated directly from the output of a transformer cannot, as a rule, be said to have quite such good characteristics as ordinary valves used with a battery, although, as a matter of fact, with the best types the difference is not great.

In the case of the detector position, which is in some ways the most sensitive spot in the receiver, a special valve has to be used of this low voltage series so as to prevent any of the a.c. hum from finding its way into the reproduction. The detector valve has a still more robust filament than the others, with the consequence that at the same voltage it carries a much heavier current.

Low Resistance Precautions.

Another important point in connection with the use of these low-voltage-filament valves, and especially with the detector, is that, in view of the very low resistance of the filament itself, the resistance of the various other parts of the filament circuit may very easily become comparable with that of the filament, and extra care must be

taken to use low-resistance leads and to have good joints wherever these occur.

In particular, the contact of the valve pins in the sockets requires much more than ordinary attention, otherwise unwanted resistance will be set up here and the filament may be robbed of a percentage of the current it is intended to receive.

(Continued on next page.)

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TECHNICAL NOTES.

(Continued from previous page.)

Long Working Life.

On the other hand, the indirectly heated valves which I mentioned have now been much developed, and owing to their very good characteristics and also to their convenience, they are in considerable use in the manufacture of "mains-receivers."

For one thing they dissipate, as a rule, a much larger amount of energy than the directly-heated type, and this enables them to deal with a larger amount of power. Although this type of valve has only come into fairly general use quite recently, it was introduced on the American market some years ago, and tests have been in progress in the meantime, so that we have the advantage of knowing a good deal about its working life as well as its operating characteristics; I think it is correct to say that this type of valve is a thoroughly proved and practical proposition and one which, as I have already remarked, will come into more and more general use as time goes on.

As a matter of fact, a set using these valves in the proper way may easily be made to give not only greater volume than a similar set using ordinary valves but, what is perhaps more surprising, greater selectivity as well.

Record Wear with Pick-up.

I am often told by readers that they find the use of electrical pick-ups causes their records to wear away much more quickly than when using the ordinary gramophone soundbox. As this is a serious matter I

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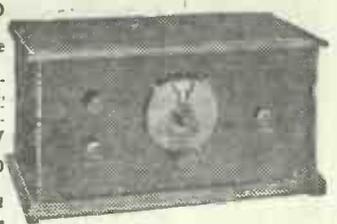
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THE "MAGIC" THREE

Described this week

should like to say a few words about the cause of it and also as to how it may, to some extent at any rate, be avoided.

It is true that the majority of pick-ups do cause extra wear on the record, and this is due to two principal causes. In the first place the pick-up is almost invariably more massive than the ordinary soundbox; by this I do not mean that it necessarily presses more heavily upon the record, but that its actual mass or inertia is greater.

In the second place the freedom of motion of the stylus-system is sometimes very much less in a pick-up than in a soundbox, that is

(Continued on next page.)

TECHNICAL NOTES.

(Continued from previous page.)

to say, the vibratory system is stiffer and consequently throws a greater transverse load upon the record track, tending to wear away the sides of the track more quickly.

Needle Pressure.

So far as the actual pressure of the pick-up needle on the record is concerned, this can easily be adjusted to any desired value, either by counter-weighting the pick-up arm or by means of counterbalancing spring which can be regulated by means of a screw.

It is a good plan to reduce the actual force between the needle and the record to the smallest possible value consistent with proper engagement between the needle and the track; if the pick-up is so counter-balanced that the needle scarcely touches the track, there is a danger of it bouncing, and so weakening the reproduction and even running out of the proper track and into a neighbouring track.

As regards the mass or inertia of the pick-up, this is a matter which cannot be adjusted in any way by the user and, as a matter of fact, provided the stylus-system is not too stiff, a certain amount of inertia in the body of the pick-up is desirable.

Turning to the question of the stylus-system, this must necessarily be under some restoring force in order to maintain its zero position, but if the force required to shift it from its zero position is unduly large—or, in simpler language, if the stylus is very stiff to side-to-side vibratory movements—then the needle reacts on the record and quickly wears the record away. Some ordinary soundboxes, it is true, do the same thing; but generally the soundbox is not nearly so much to blame for record-wear as the pick-up.

Reaction Principles.

I suppose the magnetic or "coil" system of reaction is the one which comes to mind with the majority of amateurs when the question of reaction is under discussion. The more enlightened members, however, will no doubt have a greater affection for the capacity method of controlling reaction. As a matter of fact, in practice reaction control inevitably involves more or less of each of these principles, and in some circuits the effects of capacity and inductance are deliberately combined.

Those who still favour the "reaction-coil" system, probably do so in the belief that this gives a greater amount of volume by regeneration but, whilst this may have been true some two or three years back, I do not think it would be correct to-day to say that certain capacity reaction methods will not give equal volume. Moreover, the capacity-reaction system offers some further advantages which may be mentioned in a moment.

For one thing the reaction, as you know, is apt to vary considerably with wavelength, but, by means of a special arrangement of capacity reaction, it is possible to make the reaction effect remarkably constant over a wide range of wave-lengths.

When using the reaction-coil system any adjustment of this coil in turn affects the tuning of the circuit, and as a result the tuning has to be readjusted continually as the reaction is adjusted.



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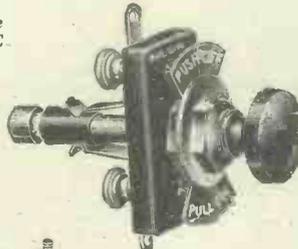
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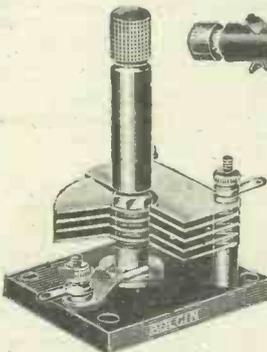
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A RAPID GUIDE TO RADIO

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By "Pentode"



THE story of radio is the story of the electron, as indeed are the stories of the inner workings of every science in the universe. But with radio we must get down to that ultimate constitution of things at the very beginning. You must know all about the nimble electron right at the start.

Once upon a time everybody thought that the smallest thing imaginable was the atom. The atom is remarkably tiny—it is far too small for the most powerful microscope to pick out, but we now know that the atom is not indivisible, that, in fact, it consists of a group of even smaller things.

It is very difficult for the human mind to grasp the significance of very small dimensions, just as hard as it is for it to grapple with colossal measurements such as billions of miles. But perhaps a few similes will help.

Let us take the atom first of all. A grain of sand, like anything else solid—liquid or gaseous—is composed of atoms, and, if it could be magnified sufficiently, it might look like a huge mountain of tennis balls, each ball being an atom. And there are in any grain of sand as many atoms as there are grains of sand in all the sea-shores and deserts in the world. That will give you some idea of the terrible tininess of the atom.

Staggering Tininess!

But, small though it is, it is in itself an assembly of even more diminutive things. These are known as protons and electrons. In the centre of the atom will be a particle known as the proton and around this kind of core are the electrons. These elements are not packed together—they are comparatively widely separated, the whole being held together by electrical force.

Now you will have gathered some idea of the size of the atom, so another simile for the electron will carry us a stage further. Think of your local town hall or the biggest picture palace you have ever visited, and let that be our atom. If half a dozen or so gnats were flying about inside the building they would represent the proton and the electrons!

One can hardly grasp the staggering tininess implied!

Now, the proton and electron are not pieces of matter such as are specks of dust. They are much too small for that. Remember, an atom is the ultimate particle of matter. No, we leave the purely material when we delve inside the atom, we really begin to get down to fundamentals.

Nobody can say for certain exactly what an electron is, but the latest theory is that it is a sort of concentrated wave of energy. The electrons in an atom revolve around the central core (proton) just as the planets do around the sun, indeed, they form a sort of miniature solar system.

It is a curious and rather awful thought that all our world, with its mountains and mantel-pieces, rivers and restaurants, oceans and match-boxes, is built of countless trillions of infinitesimally small solar systems, isn't it?

The number of electrons in an atom decides the character of the atom. Add an electron or take one or more away, and you change an atom of, say, lead, to hydrogen or gold or something else.

What Fills Space?

Until the discovery of the electron electricity was a complete mystery, but this we now know. Electricity is merely a demonstration of electron movement; a flow of electrons from atom to atom is a flow of electrical force. Electrons can travel in this way without upsetting the constitution of the material through which they pass, for, as one atom is robbed of electrons, so is its store made good by

It is a common belief that the theory of wireless is dry-as-dust sort of stuff that concerns only the engineer and scientist. This is quite wrong, for, told in the right way, it makes fascinating reading. Further, even a superficial knowledge of the subject will prove invaluable to either listener or constructor, and make the tasks of set-building and maintenance easier and more interesting. But it should be noted that this series is not confined to theory alone. Skillfully welded into the articles will be a vast amount of information directly relative to the assembling and operation of radio receivers. Hints and tips concerning all phases of "household wireless" will be given, and it is our firm belief that every reader of "P.W." will find something in the series of individual interest.

1. ATOMS AND ELECTRONS.

new ones coming along. There is merely a shuffling forward of these energy particles.

Perhaps you have wondered what occupies all that space between the electrons. Well, it isn't air, for air itself is merely a gas composed of atoms of nitrogen and oxygen; its atoms, too, have their little solar systems of widely spaced electrons.

Ether is the all-pervading medium which occupies the interstices in atoms and the spaces between the stars and planets. You mustn't think of ether as a sort of gas, because it is far more fundamental than anything that can be bottled up in jars.

The Ether Theory.

Suffice it to say that ether soaks through everything, mineral or vegetable, gaseous or solid, just like water does through sponges or air through cotton wool.

We don't know as much about this ether as we do about electrons, indeed, there are people who even now refuse to accept the ether theory.

But a medium of the supposed nature of

ether satisfactorily explains away the passage of light waves through interstellar space as well as a lot of other things, some of which we will have to deal with later.

For instance, wireless waves must be waves in something, mustn't they? And they can't be waves in water or even waves in air, because glass window panes or brick walls don't stop radio waves like they do sound waves.

Every now and then you will come across items of news concerning discoveries in regard to both the ether and the electron. But you must not be dismayed by such and jump to the conclusion that all you may have learnt from, say, this "P.W." series of articles, "goes by the board."

Of course, new discoveries are made in radio as in everything, but you will find if you examine them closely that for the most part they merely supplement our existing knowledge of the art.

What You Will Learn.

Quite recently it was suggested that the electron is not the smallest thing and that the electron, like the atom, is made up of a bunch of still tinier particles.

Well, maybe it is, but that need not worry us. If we are talking about houses we do not keep thinking about the numbers of bricks that are used in each building. Suffice it for our purpose that the electron is appallingly tiny, and that, as an entity, it fulfils all our requirements and enables us to solve all the problems of the "innards" of a radio outfit quite satisfactorily for every-day purposes.

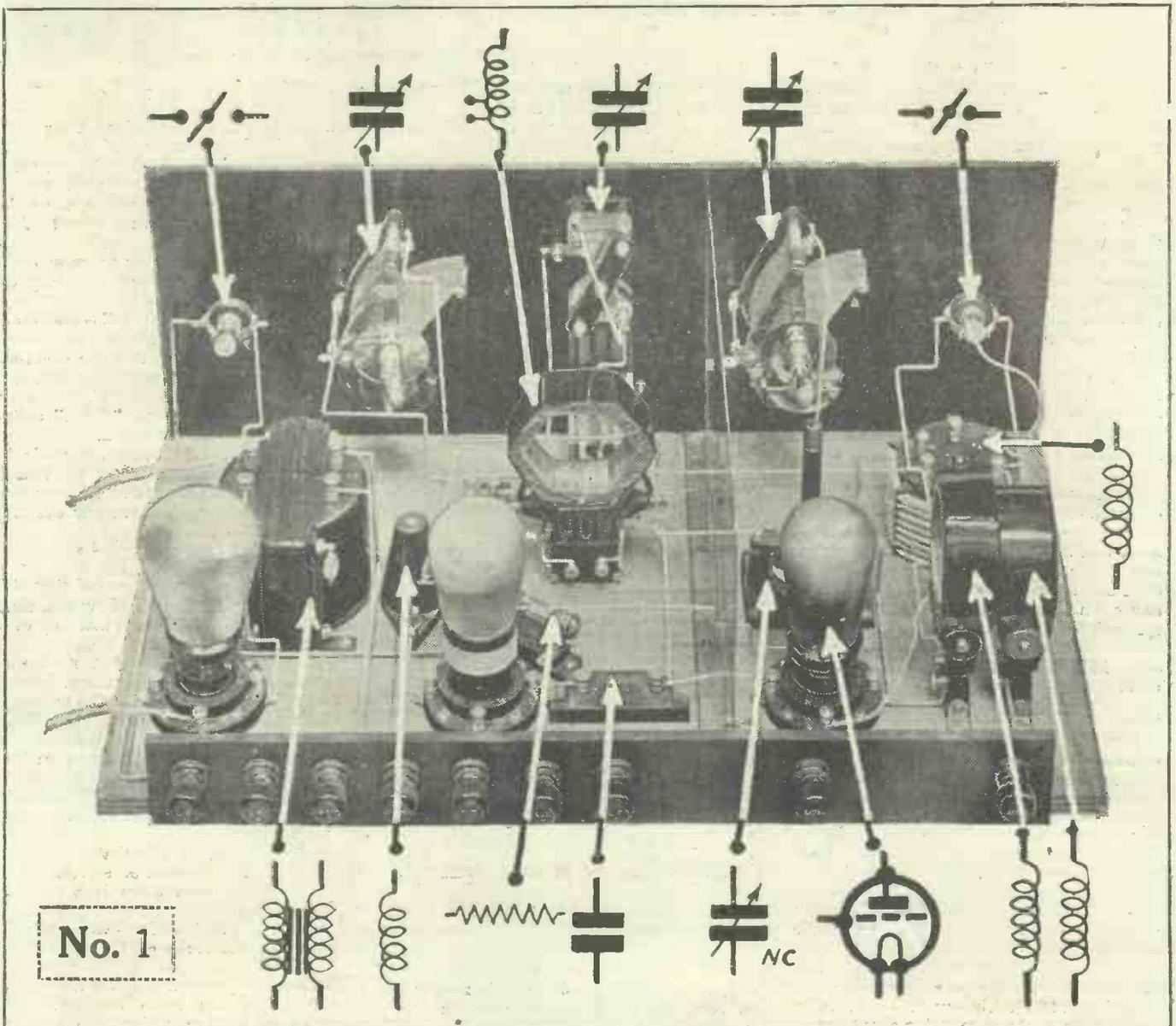
If you can accept the idea that all matter, solid or fluid, is composed of assemblies of atoms, and that each atom is a sort of minute solar system comprising protons and electrons you are half-way towards grasping the elements of the theory of radio.

How quickly you can progress after that may occasion you some surprise. The mysteries of battery action, the reasons why the electric light springs into operation when you touch a switch, and such phenomena as radio set squeals and grunts of peculiar kinds not associated with broadcast studio performances will all be quite clear to you.

Of course, you will come up against some fairly tough propositions, although I will do my very best to smooth them over. At times it will be necessary to steer through some tricky problems which, for their complete understanding, would need pages and pages of text. Similarly, every now and then we will have to handle arithmetical propositions, but don't skip these, for we shan't be juggling with advanced mathematics—only simple addition, subtraction, and multiplication will be dealt with.

CLOSE-UPS FOR CONSTRUCTORS.

A NEW PICTORIAL SERIES.



ABOVE is the back-of-panel view of a typical three-valve set using standard components. Most of the components have their theoretical symbols indicated by arrows.

These symbols are used in theoretical diagrams in order to illustrate the circuits employed in sets.

A symbol shows graphically the electrical operation of a component and need not bear any particular relation to its external appearance. And when the various symbols are joined together in circuit form one can see at a glance exactly what the resulting circuit is and does and what part each individual part plays in it.

What the Various Symbols Indicate.

At the top, from left to right, are shown the on-off switch, an ordinary tuning condenser, a tapped coil, a reaction condenser, another tuning condenser, and a wave-change switch.

To the right a coil is indicated. This coil is a "P.W." Standard loading coil.

Along the bottom, from left to right, the symbols indicate an L.F. transformer, an H.F. choke, a grid leak, a fixed condenser, a neutrodyne condenser, a valve, and two more plug-in coils.

The Same Symbol for Different Components.

You will notice that the same symbol is used for a loading coil, a plug-in coil, and an H.F. choke. The reason is that these are all, from an electrical point of view, similar articles. They are coils of wire, and their individual differences lie mostly in their values (microhenries) and appearances.

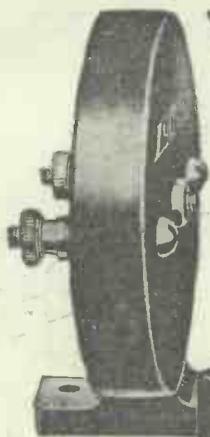
Much the same applies to the variable condensers—their differences are more apparent than real. A neutrodyne condenser could be used for tuning, only it wouldn't cover a very wide wave-band!

SET BUILDERS!

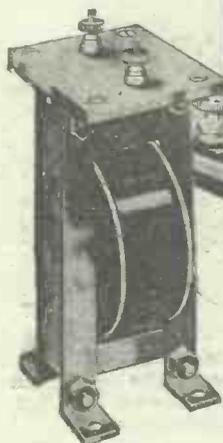
use Lotus components for easy assembling!

Draw the curtains and gather round the table. Now's the time to try your hand at building one of the new radio sets with Lotus components. You'll enjoy the trouble-free building, the easy slipping together of these well-made units. Each is a masterpiece of mechanical perfection, strong, neat and accurate.

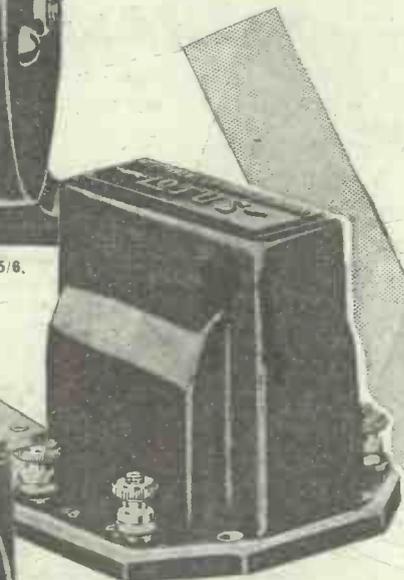
Instead of buying a number of varying makes of components, choose all yours from the Lotus range. Lotus components are made to work together in harmony and they ensure easy assembling and the achievement of all that the designer claims.



Lotus H.F. Choke 5/6.



Lotus L.F. Power Choke, 15/-.

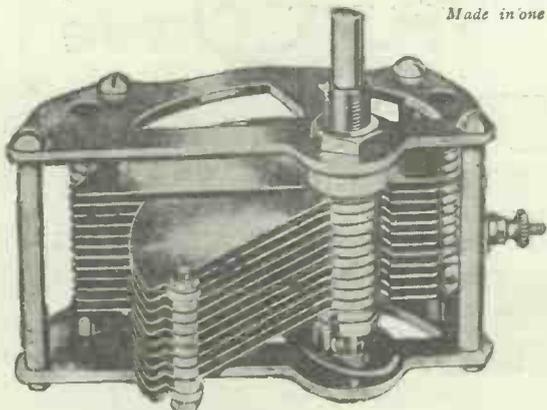


Lotus L.F. Intervalo Transformer, 12/6.

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21/-



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The importance of the continuity of this curve below 50 cycles back to 25 cycles is obvious, whilst the advantage afforded by the slight emphasis of sideband frequencies in the region of 7,000 cycles contributes added brilliance to musical reproduction. Moreover, the absence of resonant frequencies below 50 cycles absolutely precludes the possibility of low-frequency oscillation.

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"VEE" UNIT, CONE,
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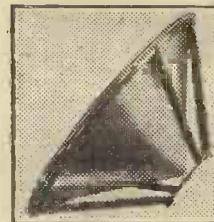
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Explains how to use your radio set as an Electric Gramophone. Here, for the first time, are given full details for the electrical reproduction of your favourite records.

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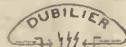
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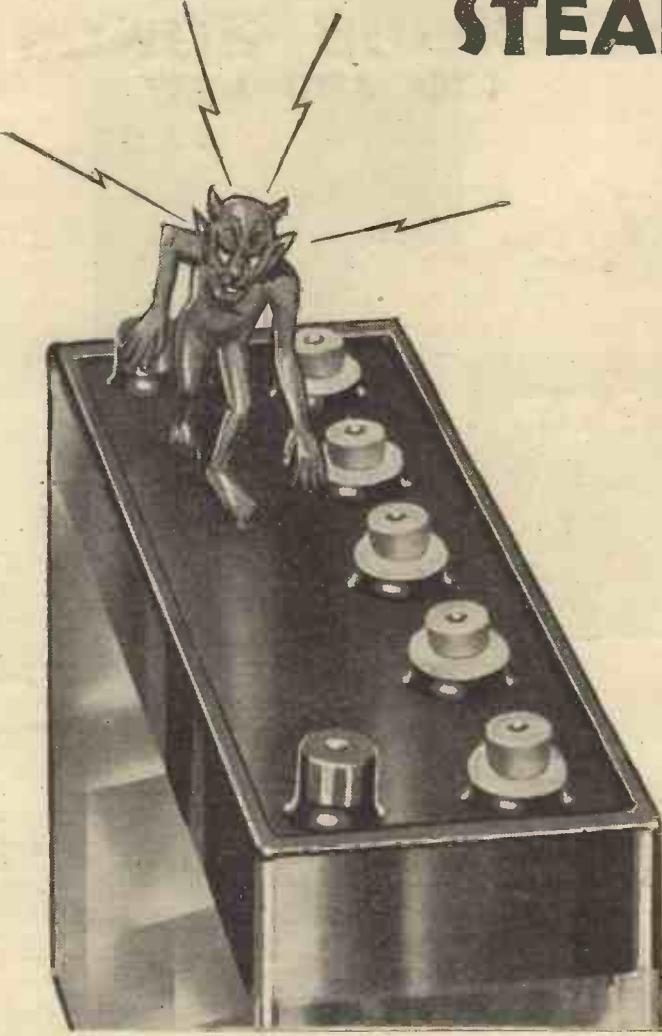
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| VILLIKENS AND HIS DINAH
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Sung by René Mallory | Vernon Duks |
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Electrical Leakage robs you of power — of energy for which you have already paid!

If you use an old-fashioned, smooth-top H.T. Accumulator you are harbouring a menace to your pocket and to your Set. Electrical leakage can sneak along smooth top H.T. Accumulators continuously whether you are using them or not.

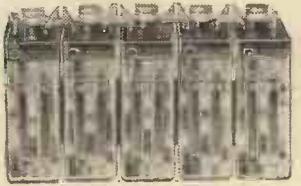
Smooth-top H.T. Accumulators are liable to leak continuously — the leak-thief is always busy on them!

And the effects of electrical leakage are serious. It causes the Accumulator to require frequent recharging. It prevents your Set getting the H.T. it needs — reception is ruined, range is reduced, volume is lowered and tone is degraded. And you have to pay for it!

Electrical leakage is ended with OLDHAM "Air-spaced" H.T. Accumulators

In Oldham H.T. Accumulators each cell is separated from its neighbour by an air-gap. These air gaps form an impassable barrier to electrical leakage. They definitely prevent waste due to electrical leakage. As a result Oldham H.T. Accumulators need less recharging—they cost less to use and they supply your Set with the smooth abundance of H.T. current that is vital to good reception. Only Oldham H.T. Accumulators have air-spaced cells. Your Dealer will show them to you.

This smooth-top type of H.T. Accumulator is put right out-of-date by the famous Oldham "Air-spaced" H.T. Accumulator.



With the new Oldham H.T. Charger you can charge any make of H.T. Accumulator at home. For less than 2d. a week you can keep your H.T. Accumulator always at "concert pitch." For A.C. Mains, 200-250 volts 40-60 cycles, price **63/-**. Then there is the Oldham H.T. Charger for D.C. Mains, price **40/-**.



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Complete with two connectors and length of cable. Woolen trays extra if required. Ask your wireless dealer to show them to you.

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steps ahead—

THE New Cossor is new throughout—not merely an existing valve modified. It has a new—and enormously strong—filament. Its construction is infinitely more efficient. As a result it has set a standard of performance which is the envy of the industry.

A high vacuum plays a big part in valve performance. Any residue of gas left behind during manufacture will lower its efficiency. This, in turn, means loss in volume—poor tone—fewer stations.

In the new Cossor Valve there is used a radical improvement in exhaustion which ensures a higher degree of vacuum than ever before.

This new High Vacuum process is but one of the many features of the New Cossor—the valves with a “punch.” The valves that will give you more volume—sweeter tone—greater range.

If you have not tried them yet you are missing one of the greatest valve developments of recent years.



Eight years ago Valves were comparatively inefficient. The above diagram symbolises the amount of air left inside the bulb after it had been scaled.

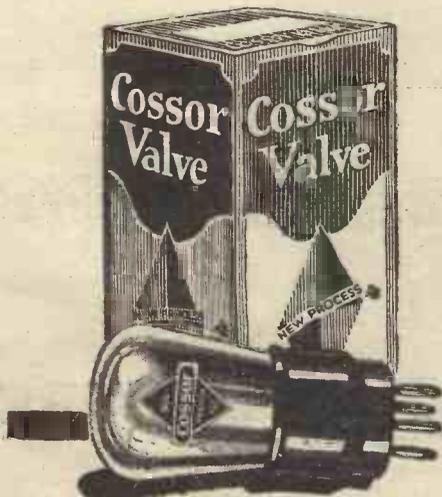


Six years of improvement produced a valve in which a very much smaller amount of air was left in the bulb as shown in the diagram on the left.

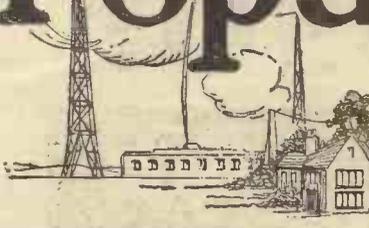


To-day under the wonderful High Vacuum Process (a new Cossor development) the residue of gas left behind in the bulb is reduced to practically unmeasurable proportions. This is one of the many features which make the NEW Cossor the season's most sensational valve development.

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Popular Wireless



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**A NEW APPOINTMENT.
 ARIEL'S LIBEL ACTION.
 RADIO SOCIETY NOTE.
 INSTITUTE OF PATENT-
 TEES.**

RADIO NOTES & NEWS

**AN INDIAN ENTERPRISE.
 THE HEART OF P C J.
 ROUND THE WORLD.
 YOUR OLD LICENCES.**

Relaying the Schneider.

THAT photograph of the Schneider Trophy Relay on page 136 of our September 28th issue, was not "part of the apparatus used by the B.B.C.," as stated. As a matter of fact what it depicted was the Marconiphone installation fitted on Ryde Pier Hotel to broadcast the commentary to the spectators of the great thrill.

The Value of Dampness.

ALL through the long drought I neglected my "earth." Never gave it a passing thought. And almost imperceptibly my set's performance waned in strength from week to week, until I suspected the valves, the battery, the B.B.C., even my own ears. Then came a real soaking rain, and lo, the set became alive and zippy again as though by magic. I have a theory that the rain also washed out all the bad connections of my aerial and lead-in, which of course disobey all the rules in the book.

National Institute for the Blind.

I ALWAYS read the annual report of this Institute with interest and admiration. That for the year ending March 3rd, 1929, states that since Braille was invented no special apparatus has more influenced the destinies of the blind than the wireless set, and that the Institute has hundreds of requests for sets which cannot be supplied, although during the year it spent £819 on radio equipment. If you are going to make a new set, or treat yourself to a new "shop" set, why not send the old one to the Institute, and transform someone's life, maybe. Address, Great Portland Street, London, W.1.

A New Appointment.

IN succession to the late Mr. E. R. Tuck, the Association of Wireless and Cable Operators have appointed Mr. T. J. O'Donnell as their General Secretary. No doubt Mr. O'Donnell has a sort of "divine right" to the job, as he has taken a very prominent and useful part in the Association's affairs for many years, and has been secretary of the Marine Section since 1920. We wish him luck—lots of it, for there is stormy weather ahead.

New B.B.C. Station.

THE new B.B.C. receiving station, the successor of Keston, situated at Tatsfield, in Surrey, 900 feet above sea-level, is now hard at work, checking the wave-lengths of British and foreign stations.

There are ten receivers, five being for short waves, and by their means watch is kept on the frequencies, so that if any deviate from the narrow path the offending station can be warned at once. This station is also continuing to pay attention to the relaying of broadcast programmes from other countries.

"Ariel's" Libel Action.

I GET no peace, what with septic programmes and sceptic readers. And I did think that the technical hounds had bitten the sceptics into a better, non-Thomas frame of mind. But on page 154 of "P.W." for September 28th, Mr. Gladstone bursts upon an amazed world with a list, to wit, two, of his fears, namely (1) That I publish a lot of fairy stories, and (2) that I do so in order to fill up space. Oh, naughty G.O.M.!

Fairy Tales and Space.

I PLEAD guilty to filling up space. It's what they give me the ink for, and the space. As to fairy tales—well, those which pass my examination and are published in good faith are a mere drop in the ocean of those I reject with a sigh for the lively imagination of the inexperienced dial-twiddler. Let the G.O.M. tremble—that'll be Fear No. 3—for the wrath to come from the noble army of Valve Barts. upon whose honourable titles he has cast such suspish.

The "Kuttemout."

WITH apologies to the G.O.M., I should like to precis a letter from G. E. A. C. (Canonbury Park, N.), who has tried our "Kuttemout" circuit. "Very selective and powerful," he says. He gets
(Continued on next page.)

LONGSTONE LIGHT-KEEPERS LISTEN-IN.



The Longstone Lighthouse, where Grace Darling lived, on the outer Farnes Islands, in the North Sea. The three light-keepers have recently erected an aerial to enable them to listen to the outside world.

NOTES AND NEWS.

(Continued from previous page.)

2 L O on a 120-degree reading and 5 G B on 155 degrees. At 140 degrees there is no trace of 2 L O, and between these two extreme readings he gets "at good strength" Toulouse, Katowice, Rome, Lyon (La Doua) and Langenberg. Further, with this set Turin is picked up at good L.S. strength. Nurnberg, always very good. "These are only a few. Others too numerous to mention roll in after London has finished."

The "Fetchemin."

SO that's that. Thanks, G. E. A. C., for your pretty fairy tale, and good luck to your dial fingers. V. D. (Hammersmith) also is smitten with the charms of "Kuttemout," the circuit that makes young men dream dreams and hear "the horns of Elfland faintly blowing," eh, G.O.M.? "Though I have made hundreds of sets, I do not want any more." Good-enoughski, as Mr. Henderson would say. By the way, V. D., your constructive criticism, always welcome, has been noted by the Editor.

Radio Society Note.

MR. C. H. PIPER, 77, Torridge Road, Thornton Heath, informs me, with justifiable pride, that the Thornton Heath Radio Society, of which he is the Hon. Sec., has met every Tuesday, summer and winter, since it was formed seven years ago. Such enthusiasm almost deserves to be aspirated. No, this libel action has upset me! I see that it is not the Sec. who tells me this, but J. P. F. Sorry, dear old J. P. for Thornton Heath! Meetings at St. Paul's Hall, Norfolk Road. Roll up, Heathers!

A "Blind" Airplane Pilot.

A REPORT from America says that Lieut. J. Dolittle, enclosed in a light-proof cockpit, took off and landed safely a few yards from where he started, doing all his navigation with the aid of lighted instruments on the dashboard. Instruments showed him his position with relation to the ground, and a wireless beam gave him his course. This claim has to be substantiated, of course, but evidently we have here the foreshadow of a new era in aviation and radio. There is yet hope for the Southern Railway on foggy days!

The Arbitrator.

SPEAKING at a conference of adult educationists, Sir J. Reith said, of the B.B.C., that an arbitrary decision to do what they believe to be right has proved to be the best way to deal with the situation. So there we have the truth, packed small. The B.B.C. has decided to please itself and to follow some ideal of its own devising. Well, I wouldn't object to that if the devising were done by a different set of specialists. In my sober opinion there are too many highbrow theorists helping to plan the programmes.

Byrd Blows Another Horn.

THE Byrd Antarctic Expedition is certainly proving to be its own publicity agent. Manager: Commander Byrd. The latest performance is reported to be the blowing of a motor-car horn in Los Angeles (Cal.) by means of a radio impulse sent

from Byrd's camp. The same impulse drew curtains from an enlarged picture of Byrd at the National Radio Exposition in Los Angeles. I will do the explorer the credit of being ignorant of this last-mentioned feat, for I don't care for the flavour of it at all.

Institute of Patentees.

WE bid welcome to a little stranger in the land of ink, namely, Number One of "The Inventor," the official organ of the Institute of Patentees. It is a most interesting production and one calculated to arouse or sustain the divine fire in the bosoms of men who invent things. There is a whole page full of "What's wanted in Radio" which ought to make the heads of some of your ingenious ones reel with ideas. Here's luck to the organ.

An Indian Enterprise.

BEFORE leaving the subject of literature, I should like to say a kindly word to "The Indian Wireless Magazine," now about two months old. In launching this enterprise someone has made a plucky attempt to focus the amateur radio move-

SHORT WAVES.

The wife of a B.B.C. lecturer says she can never recognise her husband's voice when he is broadcasting. Perhaps because it is not he who does the lecturing at home.—"The Star."

"The British Broadcasting Company" is what they call it now.—"The People."

A correspondent in the "Sunday Mercury" writes:

"There was (at the Radio Exhibition) a handsome mahogany cabinet set which can be converted into a double bed, or a roll-top desk, or a household ladder, simply by pressing a button; and all the time it goes on rendering programmes as long as there are programmes to render. A great boon to the busy."

The only drawback is there doesn't seem to be a way of turning it off.

A musician played the piano part in a concerto for violin and piano at Savoy Hill the other day for broadcast purposes. A Scot, seeing his name advertised, called to know what time he would be playing.

"But I thought you refused to have a wireless set in your house?" the musician exclaimed.

"Certainly," said the Scot; "but there's a shop I pass almost every day that sells them. I'll pop in just before you come on, ask to see a set, and get the shopman to try it out. So I'll be able to hear you just the same."—*"Evening News."*

"It is quite a mistake to suppose it needs a stout wire always to carry a high voltage," we read in some recent wireless notes.

But it needs a stout heart to listen to some of the programmes.

FROM BAD TO NO BETTER.

Wife: "Did you find out if there was anything wrong with your wireless set when you had it to pieces?"

Husband: "Yes. And now I'm trying to find out if there's anything right with it since I've put it together again."

ment in India under what are none too brilliant stars. We cannot but wish it well, though the statement that it is "the only amateur radio journal in India" is not correct, for "P.W." has been there for years. One anna a fortnight, and half of it printed in the vernacular. By the way, No. 1, Vol. 1, of "West Australian Wireless News and Musical World" has appeared. Salute, friend!

Snobbery à la Mode.

I OBSERVE that a writer of a letter to a newspaper, complaining of the disturbance caused by loud speakers, refers to the loud speaker as a modern form of aspidistra. Now, although one can sympathise with the complainant in the matter of the over-generous use which some proud listeners make of their L.F. outputs, one is somewhat tired of covert sneers at the fashion of wearing aspidistras in the front parlour window. Aspies are very handsome, pleasant plants and a great advance on china dogs and waxen fruit. Anyhow, a parlour is obviously the place for a *haut parleur*. (French for loud speaker—Editor).

Wireless Society Note.

I HAVE received the 1929-30 Syllabus of the Edinburgh and District Radio Society, and note that its high standard is maintained. It includes an auction sale and two query nights. Hon. Sec., Mr. E. I. Robertson, 10, Richmond Terrace, Edinburgh. Meetings are held at 16, Royal Terrace every Wednesday at 8.0. p.m. The list of periodicals available in its Library is interesting, but I hope that "P.W." will qualify for a place there one of these days.

The Heart of P.C.J.

SOUNDS like the title of a best-seller, doesn't it? But I refer to actual studio and allied establishments from which P.C.J.'s programmes are operated. Someone who paid them a visit tells me that the place is an eye-opener. The announcer is a polylinguist, and knows the tastes and foibles of the numerous folk of the many nations to whom he speaks.

In addition to keeping the show merry and bright, he has to record the exact times of the announcements and titles of all music played in order to check reception reports.

Round the World in a Night.

BY means of a colossal collection of records, the station is able to broadcast the music of many nations. From 6 to 8 G.M.T. you may hear the European transmissions. At 10 p.m. begins the overseas tour, and from then onwards till dawn the broadcasting is directed to more and more distant countries, till even the remoter South American Republics have their share. For the amplitude of its appeal I should say that P.C.J. is the most wonderful station in the world. A special article by the Editor on Short-wave broadcasters appears on another page in this issue.

Keep Your Old Licences.

THE persecution of the Bushey Heath lady by the Post Office because, although she had a licence she could not produce the one previously issued—she was fined 2s., by the way—furnishes a useful warning to those of us who may not be in the habit of storing up waste-paper. I have only the Press reports to judge by, but, prima facie, it does seem too bad to drag a person into court because she could not prove to the Post Office what the Post Office itself ought to be able to establish. Why did they not examine their records to verify the truth of her statement? And what is the use of a licence if of itself it cannot protect the holder? ARIEL.

SELECTIVITY and the REGIONAL SCHEME

BY
CAPT. P. P. PECKERSLEY
M.I.E.E.

IN a previous article I showed that common experience teaches us that by adjusting the electrical constants of a set we are able to find a unique adjustment which gives us the loudest signal. In Fig. 1 of that article I showed how we could express this in graph form and plotted a resonance curve.

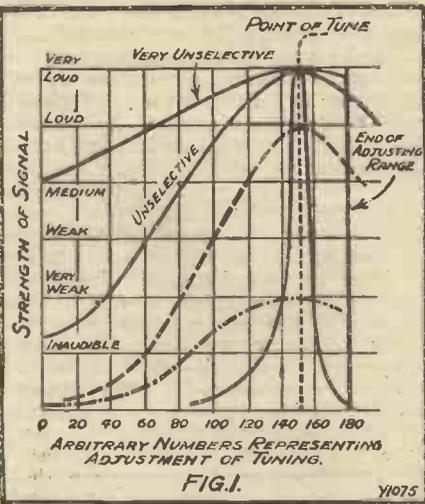
The new Regional Scheme "does not involve any scrapping of sets; it may involve modification or additions." Our Chief Radio Consultant here concludes his discussion on the "problems" that have arisen and will arise among listeners owing to the opening of Brookman's Park.

This is a very important point and is the reason for the advice to certain people who want to know how to make their crystal sets selective, which is to reduce the size of the aerial. This means moving the whole curve downwards so that the edge of the skirt comes below the audibility line. This applies in a great many cases.

I ended the article by recording a well-

When the Dual Wave Starts.

All those sets, valves or crystals or portable, in North London, will experience an overwhelmingly strong signal from Brookman's Park. This will lift up the curves above very loud—selective and unselective alike. Their valves may saturate, their loud-speaker may rattle and their quality may be filthy. The unsuspecting will mistune, i.e. find a place on the side of the resonance curve where it cuts the "very loud" line, and rest content until a second programme is introduced, see Fig. 2.



loud, medium, weak, very weak and inaudible. See immediately how the sharp resonance curve reduces the signal to inaudibility with a much smaller change in the constants of the receiver aerial circuit, while a larger range than available of adjustment is needed for the very unselective set before we can reduce the incoming signal to inaudibility.

Then the trouble will begin, because there is no tuning left in the set, albeit the thing used to tune beautifully to much weaker Oxford Street.

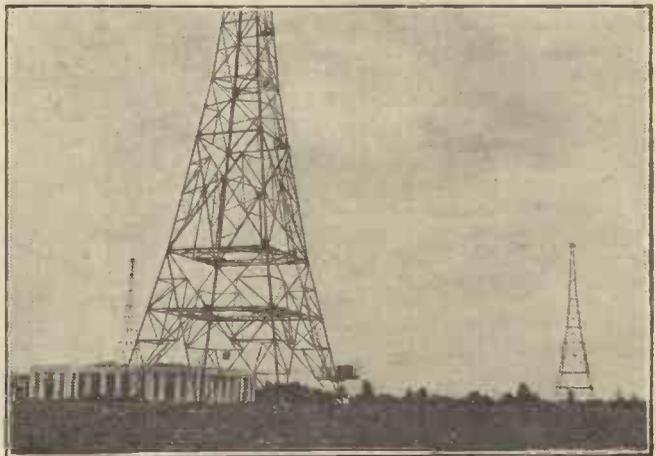
In the case shown (full lines) the two unselective sets cannot tune out the signal at all. Now, however, we arrive at our first generalisation. With a crystal set, unless we add coupled circuits and increase our difficulties of adjustment by confronting the user with two-handed control, the resonance curve is apt to be flat, i.e. like the unselective curves.

Reducing the aerial size, or with a portable turning it round to nearly the minimum, brings almost the old conditions, (Continued on next page.)

By analogy the crystal wears the crinoline skirt of simplicity instead of the revealing narrowness of the select.

HOW DOES BROOKMAN'S PARK AFFECT YOU ?

But the edges of the set the skirt must sink below the inaudibility line and fashion still de-creases, for crystal sets, the wide and ample spread. There is only one solution and that is to reduce the intensity at the point of tune from very loud to medium or loud, or weak (depending upon the initial shape of the curve) and at once the required selectivity is achieved.



A general view of the new London Station taken from the foot of one of the masts.

Resonance curves of "very unselective" "unselective," and "selective" sets. With the former loud signals cannot be tuned out. Reducing the aerial size, and so the loudness at the "point of tune" makes the "very unselective" and the "unselective" sets O.K., though some signal strength is sacrificed at the "point of tune."

known fact that some sets require but a fractional movement of their tuning adjustments to bring in or cut out a station, whereas others, whatever was done to the adjustment, never achieved complete silence even though the signal went louder and weaker. This, too, is easily explained in graph form. Thus, refer to Fig. 1 (above), where two types of resonance curve are shown.

Selective and Unselective Sets.

For the sake of simplicity I have drawn instead of numbers representing the current in the aerial, lines to represent very loud,

SELECTIVITY AND THE REGIONAL SCHEME.

(Continued from previous page.)

however, and effectively shifts the curve down again because it is no longer necessary to mistune at all with an effectively small aerial, because such an aerial is just the right size to pick up enough signal to bring it to the "very loud" position, see Fig. 2.

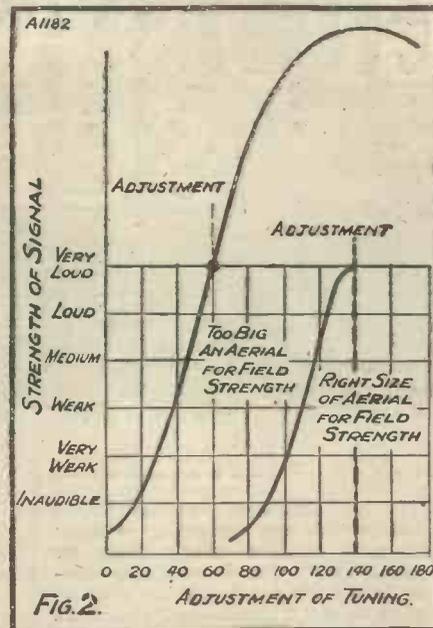
This applies to a valve set as much as to a crystal set, the valve set only scores because the skirts of the resonance curve are narrower. This means the valve user with the proper amount of pick-up in his aerial can always tune to very loud and yet be sure that the tips of the skirt edge fall below the inaudibility line.

Sharpen the Curve.

All I mean to convey is that a too large aerial on any set will rob that set of the required conditions of selectivity. In general, then, it is a question of adjusting the aerial size so that we don't let the too ample skirts spread over the inaudibility line. With a crystal set we obviously have to sacrifice more signal at the point of tune than with a valve set which has a sharper resonance curve. The question is, do we, with a crystal set, sacrifice too much, and must we therefore sharpen our curve?

This depends. Certain iron wire aerials and lumped coils and low-resistance crystals produce so flat a resonance curve that the point of tune must lie even on "very weak" (see figure) before the skirts of the curve come below audibility. In this case we must sharpen up the resonance curve, somehow, if we want reasonable signals on the point of tune. Coupled circuits can be very easily adapted to crystal sets. A copper aerial and a decent earth may work wonders. Gas pipe earths flatten the resonance curve as do these very lumped coils.

In sum, a proper study of the curves of Figs. 1 and 2 represent the whole problem in a nutshell. If you have a sharp resonance curve you can have lots of volume at the point of tune, and you can select anything you like, the flatter the resonance curve the more signal strength at the point of tune must you sacrifice to get more



selectivity. And you can't make up again on note magnification nohow. There is, in general, a universal cure—cut down the size of your aerial until the signal at the point of tune is satisfactory.

Try a Coupled Circuit.

If, however, the device is still too unselective, you must set about sharpening up the resonance curve by fitting better components or using a coupled circuit or improving the earth, etc., etc.

I advise crystal and single-valve users to

start trying some simple experiment now with 2 L.O. Can you tune through, or is there a background of London wherever you set your dials? If London persists everywhere try a shorter aerial temporarily rigged, or—waiting for Brookman's Park—more sensibly use an aerial series condenser of .001 mfd. in series with the existing aerial.

Practise Now.

The latter suggestion is by far the soundest until Brookman's Park starts, because you may get weaker signals from the new station (particularly if you live very close to Oxford Street now, when your aerial may even want increasing). But as an experiment try making your set selective and practise tuning through and be ready for the twin service when it starts.

I cannot—this article is over-long already—give advice to all and sundry wherever they may happen to live in relation to the old and new sites, but I can say with absolute definiteness that a properly designed crystal set with a suitable aerial will give a medium signal and the required selectivity.

If you want a loud signal and the required selectivity use a coupled circuit. All will depend upon the damping in your set. If you are really sensible get a small indoor aerial and a single-valve set when a spot of reaction so sharpens the resonance curves that all your problems melt away and you can have single-handle control and a fine factor of safety.

Watch that Aerial!

In general, the unselective set is a set with a too big aerial or a poor high-frequency circuit, valve, wire and earth. I can make a three-valve set behave on a tiny aerial 1 mile from the new station just exactly as its behaves on a big aerial 50 miles from the new station. I can make both resonance curves identical, but I shall never make a set work if I put up a huge great aerial in a huge great field strength.

Multi-valve, single-valve, crystal, portable, transportable, super this, or super that, all, all and all will be unselective if the aerial is too big, all, all and all will give perfectly good loud signals, and will be perfectly able to select between two programmes if they possess reasonable circuits and an aerial adjusted—physically or by aerial series condenser—to be the right size for the field strength conditions existing.

I have spoken!!

POINTS TO REMEMBER.

If you are using a crystal set a good earth is quite as important as a good aerial.

If you use a counterpoise aerial this can be fitted with an earthing switch in the same way as an ordinary aerial.

A small glass nasal douche such as can be obtained from any chemist for a few pence is very good for filling small wet H.T. cells without making a mess, as it enables the flow of acid to be regulated exactly by the finger pressure upon the aperture.

When a wet H.T. battery has started to "creep," it should be thoroughly wiped and dried before it is put into condition again, great care being taken not to splash the acid when refilling.

BEHIND THE SCENES AT AN OUTSIDE BROADCAST.



Two engineers controlling the output from a large concert-hall during an "O.B." At Savoy Hill the programme is divided and sent to the various stations for broadcasting.



The MANCHESTER RADIO EXHIBITION

THE Manchester show is in every sense a national one. It gives northerners just as great an opportunity to see right-up-to-the-minute radio as Olympia does southerners, and those fortunate people who can travel great distances for the purpose.

There is a tendency to regard the Manchester Radio Exhibition as a sort of "after-annexe" to the London show. It is, of course, nothing of the kind. It is quite capable of standing by itself, on its merits, as a national exhibition.

It is promoted by that most enterprising newspaper, the "Evening Chronicle," in conjunction with the R.M.A. and Provincial Exhibitions, Ltd. The "Evening Chronicle" has done a great deal to popularise broadcasting in the North, and it has always devoted considerable space in its columns to articles of interest to home constructors.

Larger and Better Than Ever.

It appears to be one of the very few newspapers in the country that early realised that radio was going to prove an extremely vital department of our modern social amenities and, further, the "Chronicle" did not exploit the art as a "stunt," but persevered with its valuable pioneering until to-day it can truly be said to occupy as honoured a position in the radio world as it does in its wider sphere of general journalistic activities.

This is the sixth radio exhibition we primarily owe to the "Evening Chronicle," and it is larger and better than ever. It is no provincial bazaar held in a mission hall, but a huge assembly of products arranged by Britain's leading manufacturers. Indeed, there are this year over a hundred firms exhibiting.

The show is being held in the City Hall, and it opened on October 16th, while it was arranged that no less a personage than the Right Honourable J. H. Clynes, M.P., the Home Secretary, should be present at the opening ceremony.

By the way, it will be appreciated that while all this lies in the future at the moment of writing, by the time these words appear in print the Manchester Exhibition will be in full swing.

The "Northern" Radio Show is being held from October 16th to October 26th, and is an exceptionally interesting one. Here are some preliminary details.

By
OUR SPECIAL CORRESPONDENT.

The show runs to Saturday, October 26th, and is open daily from 11 a.m. to 10 p.m.

A great feature are the excellent concerts which are given daily by many of the leading radio artistes, and which are being broadcast.

One cannot help thinking that in at least some respects, the great Manchester Exhibition manages to score over its Olympia predecessor.

Facilities are being provided for exhibitors to demonstrate loud speakers on their stands. Lines are run to these from a common amplifier specially built for this by Messrs. Ferranti.

This stand demonstration idea originated in Manchester and was, as readers will remember, duplicated by Olympia this year for the first time. That an exhibition of radio gear can be held in muteness is almost absurd—loud speakers are so far removed from the purely decorative class of article.

However, the instruments can be heard as well as seen at the Manchester City Hall, and northerners should take advantage of the opportunity to listen to all the leading makes of speakers.

There is another very special feature of this year's Manchester show in the form of another scheme permitting demonstrations of apparatus. There are four silence rooms. Each room contains eight cubicles, these cubicles being covered by curtains.

No names are displayed, each cubicle carrying only a number. Behind the curtains there are radio-gramophone outfits.

The idea is that the exhibitor who happens to have the use of one of the silence rooms at any particular moment reveals only his own gear; the visitor does not see any of the other radio-gramophones unless their owners escort him into the silence-room for the particular purpose.

Special Exhibition Critique.

We have mentioned that there are over one hundred exhibitors and it should be noted that there are included important firms that did not show at Olympia for some reason or other. This, then, is the reason, if there is no other, why everyone should make an attempt to visit the Manchester Radio Exhibition, even although they have been to Olympia.

"P.W." is making a very special effort to include a review of the exhibits in next week's issue.

As we go to press some few days before publication this task is not as easy as it may sound. But by an intensive speeding-up of all our resources we are endeavouring to present an interesting and informative critique which will be in our readers' hands while the show is still running. As "P.W.'s" special representative, I am visiting Manchester for this important business, and if all goes well my "copy" will be delivered to the printers in just sufficient time for it to "catch" next week's number.

The attendances at Olympia this year reached record-breaking figures, and on at least one occasion police reserves had to be called out to deal with queues over a mile in length. Now then, Manchester, what is your rejoinder to this challenge from the South?

A TELEVISION STUDIO.



It was hoped that Television demonstrations could be given at the Manchester Radio Exhibition on the lines of the above, which shows a Baird experimental studio in action.

LATEST BROADCASTING NEWS.

5GB NEWS.

PORT OF LIVERPOOL ON THE AIR—A 600th CONCERT AT MANCHESTER — SCOTLAND'S OWN WEATHER — NATIONAL ORCHESTRA OF WALES. THE B.B.C. BIRTHDAY.

AMONG several particularly interesting forthcoming musical programmes arranged by the Birmingham Station for 5 G B listeners is one on Sunday evening, October 27th, when Sir Arthur Sullivan's Oratorio, "The Golden Legend," will be broadcast from the Broad Street Studios. The soloists are Stiles-Allen (soprano), Esther Coleman (contralto), John Adams (tenor), and James Coleman (bass).

On the following Friday evening listeners will hear another Violin and Organ Recital by Frank Cantell, Leader of the Studio Symphony Orchestra, and the Midland Pianoforte Sextet, and Mr. Gilbert Mills relayed from the Church of the Messiah, Birmingham. The transcription of the accompaniments will be to the arrangement of Mr. Mills.

There is great satisfaction in Birmingham because of the visit there on October 10th of Lord Clarendon and Mrs. Philip Snowden to explore for themselves the local broadcasting situation. It will be interesting to see if Savoy Hill makes any changes in its policy of eliminating Birmingham from the scheme of things in broadcasting.

Port of Liverpool on the Air.

A special feature programme for listeners in the Northern area has been arranged for Tuesday, October 29th, when scenes representative of the Port of Liverpool are to be broadcast. It will be followed at 8.30 by the relay for half an hour of speeches from a Port of Liverpool Banquet.

A 600th Concert at Manchester.

More than usual interest is attached to the broadcast from Northern stations of the Manchester Tuesday Mid-day Concert Society on October 29th. The concert is the six hundredth of a series which began as far back as 1915 with the object of assisting necessitous artistes in war time, and providing concerts at the hospitals around Manchester.

Until 1922 the concerts were managed by a committee formed by Mr. Sydney H. Nicholson, Organist of Manchester Cathedral, when the Tuesday Mid-day Concert Society was formed. The concert on October 29th at the Houldsworth Hall will be given by the Orchestra of the Royal Manchester College of Music, and will be conducted by the new Principal, Mr. R. J. Forbes. Arthur Catterall, Leader of the Hallé Orchestra, will also be heard in violin solos.

Scotland's Own Weather.

Scottish listeners are in future to have their own Weather Forecast. Hitherto only the Western area of Scotland has been dealt with in the weather forecast, but this is

now to be extended to the whole of the country.

The forecast, which will be specially prepared by the Meteorological Department of the Ministry of Air at Renfrew, will be broadcast in the early evening so as to give farmers, for whom it is specially intended, ample time to make their plans for the following day.

National Orchestra of Wales.

Three concerts by the National Orchestra of Wales, conducted by Warwick Braithwaite, have been arranged for the last week in October, and two of them will be broadcast from the Cardiff and Swansea Stations. There is one on Sunday, October 27th, in

the Park Hall, Cardiff, when the vocalist is Tatiana Makushina, and listeners will hear the last part of this concert after the "news."

The B.B.C. Birthday.

Thursday, November 14th, the official birthday of the B.B.C. will as usual be celebrated with a short programme by the Staff at Savoy Hill. It is difficult to decide who gets the greatest enjoyment from this annual break away from the conventional type of programme, the staff who give it, or the listeners who unflinchingly write to Savoy Hill demanding more frequent doses of the really clever entertainment which the staff invariably provides.

TO BE HEARD FROM 2 L O.

Mr. H. G. Wells will be heard from 2 L O on Monday next, when he is to speak for half an hour, commencing at 9.15 p.m.

TECHNICAL NOTES.

By Dr. J. H. T. ROBERTS, F.Inst.P.

DESIGN OF COILS.

AN INTERESTING DISCUSSION ON THE VARIOUS TYPES OF COILS NOW USED IN BROADCAST RECEIVERS.

I OFTEN receive enquiries from readers with regard to various matters relating to the coils used in a wireless receiver, and as some of these enquiries indicate that the writers are in doubt about what are really comparatively simple points (in some cases amounting to nothing more than a question of terms), I thought it might be rather useful to say a few words about the various kinds of coil which are in use.

To treat this matter properly, perhaps we should go back to the first type of coil, known as the solenoid. As most of you will remember, this was the only type of coil used in the very early days of wireless and it consists of a plain cylindrical coil, generally wound upon a tube of insulating material, either of a fixed size, provided with tappings so as to give a range of wave-lengths up to perhaps 2,500 metres, or alternatively having a slider to make contacts at various points which, of course, comes to very much the same thing.

Short-Wave Coils.

The solenoid is still in use for short-wave

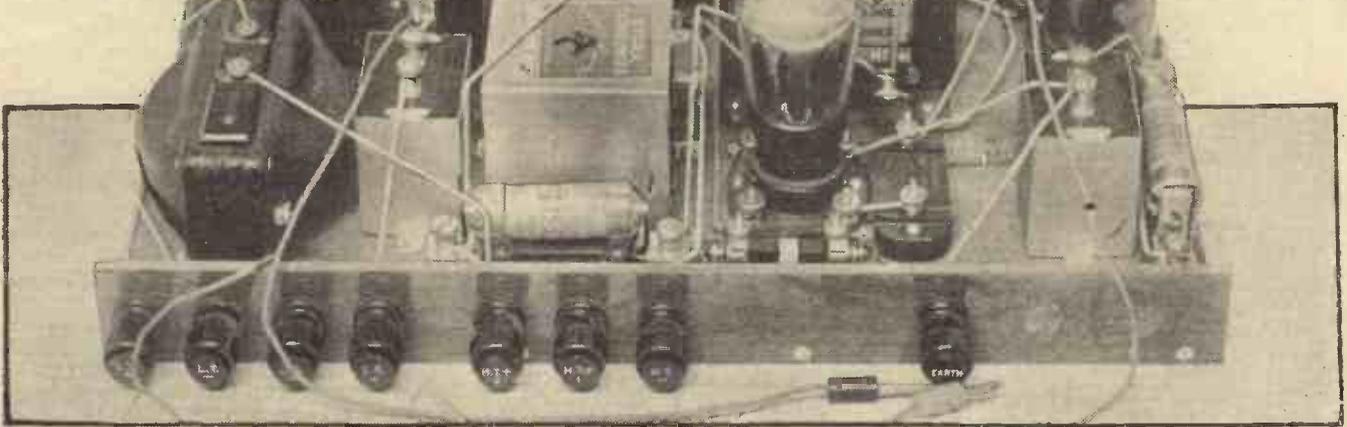
reception, where it is more especially in favour. For ordinary wave-lengths, however, it has the disadvantage that it is apt to be unduly large as compared with other types of coil which may be used in its stead and also—in common with many other types—it gives a distributed electro-magnetic field. By this I mean that the field created by the coil spreads out and around in the neighbourhood of the coil, very much after the fashion of the spider-web diagrams you see in elementary books on magnetism, showing distribution of the lines-of-force around a permanent magnet.

Limiting the Field.

As a matter of fact, in solenoid coils as used to-day the "distributed field" is largely overcome by the very simple process of winding the two halves of the coil in opposite directions. This limits the field very much and is in some ways preferable to the use of a large amount of shielding. Shielding naturally prevents interaction

(Continued on page 356.)

WHEN VALVES GET HOT



I HAVE had several letters recently from readers telling me that their output valves get very warm after they have been in use for half an hour or so, and asking whether anything is the matter, and if it is quite a normal occurrence.

Unfortunately, this is not an easy question to answer, because the reply may be two-fold. It is quite possible that this heating-up is perfectly normal; but, on the other hand, it is just as possible that it is caused by some fault either in the valve or in the way it is being operated.

Some power valves of the output variety get quite hot—even too hot to touch—and operate quite normally. The L.S.5 A, for instance, has a plate which very often gets red hot and makes the valve far too hot to touch, although no harm comes to the valve owing to this fact.

The P.625 A gets very warm under normal operation, and the P.625 also undergoes a rise in temperature. These are quite normal occurrences and are nothing to worry about, but there are other cases where valves get hot which denote there is something wrong. Such instances usually indicate that the valve is being overrun and is giving too freely of the electrons from its filament, with the result that before long the valve will give up the ghost.

The Only Sure Test.

Unfortunately, unless you have considerable experience with valves, it is difficult to decide whether the valve is working normally, or whether the heat is a sign of wastage. A milliammeter in the plate circuit of the valve is the only sure test.

If you find that the valve is giving the correct milliamps at the correct H.T. voltage and grid bias, then you may assume that if the valve is hot it is quite a normal state of affairs, but if at any certain H.T. voltage you find that the valve is getting very hot and there are more milliamps flowing than are shown in the maker's curve, although the grid bias is adjusted correctly, then it is ten to one the valve is what is known as "soft"—that is, there is too much residual gas in what should be the vacuum of the valve.

The only thing to do in such a case, to check the excessive emission, is to drop the H.T. voltage or very greatly increase the grid bias in the hope that the emission will

Many a good power valve has been ruined because it has been overrun. This article tells you how to avoid this.

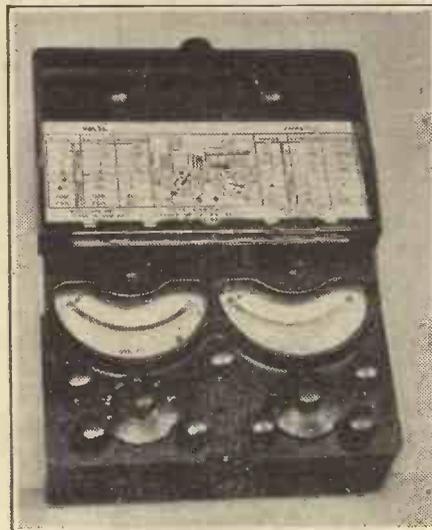
By K. D. ROGERS.

"slow down," as it were, and then the valve will have something more like a reasonable life. Reproduction, however, with a soft valve is generally unsatisfactory.

Insufficient Grid Bias.

One of the causes of valves losing their emission, apart from softness is due to too much H.T., with insufficient grid bias, or an accident with the grid-bias connection. I have come across many cases where a valve has been ruined by the positive or one of the negative plugs in a grid-bias battery being knocked out, or by the grid leak in a resistance-capacity-coupled circuit being out of contact with its holder, thereby breaking the grid bias to grid connection.

In such cases the internal resistance of the valve is far too low, and too much emission from the filament is allowed.



A test meter is of great value when you are doubtful about the health of your valves.

So, if your valves start running hot, make sure that the grid-bias tappings are properly connected and that the proper grid bias is used. Similarly, check up the H.T. voltage and see that proper H.T. is being used. Too much H.T. on a valve makes it run very hot indeed, and, though it may appear to do no immediate damage, it will greatly shorten the life of the filament.

Rectifying valves in mains units tend to run hot, and this is quite a normal state of affairs, so that no worry need be felt here, but when receiving valves start running hot, then is the time to sit up and take a little notice, and to make sure that nothing is out of order, that the grid-bias connections are correct, and that the H.T. voltage is not excessive.

I recently came across a case where the changing over from an H.T. battery to a mains unit cost the lives of several valves before the owner of the set rumbled what was taking place. Not having a high-resistance voltmeter, he was relying on the calculation of the maker's figures for the H.T. voltages he was obtaining from his mains unit, and, assuming that he was getting something like ordinary voltages as when he had a battery, he made the grid bias of the output valve of the same value as he had formerly.

Use a Milliammeter.

Unfortunately, however, the H.T. from the mains unit was a great deal in excess of that from the battery, so that the valve was very seriously under-biased. The result was it got hot owing to far too much emission, and very soon after the valve ceased to work.

I have known valves which have been on the soft side, and whose plates have got so hot (there being no visible sign owing to getting on the bulb) that they have become unwelded from their supports, and the internal structure has finally collapsed.

There is only one sure way to watch your valves and to see that if they do get hot it is not due to any fault either in the valve or in the way it is being operated. That way is to keep a milliammeter in the negative H.T. circuit of all the valves, or in the plate circuit of the output valve, and to watch this meter and see that its reading is not greater than it should be at the H.T. voltage and grid bias you are providing.

HOME LISTENERS FIRST.

By THE EDITOR.

FROM time to time complaints crop up in the Press dealing with the inadequacy of the Chelmsford short-wave broadcasting station. These complaints, according to the "Daily Mail," are received from all parts of the Empire. This is quite likely, for we ourselves have received from time to time letters from overseas readers grumbling at the so-called Empire Broadcasts.

But let us look at the subject impartially. Is there any reason for these complaints, and also have overseas listeners any right to complain? After all, they are receiving a service which is supplied by the B.B.C., and that service is paid for directly out of the pockets of British listeners.

The Limitations of 5 S W.

Now a short-wave broadcasting station is not the slightest good to listeners in this country; apart from the fact that we have our own broadcasting stations to supply us with programmes more suitable to listeners actually living in this country, there are technical reasons why a short-wave station is of no practical value to the average listener.

The B.B.C. declares that it can do nothing further in the matter. As it is, in our opinion, it has done quite enough; and if the B.B.C. says it has no more money to spend on Empire Broadcasting, that answer should suffice, for what money is spent takes the form of a present to overseas listeners, and it cannot be said that listeners overseas—or, more particularly, overseas Governments in the various parts of the Empire—have reciprocated any too well.

At one time we strongly urged the inauguration of an Empire broadcasting short-wave service, because we believed that the various Empire Governments would, in turn, start a service which would be of interest to listeners in this country. But although something has been attempted it is, on the whole, rather meagre, and certainly the B.B.C. has given far more than it has received.

Expecting Too Much.

The B.B.C. rents 5 S W at Chelmsford after 7 o'clock every evening, so listeners need not run away with the idea that 5 S W is the personal property of the B.B.C. The station is owned by the Marconi Company, and, by arrangement with the B.B.C. (who, of course, stand the expense) it radiates 2 L O's programmes. If overseas listeners expect the B.B.C. to provide special programmes to be broadcast only from 5 S W, we think they are expecting far too much.

It is a complaint that Empire listeners are forced to depend on other countries for short-wave programmes. For that matter, so are British short-wave listeners in this country. They have to depend chiefly on American short-wave stations, and on P C J and other well-known short-wave transmitters.

It is true that one or two short-wave stations in Australia are to be received from

time to time, but the service given is not comparable to that given by other foreign short-wave stations. It is rather ungrateful when one considers the letters published in the "Daily Mail" the other day from a correspondent who lives on a Ceylon Tea Estate. This man wrote:

"The whole programme from P C J came at full loud-speaker strength. I think that 5 S W, Chelmsford, should be ashamed to broadcast at all."

Another listener in India wrote:

"One gets tired of waiting for the day when the British station will transmit a regular service to suit the whole Empire."

Well, if British listeners care to start a plebiscite on the question, and the majority are in favour of the B.B.C. spending much

NEXT WEEK:

"REFINEMENTS FOR THE MAGIC THREE."

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more money on 5 S W, no doubt the Chelmsford station will improve, and British listeners abroad will be satisfied. But we cannot see any reason why B.B.C. listeners' money should be spent on supplying programmes for listeners abroad when, if it is a case of propaganda, that job should be undertaken by the Government; and, further, why we should supply a service gratis and for nothing and get only a very inadequate service in return—if any service at all.

Our suggestion is that the B.B.C. continue as they are continuing, that British listeners abroad should be very lucky to get the service at all, and that the main idea is that British listeners' money subscribed in this country in the form of licence fees should be devoted almost entirely to the improvement of British broadcasting programmes and to the improvement of a British broadcasting service.

A good deal has been said about the inaugural television experiments which took place a fortnight ago. The first official tests of television were made through 2 L O and, as far as we know, these tests will be continued until Christmas, when the B.B.C. may decide to give the Baird Television Development Company three months' notice to terminate the transmissions.

As usual, a lot of exaggerated matter has appeared in the Press in connection with these television experiments, and although we—and, we trust, our readers—have learnt to discount a good deal of this exaggerated propaganda, the fact remains that it is a good thing these experiments have been

inaugurated, for the opportunity may now soon be given to British listeners to judge for themselves whether television is in a state of development which would warrant television broadcasts being included as a regular feature in the B.B.C.'s programmes.

But, as we write, it is interesting to note that, although these television transmissions have been in operation for nearly a fortnight, so far there is not the slightest sign of television sets coming on the market. Consequently, we doubt whether more than one or two expert listeners who have constructed their own television outfits have had an opportunity of tuning in these transmissions and judging for themselves what television is really like.

Exactly why the Baird Television Development Company have missed the psychological moment for putting on the market kits of parts for television receivers, or complete television receivers, we are unable to say definitely, but we are under the impression that, although the Baird Company are willing for various manufacturers to take out licences to market television receivers, manufacturers are not particularly keen to do so because they do not wish to stock these kits of parts and complete sets, etc., until they are certain that the transmissions will continue.

A Television Deadlock?

In a sense this is understandable. Perhaps it would help matters if the B.B.C. would state definitely how long they intend continuing these television transmissions. We understand on good authority that the B.B.C. have agreed not to discontinue them without giving three months' notice, but even that does not seem to satisfy manufacturers who might otherwise take out licences from the Baird Company and begin manufacturing and marketing televisions.

It may be that some sort of a deadlock has been reached, for there is certainly no indication at the moment that the public will shortly have an opportunity, if at all, of "seeing in." And if nothing is done to provide the public with the means of judging television, there will not be much sense in continuing these television transmissions unless, of course, the B.B.C. are willing to do so in order to assist Mr. Baird in his experimental researches.

But for over two years now we have heard about these television receivers which would be available for the public as soon as the B.B.C. toed the line and granted the necessary facilities for television transmissions. We, ourselves, have had a television receiver on order for two years and, although we have made repeated enquiries, we can get no satisfaction as to when we shall get delivery.

Let the Public Judge.

However, we sincerely trust that the effect of these transmissions will not be prejudiced by the delay in marketing television sets. The sooner these sets are on the market the sooner the public will be able to judge for themselves, and the sooner will the controversy which has raged around television for over two years now be settled one way or the other.

If the transmissions appeal to the public, then undoubtedly the B.B.C. will have to continue them, and possibly include them in regular broadcasting hours, but if they do not meet with interest, then the B.B.C. will have no justification for continuing them.



WHY NOT CRYSTAL SHORT-WAVERS?

An article of interest to all short-wave enthusiasts, for it answers a question that often puzzles listeners.

By A. JOHNSON-RANDALL.

"WHY can't I use my crystal set for reception on the short waves?"

This was a query sent in by a reader quite recently to the "P.W." Technical Queries Department. The number of short-wave enthusiasts is steadily increasing and it is only natural that many of them should wonder why crystal receivers should not be employed on wave-lengths of 20 to 50 metres, provided suitable coils are available.

A crystal set appeals chiefly because of its economy and simplicity, but its limitations become very apparent as the wave-length decreases. In the first place our crystal receiver has no amplifying properties of its own. A crystal will rectify but it will not magnify. Our aerial picks up the weak high-frequency impulses which are transmitted from a broadcasting station, and the amount of energy actually picked up is dependent solely upon the efficiency of the aerial and earth system.

A Good Aerial Essential.

If our aerial is high, unscreened, and has reasonable length, then we may expect good sensitivity or pick-up from it. These high-frequency impulses which the aerial absorbs are passed on to the wireless set and, of course, have to be rectified by a detector before they become audible as speech or music in the telephones or loud speaker. Now a crystal will rectify these impulses and pass them on to a pair of telephones, and thus we are able to hear what the broadcasting station gives out.

This is perfectly straightforward in the case of the local station or a high-power transmitter situated within range of our aerial. Unfortunately, however, the aerial has only a limited pick-up and, moreover, a crystal has but a fair sensitivity, and in consequence will not respond to impulses below a certain intensity. For instance, it will not respond to very weak signals, such as those from a distant station.

A Valve More Sensitive.

Now let us take the case of the ordinary reacting detector valve. Here we have a device which will do two things. First, it will rectify. Secondly, it will magnify and we are able to react, that is to say, "feed back" energy, into the tuned circuit, and by so doing increase the sensitivity of the set very greatly. This property of reaction enables us to obtain a very simple but extremely efficient and sensitive arrangement with which to receive distant stations. We are enabled to pick up and magnify impulses which would not be audible in the case of a straightforward crystal receiver. Thus, a reacting valve detector is many times more sensitive than a crystal set ever can be. Short-wave transmissions are often sent out from

stations many thousands of miles away. Some are in Australia, others are in America, and so on, and it is this fact that the waves are travelling over such vast distances, and from countries so far away, that makes short-wave reception so extremely interesting.

Crystal Damping.

These short-wave impulses, when they reach this country, are extremely minute, and no crystal receiver can be expected to detect them and render them audible in a pair of telephones. Readers who have themselves operated a short-wave receiver will know quite well from practical experience that the success of their reception depends entirely upon the intelligent use of reaction and it is a fact that most of these transmissions are received with the set very near the oscillation point.

That is, of course, the condition when the detector valve is in its most sensitive state. Hence, for short-wave reception a crystal detector alone is hopeless.

greatest possible tuning efficiency and the lowest high-frequency resistance.

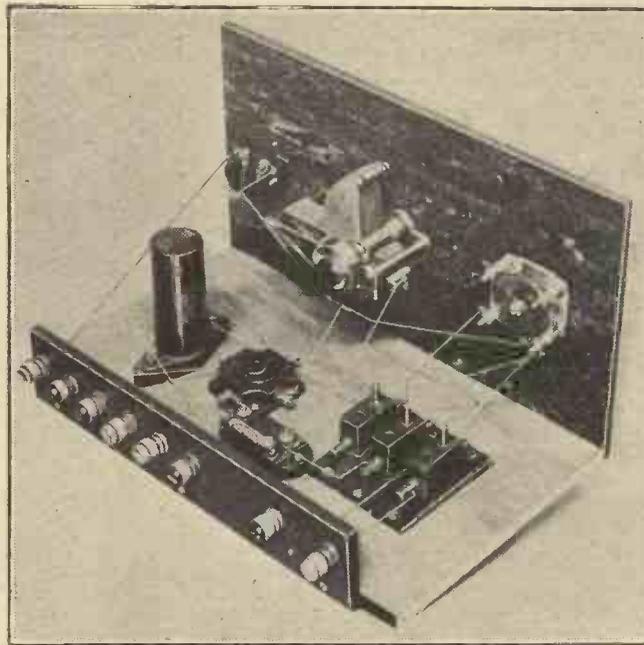
Therefore, our friend the crystal becomes a much greater nuisance on the short waves than on the long waves, because the crystal damping exercises a much bigger effect upon the circuit as a whole. Thus, apart from the question of sensitivity, our tuning difficulties are increased, and for short-wave work a crystal cannot in any way be compared with a reacting valve detector. Finally, even if the crystal were highly sensitive, there is still the fact that it requires constant adjustment and that its sensitiveness varies with pressure, and sometimes with the atmospheric conditions. The more sensitive the crystal the more is its adjustment upset. This is a disadvantage not possessed by a three-electrode valve which, provided it is operated correctly, is perfectly stable day in and day out.

Again, there is the question of short-wave Morse transmissions. Messages are sent out on what is termed the continuous wave (C.W.) system, and to receive them it is necessary for the set to be in an oscillating condition. A crystal will not oscillate and therefore could not be employed for C.W. reception.

Not Worth While.

Possibly something could be achieved by using a separate reaction valve to "feed" oscillations into the tuned crystal circuit, but this would not be worth while. If one has to utilise a valve and its attendant circuit why not do so in the ordinary conventional manner and employ a straight valve detector?

Therefore, the answer to our reader's question is that, first, a crystal, in itself, is far too insensitive for general short-wave work. Secondly, reaction cannot be used to increase its efficiency and thus to make it more sensitive to weak signals, such as those from stations on the short wave-lengths. Thirdly, a crystal will not oscillate and consequently cannot be used for the reception of continuous waves.



A simple single-valve receiver will give excellent results on the short-waves. The essential feature is smooth reaction control.

There is also another point. A crystal is connected across the tuned circuit, either directly or indirectly. Because of its comparatively low resistance it exercises what is termed a damping effect upon the tuned circuit, and produces a decrease in efficiency. As the wave-length gets lower we have to cut down all losses in order to gain the

far too insensitive for general short-wave work. Secondly, reaction cannot be used to increase its efficiency and thus to make it more sensitive to weak signals, such as those from stations on the short wave-lengths. Thirdly, a crystal will not oscillate and consequently cannot be used for the reception of continuous waves.

SET BUILDING TIPS

Some Valuable Advice to Home Constructors.

By A. E. ANSON.

THE enthusiast, having built his one-valve set, is generally so elated he immediately wants to go full speed into a superhet. or 6 H.F. plus 8 L.F. Unfortunately the ordinary arithmetical laws do not hold good. It is not merely a case of adding valve after valve to get results multiplied by the amplification factor of the valve. Optimists set out to do this just after the war and soon discovered the pathway was set with snags.

Indeed, it might be fairly said that for the last ten years the best radio brains in the world have all been busy cleaning up these snags.

To-day, huge amplifications are possible, but it is still advisable for the constructor, for whom this is written, to get the ambitious schemes he sets himself properly in focus. It will save much weeping and gnashing of teeth over impossibilities.

Go Slow at First.

Therefore go slow—make the best of your one-valver, test it, learn all it will teach you before you lay it on one side for better things. There is much to learn from the humble one-valve set, in fact, if mathematicians really understood its inner secrets radio would be given an immense impetus.

Before another set is contemplated it is imperative to learn how to distinguish oscillation. If half the ambitious constructors had learnt this lesson we should have all the fever whistles prowling round the world at night.

If reaction is increased there comes a moment when a weird, rushing sound is heard. A wetted finger lightly touched upon the aerial terminal will cause a pop—a distinct plop. Just before this pop occurs reaction will cause music or speech to become distorted. The plop test shows the moment oscillation has commenced. If the set is tuned to a carrier-wave a whistle will be heard. By careful tuning this whistle may be made to turn into a low growl and speech, although distorted, will be almost intelligible. Meanwhile, your neighbours for a mile or two around will be wishing to slay you, for they also hear your growls.

Adding an L.F. Stage.

If you can't get that distant station on your one-valver go slow, don't try to dive before you can swim. A more expert enthusiast will probably astound you—with a few deft adjustments of reaction and tuning he will make the far-off station take on new strength.

Copy him, learn to tune. All the valves in the world won't help till you have learnt this.

After a time the first thrills of the first radio set will lose their charin. Now is the

time to add an L.F. valve. It is a simple matter. There have been many designs in the pages of POPULAR WIRELESS. It will open out a new and interesting field. But don't get carried away by an excess of enthusiasm and clap on a couple more L.F. valves. You will come a cropper.

Motor-Boating and Distortion.

Three L.F. transformer-coupled valves probably marks the L.F. limit. But great care is required. All sorts of tiresome things happen. Motor-boating, howls, squeaks, distortion, and other parasitic noises creep in. There is a cure for them all up to a point.

Provided you realise these limitations there will not be gnashing and sorrowing over the poppings of an unstoppable motor-boat pouring out of your loud speaker in a melancholy and monotonous fashion. If this happens with only one L.F. valve there is something definitely wrong, probably the primary connections should have been connected up the other way round.

In the same way remember that each L.F. valve will probably amplify the input some thirty times. A mere 1 of volt on the grid of the first L.F. valve will have become 3 volts on the grid of the second valve, and 90 volts on the grid of the last valve. Unless very special attention is paid to the last valve distortion will be horrible.

In fact, a 90-volt grid swing calls for special valves and circuits, special H.T., special loud speakers, and a large hall in which to hear results. Obviously three L.F. valves require special thought to grid bias.

Besides, if three L.F. valves are relied upon to get those distant stations you are putting the cart before the horse. It can be done better with less L.F. amplification and more H.F. amplification. But go slow, don't rush into a multitude of H.F. valves.

H.F. circuits are tricky brutes. Thanks to the screened-grid valve

they are undoubtedly simpler, but there are still snags. One H.F. is not too bad. Anyone who has mastered his one-valve set is competent to add an H.F. valve. The chief snag is the tendency to oscillate. With screened-grid valves interelectrode capacity plays a more humble part. But stray coupling must be avoided.

In practice this means a sheet of metal between the aerial coil and the tuned-anode coil. Don't be satisfied until you get the L.F. set quite tame. A little judicious screening will soon cure any tendency to oscillate on the normal broadcast waves.

Screen the H.F. Side.

It is inadvisable to build a set involving two H.F. valves without a careful study of designs produced by experts. Anyway, such a set means complete screening. Even if screened-grid valves are used it is necessary to isolate each H.F. coil and its associated wiring in a separate metal compartment, preferably of soldered copper with an overlapping lid.

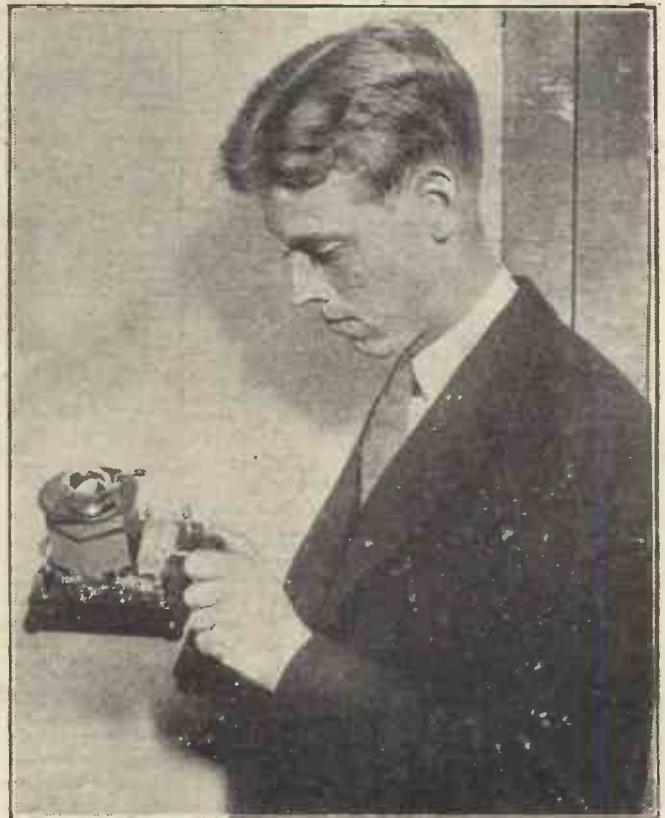
Even then quite absurd little details will spoil results. Fortunately, if the ambitious constructor has appreciated the problems of his earlier sets these snags are easily detected.

An appreciation of what lies ahead is just as important in radio-set construction as in exploration.

You would not consider yourself competent to swim the Channel on the strength of being able to float in the bath.

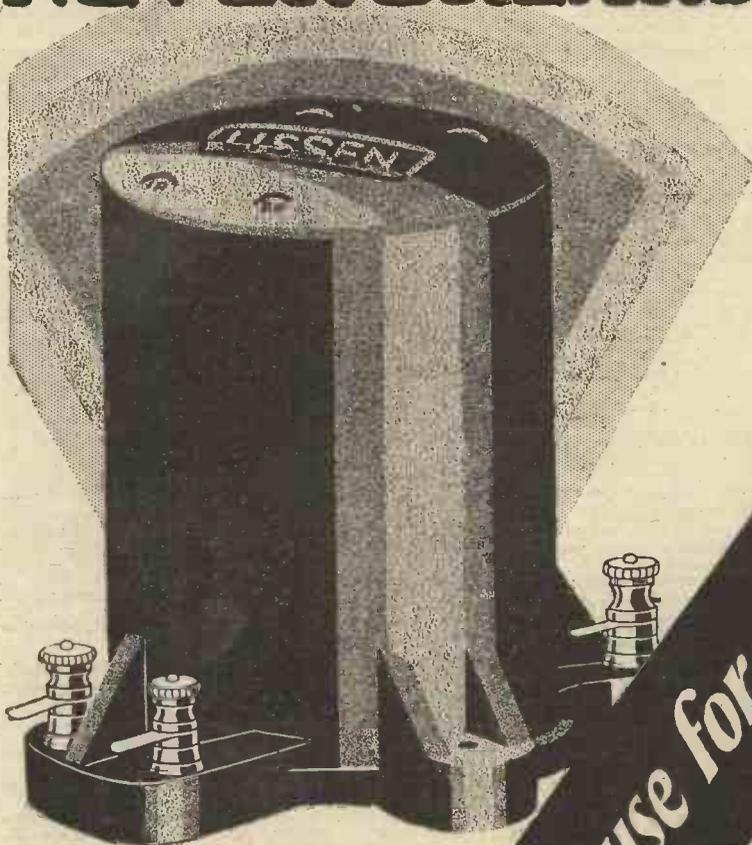
Well, it is the same with radio. Don't try to make impossible sets—unless you want your radio friends to smile at you a smile of bitter experience.

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FROM A NEW ZEALAND READER.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have been a subscriber to "P.W." weekly since August, 1928, and I do not think I have missed a copy since that date, but the purpose of this note is to tell you all about, and to thank you for the circuit by W. L. S. of an S.G. short-wave which appeared in "P.W." on April 20th, No. 359, Vol. XV., and which I have just made up and operated, with results that far exceeded my expectations.

I have been listening for exactly one week, and during that time I have logged UK 2 ME (Sydney, Australia) on 28.5 metres; W 2 X A D, on 19.56 metres; W 2 X A F, on 31.4 metres; W 6 X N (K G O), on 23.35 metres; P C J, on 31.4 metres; V P D (Suva), on 25.4 metres; R F M, on 70.1 metres; W 8 X K (K D K A), on 25.4 metres; G 5 8 W and G B X, on 27.86 metres. With the exception of 5 8 W and G B X all the foregoing have been asked for verification.

Each morning I have listened for 5 8 W I have heard the station working, but always there is a very strong ripple. G B X I have heard on Duplex Telephony Tests with 2 M E, and on one evening during the week I heard portions of a conversation between an English lady speaking through G B X to her crippled son who linked with 2 M E.

I am hoping to receive both of these stations at good strength, when I will be right after verification. Components as specified by W. L. S. were rather difficult to obtain, so I used any old parts I could find. My extra purchases being a P.M.5B, a P.M.16 S.G. and a panel.

Other valves in use are Phillips' 615 det. and Phillips' 609 first audio. I added a resistance-coupled last stage.

My coils are crude but convenient—two turns 3 in. 18-gauge enamelled wire, self-supporting for the aerial coil; two turns 30-gauge D.S.C. on a home-made 4-pin 3 in. former for reaction; and two turns of 24 D.C.C. on same former for grid coil, these cover the wave-band from 40 to 35 metres. Another set on Colvern formers covers the band from 33 to 85 metres; and still another set on Colvern formers aerial 30 turns, 30 D.S.C.; reaction, 33 turns, 30 D.S.C.; grid 93 turns, 30 D.S.C., gives me the broadcast band from 250 to 550 metres.

I enjoy loud-speaker reproduction of all the New Zealand and Australian A class stations, and a good many of the B class.

Using '00025 variable tuning condensers I found that by using a '0005 variable condenser for reaction I had a receiver that was practically single-dial control, in fact, I use a knob only to tune the R.F. side and make all final adjustments between C₁ and C₂. My broadcast receiver is a six-valve Crossley Armstrong circuit, and I have a log of approximately 70 stations on it, among the more distant being V U C and V U V (India), J O A K, J O H K, J O G K (Japan), and W E N B (Chicago).

From Christmas to the beginning of the winter a whole heap of American B.C. stations come in very well here. At the present time K F O X, K X X, K M O X, K H J, and K 3 O are the only stations audible, and they never get to better strength than R 5.

While once again thanking W. L. S. for a splendid circuit, might I be permitted to make a correction re his Short-Wave Notes of June 8th, and say that if there exists a dead spot between New Zealand and

CORRESPONDENCE.

FROM A NEW ZEALAND READER.

THE "SHORT-WAVE" TWO—RESULTS WITH WET BATTERIES—CAPACITY EARTH.

Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

South Africa It does not apply to the North Island of New Zealand, for 7 L O (Nairobi) on 33 metres rolls in here in good style in the mornings, and some little time ago one of our "hams," a Mr. Roy Clarke (Z L 2 A W), of Wellington, succeeded in establishing two-way communication with five continents in one hour, and South Africa was one of the list.

Under separate cover I am forwarding a copy of our Radio Paper, and my only regret is that the chief short-wave contributor, Mr. Sellens, is at present on the convalescent list, although I have no doubt you will find the notes of other correspondents of interest. Kia Ora, Popular Wireless.

Huntly, Waikato, New Zealand. Yours fraternally, HRY. JAKEMAN.

THE "SHORT-WAVE" TWO.

The Editor, POPULAR WIRELESS. Dear Sir,—You may be interested to know of the results I have obtained with the "Short-Wave" Two, December 22nd, designed by W. L. S.

My list of stations is as follows: W 2 X A D, W 2 X A O, W 2 X A F, W 8 X K, G 5 8 W, P C J, Monte Grande, Drummondville Beam station, a Dutch Beam station, and an American Beam station working with Sydney, Australia. Several English amateurs, also French and German. The following stations I have put on speaker: W 2 X A D, W 2 X A F, P C J, G 5 8 W, Drummondville Beam station, and a German station.

On Broadcast Band: Radio Turin (good strength), Radio Toulouse (good strength), Radio Barcelona, Nurnberg, Bourne mouth 6 B M., and several stations unable to identify. On long-waves 5 X X comes in with splendid volume. Like W. L. S., I heard the arrival of the Graf Zeppelin at Los Angeles relayed by W 2 X A D at wonderful strength. Considering that the coils I use for short-wave work are home-made plug-in type, this is a good performance for a two-valver.

Yours truly, E. J.

P.S.—The Drummondville station I heard some three months back.

In reply to your request for details of the new Regional station now working from Brookman's Park, I received splendid signals on the Guaranteed Reflex from this transmitter when at Potter's Bar from mobile van.

Portsmouth.

RESULTS WITH WET BATTERIES.

The Editor, POPULAR WIRELESS. Dear Sir,—With reference to the correspondence a few weeks ago from the Wet Battery Company, I fully support their claims as to the efficiency of the Leclanche batteries.

In a back number of "P.W." (No. 265, July, 1927) this firm gives practical details of same for L.T. supply. Having made and used several types of primary batteries previously this particular type was made and given a severe test to supply a two-valve set, and I am pleased to say it has given satisfactory results for just a year without trouble of any kind.

My own four-valve set, H.F., Piladyne det., and two L.F. transformer-coupled, is supplied with this type of cell for H.T. 108 volts, and this has lasted 14 months without changing same.

It is also interesting to note the "grid bias" which was made of 6 cells, 9 volts. It was built up two years ago in August, and is only a shade under 9 volts at the present time. I fully realise current is not taken from this battery, but it shows the efficiency and reliability of this type of cell.

Wishing "P.W." future success.

Yours faithfully, F. CRAMPORN.

Coventry.

CAPACITY EARTH

The Editor, POPULAR WIRELESS.

Dear Sir,—I have been trying the relative efficiency of a capacity earth as against that of an outdoor earth, and perhaps the following may be of interest:

Data: Aerial—indoor under roof. Set—Crystal set with Hertzite detector. Outdoor earth—Earth pin 2 ft. in damp ground (it had been raining all night) with 25 ft. lead of insulated cable to set; 20 ft. of this was stretched from window sill to set at an average height from floor of about 2 ft. Capacity earth—25 ft. of insulated cable on floor close to skirting board. Cullercoats distant about 10 miles. Newcastle distant about 1/2 mile.

Using the outdoor earth I tuned in to Newcastle and got very poor crystal strength. On tuning to Cullercoats, signals could be heard some feet from the 'phones.

Using the capacity earth the signals from Newcastle could be heard several feet from the 'phones, whilst those from Cullercoats were as nearly as possible inaudible.

Perhaps some of our experimenters can suggest a reason why the two earths should behave in opposite ways with signals from the above two stations.

Yours truly, BERT THOS. ORD. Gateshead.

THIS week I have to thank several correspondents for interesting letters, particularly Mr. N. C. Hardman (G 2 P O), who has sent three long letters concerning the transatlantic 'phone, about which I asked for details a week or two back.

He has put matters completely right, as far as I am concerned; but I will not publish all the details in full. A notable point is that on each side of the Atlantic there are two transmitters and receivers dealing with the same speech, presumably with a view to the elimination of fading.

That on the American side is mostly handled by W M I and W N D, both of the American Telephone and Telegraph Co. Rugby, G B T and G B U, handles the outgoing traffic at this end, while the receiving stations at this end are in Fifeshire

Transatlantic Telephony.

Mr. Hardman has had a long-wave and short-wave receiver coupled to the same output transformer and has been able to get both ends simultaneously. Many correspondents do not seem to realise that the transmissions from this country are chiefly on 5,000 metres odd, using the side-band system of telephony.

The 'phone that everyone seems to be

SHORT-WAVE NOTES.

By W. L. S.

receiving is just below the amateur 20-metre band, the lower limit of which is 20.8 metres, so presumably this is one of the stations working from W N C, wave-length given as 20.73 metres. This also works on 30.77, 22.4 and 16.1. There are some twelve short-wave transmissions on this side from Rugby, but it does not seem as if they are always in operation, whereas the long-wave side is apparently always to be heard.

Just recently, the 20.73-metre station has been working with the loud speaker on which they receive the replies within earshot of the microphone, so that one has been able to hear both ends on the same setting. Another effect of this has been the setting-up of an awful microphonic howl which makes the outgoing speech rather difficult to follow.

Another correspondent reports using the "P.W." "All-Purpose" Three, described in May, 1928, and has got down to something

in the neighbourhood of 14 metres with it. He is getting W 2 X K on 17.34 metres on about 140 degrees on his dial! I don't think you can have reached 10 metres, "E. F. B.," as a single-turn of much smaller diameter than you mention is the coil I use for the job.

Short-Wave Journals.

"H. E. H." asks what journal or journals one can take who desires to interest himself solely in short-wave transmission and reception. There is rather a large choice here; in this country the purpose is best served by the R.S.G.B. official organ, "The Bulletin," published monthly to members. From the States there is Q S T, obtainable monthly from bookstalls, or by joining the American Radio Relay League. To do this one has only to be interested in amateur radio and send three dollars to the Headquarters at 1711, Park Street, Hartford, Conn., U.S.A.

Regarding the 75-cm. transmitter I mentioned some time back, fuller information on this is obtainable from Q S T, or from the A.R.R.L. Handbook, which contains all that the average person is ever likely to want to know about short-wave radio communication.

PURE LISSEN CURRENT FROM YOUR MAINS!



D.C. Model A
27/6

TYPES AND PRICES.

D.C. Model "A."
Employs 3 H.T. + tappings; H.T. +1 giving 80 volts for S.G. valves; H.T. +2 giving 60 volts at approx. 2 mA. for detector valves H.T. +3 giving 120/150 volts at 12 mA.
Price 27/6

D.C. Model "B."
Employs 3 H.T. + tappings: H.T. +1 and H.T. +2 are continuously variable (by means of two control knobs) and capable of giving any desired voltage up to 120/150 volts at approx. 2 mA.; H.T. +3 giving 120/150 volts at 12 mA. for power valves.
Price 39/6

A.C. Model "A."
Tappings as in D.C. Model A.

LN	for A.C. Mains voltage	PRICE
577	220-230	£3 : 0 : 0
578	240-250	
579	220-230	
639	100-110	

A.C. Model "B."
Tappings as in D.C. Model B.

LN	for A.C. Mains voltage	PRICE
579	200-210	£3 : 15 : 0
580	220-230	
581	240-250	
640	100-110	

You cannot get purer current for radio than the pure D.C. current of a Lissen Battery—BUT IF YOU WANT TO USE AN ELIMINATOR USE A LISSEN ELIMINATOR.

Because no current from any eliminator is smoother or more silent than the current from a Lissen eliminator. No eliminator output is more constant, none is so free from hum.

Lissen have made eliminators safe—notice that the neat moulded cases of these Lissen Eliminators are made entirely of insulating material—see also the thickly insulated "cabtyre flex" that Lissen have used.

Lissen too have made it easy for you to choose the right eliminator—there are only four models and they satisfy the requirements of 90% of listeners. In producing these eliminators Lissen have compared their current with the purest form of current known, namely the Lissen Battery, and have got as near to that standard as it is humanly possible to do.

If you are buying an eliminator, be sure to see a Lissen Eliminator. Your dealer will be pleased to show you one that will suit you.

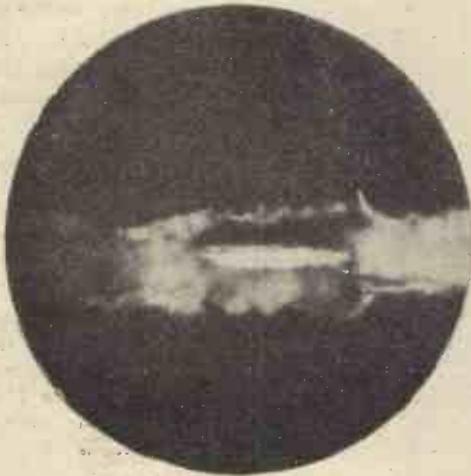
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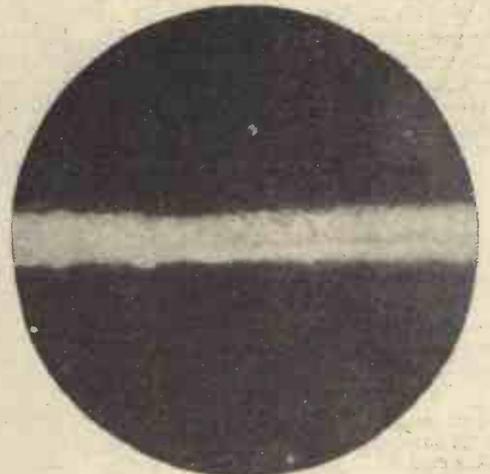
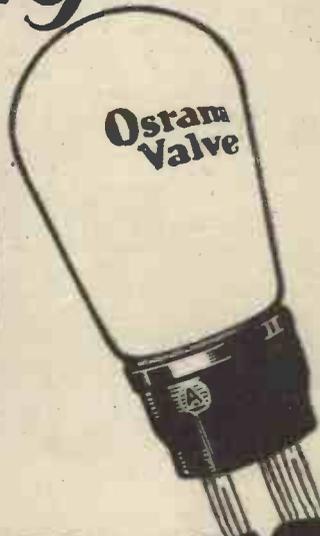


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WITHOUT**

"TENACIOUS COATING"

This reproduction shows part of the filament of a badly coated valve before use, showing a serious gap in the coating. A gap such as this starts the valve off in its life with a poor performance. The valve then prematurely fails.

WRITE for booklet "OSRAM WIRELESS GUIDE" (1929 edition) giving full particulars of the full range of OSRAM VALVES with the "TENACIOUS COATING." Also helpful wireless information of importance to every listener. Sent post free.



**A GOOD Filament
WITH**

"TENACIOUS COATING"

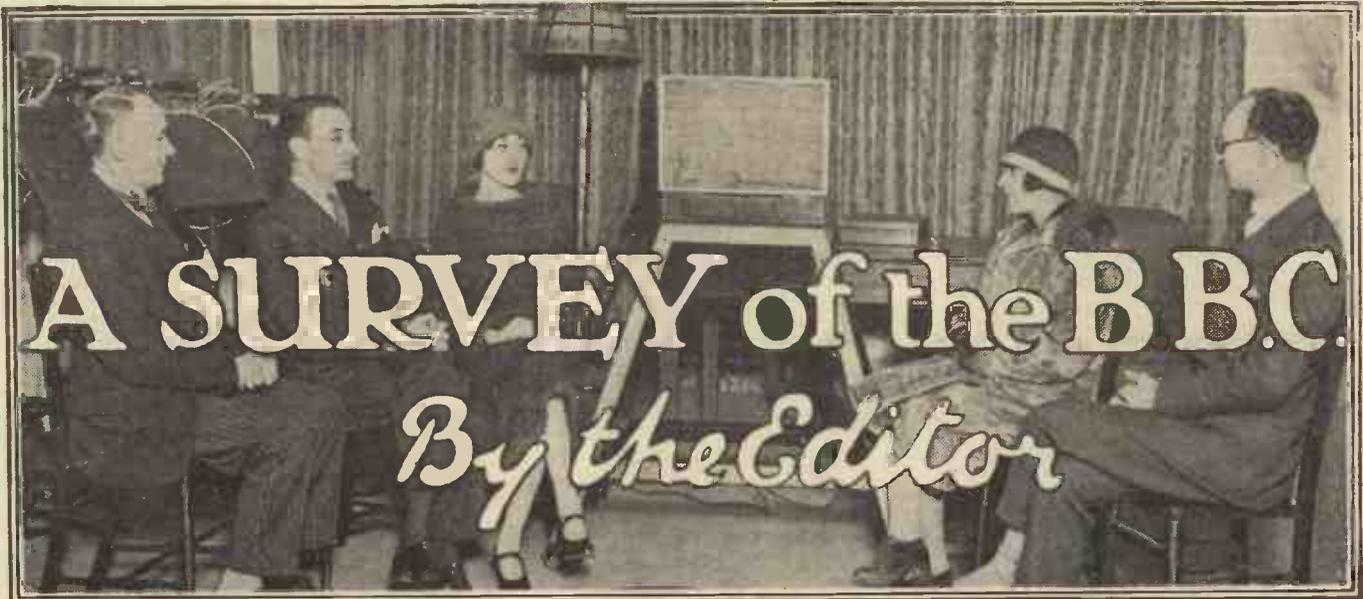
Reproduction from an untouched micro-photograph showing the coating typical of all OSRAM VALVES. Notice the absolute evenness of the coating. There are no gaps, the coating clings, so that the full benefit of the coating is maintained. The secret is the startling discovery of the scientific process of "TENACIOUS COATING."

Osram Valves

with the

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MADE IN ENGLAND. Sold by all Wireless Dealers.



A SURVEY of the B.B.C.

By the Editor

IN the first article of this series it was explained that lack of unanimity between Sir John Reith and the Board of Governors was leading to a crisis. Various expedients were suggested for relieving the strain, and it was hoped that a solution would be found which, while implementing the constitution of the B.B.C., would make it possible for Sir John Reith



Mr. R. H. Eckersley, who is chairman of the Programme Board.

to continue as Chief Executive indefinitely. Incidentally, it was deplored that such a large proportion of the time and energy of the heads of the B.B.C. was being diverted from broadcasting to the difficulties of reconciling administrative "opinions." I

now turn to an examination of the actual administrative machine.

Pioneering.

When I explained the administrative scheme of the B.B.C. two years ago I was able to describe it as in many respects a model organisation. The new Board of Governors had not yet attempted to do more than their predecessors; in other words they had accepted and carried forward the old B.B.C. Sir John Reith was in every sense dictator of everything connected with Broadcasting. He had at his right hand Admiral Carpendale, who earned a terrific reputation as a disciplinarian in the Royal Navy, and lived up to his reputation.

Unquestioning obedience to high authority, total absorption in the work, and a general attitude of intensity—these were outstanding characteristics of a product

This is the second article of a short series in which the machinery of the British Broadcasting Corporation is candidly criticised. It is the best-informed series of articles that has been published, and discloses behind-the-scenes details that are seldom, if ever, made known to the public.

2. THE PRESENT POSITION OF THE ADMINISTRATION.

of the old administrative system of the B.B.C. There were, of course, disadvantages—lack of resilience, an attitude of aloofness, and almost Calvinistic austerity and gloom.

But good programmes were produced. There was still the first flash of enthusiasm—something of the feeling of pioneers—and this goes a long way to overcome obstacles, disappointments, and stupidity. On the whole, the spirit of the staff in the twenty-one stations was good.

After Two Years.

Two years have passed, the old system of distribution by numerous stations of low power is now in process of being superseded, with the advent of the Regional Scheme. What is the form and the effect of the present administrative machinery? Nominally of course, the Board of Governors are the Trustees of the Public, and as such are responsible for all the deeds and misdeeds of the B.B.C.

As explained in the first article the intention of Parliament in granting the Charter was that the Governors should constitute a "working" Board and not a "dummy" Board, and it was for this reason that generous stipends were sanctioned. But the Board of Governors has still a lot to do. Sir John Reith remains Chief Executive. He is still Dictator whenever a point of real importance has to be dealt with. For a time, he experimented with a mild variety of devolution.

He thought of reposing an increasing degree of responsibility on what he called the Control Board—that is, an informal committee of the heads of executive depart-

ments. This experiment was soon abandoned, although the formality was perpetuated. All real authority is centred in Sir John Reith. What little devolution has taken place is designed to prepare the way for Admiral Carpendale to succeed Sir John Reith when the latter decides to leave the B.B.C.

Too Much Organisation.

When I discussed this subject two years ago, I detected an incipient tendency to create and to extend an artificial distinction between broadcasting and something separate but superimposed, some great mysterious thing called "expert organisation." This tendency has not abated in the interval. Savoy Hill and its chiefs think far too little about broadcasting and far too much about organisation.

Just as in theory the Control Board



Mr. E. R. Appleton, Director of the Cardiff Station, giving a running commentary of an important event.

controls the important policy, so, in theory, the Programme Board takes programme decisions. The Programme Board consists of the heads of the various departments

(Continued on next page.)

A SURVEY OF THE B.B.C.

(Continued from previous page.)

of the Programme branch, namely, the officials responsible for music, drama, education, religion, balance, talks, outside broadcasts, and finance.

But, in practice, the real decisions are taken by the chairman, Mr. R. H. Eckersley, acting in consultation with Mr. Grossmith and Mr. Filson Young, who assist him in interpreting the wishes of the Director-General and the Controller. And that is the present administrative machine of the B.B.C. What of its products and results? First of all, then, the average standard of programmes has improved considerably in the past two years. Music is better, although still in need of more positive direction; radio drama is immeasurably better; talks have improved; education has developed; religion is about the same.

There is almost a disagreeable absence of mistakes. The elegant polish of the anonymous announcers is organised to a pitch of irritation. There is no doubt at all that the pioneering period of the B.B.C. has given way to something not unlike the robotism of current literature. The "high spots" are not there now; nor do they appear to be sought. The programmes reveal the supremely tidy mind of the perfect organiser. Even their rate of progress and improvement seems to be controlled and organised.

This state of affairs has undeniable advantages; it is foolproof; it provides a steady average output and performance; by keeping just "good enough" it avoids stimulating demand. On the other hand it enshrines mediocrity; it discourages genius as distinct from talent; it makes this machine age rather more than less the machine; and, what is even of more practical importance, it cannot maintain its momentum; it inevitably slows down in the absence of genius or enthusiasm.

The Present Position.

The present position of broadcasting administration in Britain needs attention. The original pioneering enthusiasm has waned. The executive chiefs are so interested in the abstract problems of organisation that broadcasting suffers. There is a distinct and increasing deficiency in humanity. Anonymity has been applied to an extreme extent.

The staff of the B.B.C. is disciplined out of individuality. The habit of unquestioning obedience is so implanted that it influences the attitude of ex-employees long after they have resigned. There is far too much of the successful factory and far too little of the inspiring spiritual dynamo.

So much for broadcasting administration at headquarters.

What of the Provinces? It was there that we found most hopeful ground two years ago; more humanity, more understanding of the psychology of the listening millions. To-day, alas, the B.B.C. outside London is sadly reduced. The best of it is at Manchester and Birmingham. Mr. E. G. D. Liveing and Mr. Percy Edgar look after the North and the Midlands with conspicuous understanding and success. Mr. Liveing's grasp of the human problems of the North has served the B.B.C. in good stead. Mr. Edgar has overcome the greatest difficulties in

founding a new Midland Region for the B.B.C.

There is real personality in the work of both Manchester and Birmingham. The Northern Wireless Orchestra for Mr. Liveing and the 5 G B Orchestra for Mr. Edgar have been wonderful recruiters both of licences and goodwill for the B.B.C. Until recently the headquarters of the B.B.C. had the good sense to leave the main provincial centres with a reasonable amount of autonomy and local initiative. But the tendency now is to restrict this.

In the Provinces.

Again the fetish of organisation! I have already mentioned Manchester and Birmingham. In Scotland, Mr. Cleghorn Thomson has done wonders. Scottish programmes are now of real artistic merit; rather too good, indeed, for regular admission to S.B.! Mr. Thomson has gone one better than his colleagues at Manchester and Birmingham. Anticipating the new "organisation ramp," he took the initiative in reducing his staff, retaining only a nucleus of first-class material. He has now reorganised this, retaining his freedom of action and the characteristics of his work across the Tweed.

Then down in the West there is Mr. Appleton hard at work making the new Region that will comprise Wales as well as the West Country. Here, again, the mainspring of organisation is humanity and sympathy, with ever-improving results.

So once again it is in the Provinces that



Mr. Percy Edgar, the Birmingham Station Director, hard at work dealing with criticisms and appreciations from his army of listeners.

broadcasting organisation is best. And, of course, this is because in the Provinces the B.B.C. officials think about broadcasting and not about the abstraction of organisation. But, alas, if present intentions materialise, there will be no successes of the kind to record in a year or two, for the simple reason that there will be no B.B.C. officials in the Provinces. Savoy Hill goes on steadily reducing the Provinces and expanding the already unwieldy mass in London.

Centralisation.

The argument is that it is cheaper and more efficient to do most programmes in London now, and that when the Regional stations are finished, all programmes will originate in London. This is the objective which Mr. R. H. Eckersley is seeking with all the determination and inflexibility for which he is noted. This is the objective

which Sir John Reith has accepted and recommends to his Board of Governors.

A completely centralised organisation for the B.B.C. is certainly commended on grounds of mathematics, and probably on all the grounds familiar to the expert "organiser." But this alone does not make it either right or expedient. There are factors of vastly greater importance. Is the B.B.C. to kill what is left of the imagination, humanity, and initiative of its provincial workers?

How much better it would be to envisage the new problems presented by the Regional Scheme in the way that Captain Eckersley would do. Let the Regional Scheme go on to technical fulfilment; but allow programmes to be originated with the full character and traditions of each Region; let contrast be in point of view as well as in artistic variety and standard.

The B.B.C. is in danger of being organised out of existence. I suggest to those whose responsibility it is to take stock afresh, and not to rest until they hear the approval of the "still small voice" of humanity.

CONCERNING ACCUMULATORS.

An accumulator is a very robust piece of apparatus, provided it is looked after carefully.

The voltage of an accumulator should never be allowed to drop below 1.8 in the case of a 2-volt; 3.6 in the case of the 4-volt battery; or 5.4 for a 6-volt accumulator.

THE HYDROMETER TEST.

One of the best ways of testing the condition of a low-tension accumulator is by means of a hydrometer (instructions for use are supplied with this).

The liquid in an H.T. accumulator should never be spilled upon the case.

It is useless to expect really good quality unless you have ample H.T. voltage and current available for the various valves.

Any leakage, however small, across the insulation of an H.T. accumulator constitutes a continuous discharge, so that great attention should be paid to maintaining the insulation as perfectly as possible.

To restore the level of the electrolyte of an H.T. accumulator after loss by evaporation, use only distilled water (obtainable from any chemist).

CLEANLINESS ESSENTIAL.

Keep the terminals of your accumulators clean and bright, using sandpaper or a file if necessary, and maintain a coat of petroleum jelly on all enclosed metal parts to protect them.

The short strip of a flashlamp battery is the positive terminal and the long strip is the negative.

Complaints of oscillation produced by neighbours' sets or by electric motors, etc., should be addressed to the Chief Engineer, B.B.C., 2, Savoy Hill, W.C.2.

BEAUTY · TONE AND HARMONY · THAT'S



The most critical listener with the most sensitive ear—these speakers were designed to please him.

Nor was appearance an afterthought. Both these speakers are finished a rich brown colour and have decorative grilles backed with gold gauze.

Whichever you choose—the speaker to suit your pocket—you will know that you have an instrument which will satisfy you.

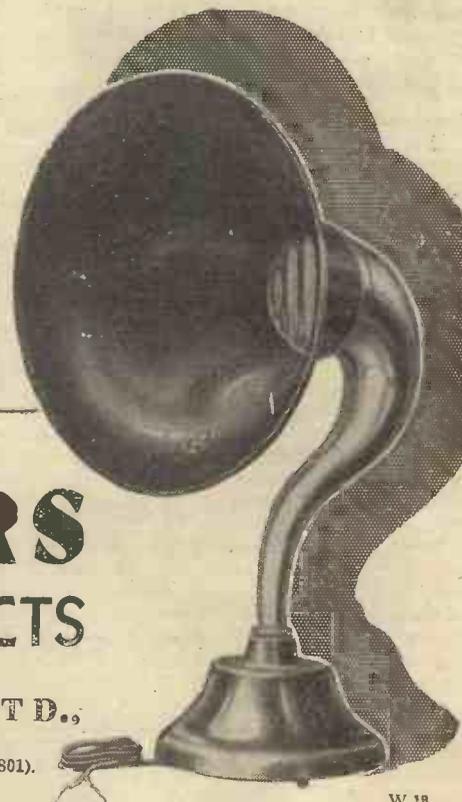
The B.T.H. Cone Speaker.

PRICE £3



The B.T.H. C.2 Loud Speaker.

PRICE 45/-



LOUDSPEAKERS EDISWAN RADIO PRODUCTS

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The EDISON SWAN ELECTRIC CO., LTD.,

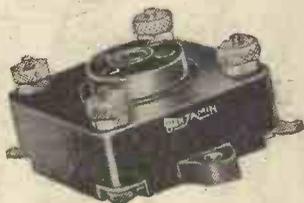
HEAD OFFICE & WEST END SHOWROOMS, EDISWAN RADIO DIVISION:

1a, NEWMAN STREET, OXFORD STREET, W.1. (Museum 9801).

SHOWROOMS IN ALL THE PRINCIPAL TOWNS.

They must be good - 3,000,000 Valveholders already sold!

CLEARER-TONE VALVEHOLDER



The original Clearer-Tone Valveholder, in face of considerable low price competition, has more than held its own and will be continued at

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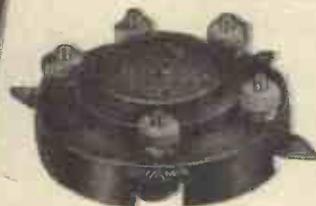
VIBROOLDER



The Benjamin Vibroolder was last season's most successful accessory, the self-aligning feature ensuring positive contact with all types of English 4-pin valves.

1'6

5-PIN VALVEHOLDER



Designed for use with the new 5-pin valve with centre leg. The Benjamin anti-microphonic feature is incorporated, and also patented contact, which ensures perfect contact when using either solid or split pin valves.

1'9



Seen the new Switch ?

Some people say "Turn off the wireless"—and that's just what you do with this rotary switch. It's an attractive alternative to the usual pull and push type. All insulated, with indicating "On" or "Off" dial, pointer knob, terminals, and double contact. Suitable for use with panels up to 3/8-inch thickness. Quick make and break action . . .

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BENJAMIN

RADIO PRODUCTS

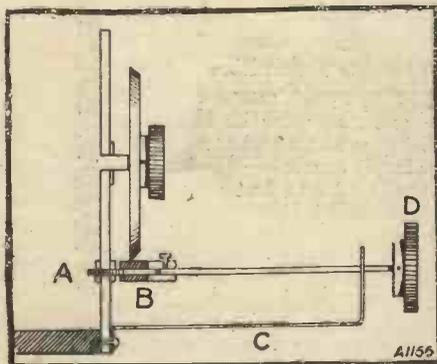
THE BENJAMIN ELECTRIC LTD., BRANTWOOD WORKS, TOTTENHAM, LONDON, N. 17



CAPT. ECKERSLEY'S QUERY CORNER

Overcoming Hand-Capacity.

E. McN. (Edinburgh).—Is there any effective way of overcoming hand-capacity in a short-wave receiver? I have tried a copper screen behind the panel, but this does not seem to make things very much better."



This method of avoiding hand-capacity was suggested by a reader of "P.W." A is a piece of Meccano rod, 1 in. long and tapped for half its length, held to panel by one nut each side. B is a Meccano coupling link which revolves on A and carries a 4-in. spindle fitted with a knob, D. C is a Meccano strip which acts as a support for the spindle. With a piece of bicycle inner tube fastened round B, this apparatus will be found to give a very smooth control and will be free from hand-capacity.

Enclose the whole of your H.F. circuits completely, take the aerial well away from near your hand, and you will have no trouble. Lots of people, to save expense, extend their handles right out away from the set and get over their troubles this way.

Using a Frame Aerial.

G. O. L. (Scvenoaks).—"I have a portable set incorporating a frame aerial. I have always understood that one had to rotate the set in order to obtain the correct direction for a particular station.

"In my case the frame brings in a number of stations without my having to rotate the set, in fact, it does not seem to possess any

* * * * *

Under the above title, week by week, Capt. P. P. Eckersley, M.I.E.E., late Chief Engineer of the B.B.C., and now our Chief Radio Consultant, will comment upon radio queries submitted by "P.W." readers. But don't address your queries to Capt. Eckersley—a selection of those coming to the Query Department in the ordinary way will be dealt with by him.

* * * * *

marked directional properties. Why is this? Is it because I am using the set in the house?"

The point is that the set ought to have to be rotated only on the rare occasions when the direction of the station to be received is at right angles to the length of the box (or parallel to any line going front and back at the least distance—i.e. parallel to its depth). Nearly every portable has a frame aerial, and this will receive nothing if it points at right angles to a station's direction.

It receives well in any other position, hence, of course, you bring in a number of stations without rotating the set. But choose one and slowly turn the set. Is there a defined position where it disappears? If so, you are getting a true direction effect.

Sometimes, when there is a lot of steel-frame building about, this effect is not noticed. Try the set outside, away from buildings. Sometimes the frame is series earthed; in this case it has no directional properties.

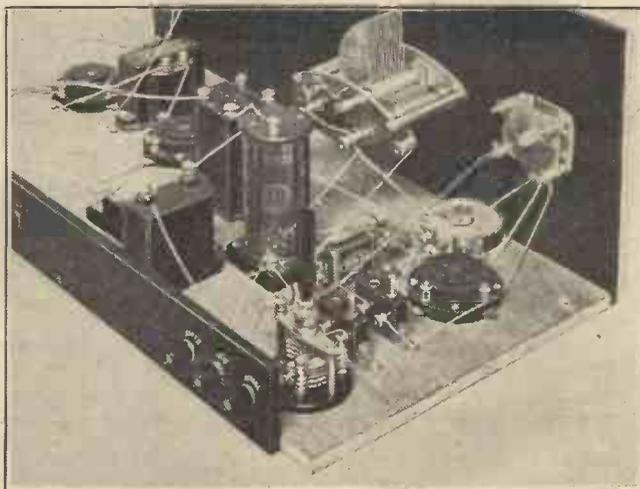
Short-Wave Reception.

C. W. R. (Southall).—"Although I am only about thirty or forty miles from 5 S W, I am unable to hear this station as satisfactorily as some of the American short-wave stations, which in some cases use less power. Why should this be?"

Short waves have this property, that the direct or ground wave, i.e. the wave which we use in broadcasting for local reception, dies out very quickly, say in 10 to 20 miles from 5 S W.

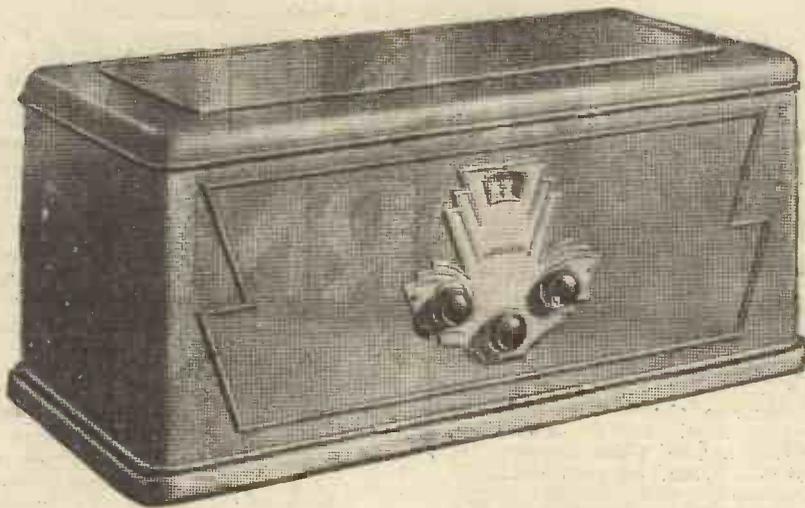
But the upward radiations go on up to the Heaviside Layer, where they are turned down again and impinge on the earth a few hundreds of miles from their point of origin. They "come down" at what we call a "skip distance," and you are within that distance, and 5 S W's radiations are passing over your head in an arch of radiation.

Not so America; you are getting their radiations as they come down from above, but someone twenty or thirty miles from 2 X A D, etc., would hear nothing.



The "Magic" Three is specially designed for use on the short-waves, as well as on ordinary broadcast wave-lengths.

Olympia's Masterpiece!



—and its price is only

£8.15s.

Price includes the three Cossor Valves of the latest type, the handsome one-piece cabinet and all the parts necessary for its rapid assembly.

Also for A.C. Mains operation—works direct from the electric light mains. Supplied complete with three of the latest type Cossor Mains Valves, factory-built and tested A.C. Mains Unit, handsome one-piece cabinet and all parts Price **£15.0.0**

One dial Control

The 1930 Cossor Melody Maker is simplicity itself—anyone can use it—no "tricky" tuning—turn only one knob to hear the programme you want.

No coils to change

Coil changing is ended with the 1930 Cossor Melody Maker. When you want to hear Daventry, Paris or any other long-wave station—merely twist a knob.

Only 10 components— only 20 wires

In spite of its wonderful power—its ability to bring you over thirty programmes any evening—even while your local station is working—the Cossor Melody Maker is amazingly simple—only 10 components to mount—only 20 wires to connect—that's all.

NEVER before has any Receiver created such a sensation as did the 1930 Cossor Melody Maker at the Olympia Radio Exhibition. From morning till night huge crowds surged round this wonderful Receiver—eager to view its handsome one-piece cabinet richly lacquered in two-tone blue—eager to examine its three simple controls—one knob for tuning—one knob for volume and one knob for wave-lengths. And then they looked inside and saw the amazing simplicity of its assembly—the Synchronised Control Unit, factory-built and factory-tested—the 9 other components and the 20 connecting wires. In an hour or so anyone—without previous Radio knowledge—can assemble it and obtain results equal to a costly factory-built Receiver. And the same Receiver can be converted to all-electric operation by the simple addition of the factory-built Cossor A.C. Power Unit and three Cossor Mains Valves. Go and see this amazing Receiver at your Dealer's—he'll be glad to tell you all about it or—use the coupon.

Use this Coupon NOW

To Messrs. A. C. Cossor Ltd.,
Highbury Grove, London, N.5

Please send me free of charge a Constructor Envelope giving full details of 1930 Cossor Melody Maker (a) A.C. Mains Model (b) Battery Model.

(Please strike out one you do not require)

Name

Address

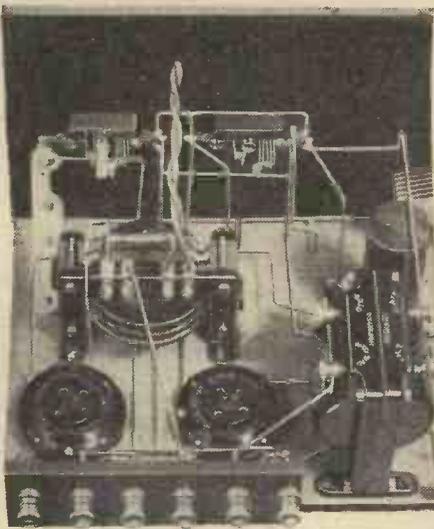
P

If you are interested in the A.C. Mains Model please give voltage and cycles of your house supply.

A. C. Cossor Ltd., Highbury Grove, London N.5.

The 1930 COSSOR "Melody Maker"

Britain's Greatest Radio Achievement!



CURING - - INSTABILITY

Does your set suffer from self-oscillation or other forms of instability? If so this article will help you to cure the trouble. Many useful hints for the successful construction and operation of valve receivers are given

By L. ROBINS

A CORRESPONDENT writes to say that he is unable to use any reaction on his set, it being too fierce, the set bursting into oscillation at the slightest provocation, although good components are used throughout. Our correspondent ends up by asking how he can obtain smooth reaction.

Uncontrollable Reaction.

The set in question is an ordinary four-valver with a screened-grid valve, a detector worked on the leaky-grid principle, followed by a resistance-coupled stage and a transformer stage of L.F. amplification. The reaction is carried out in the usual way by means of capacity control from the plate of the detector to a coil wound in series with the grid coil of the detector valve.

Just a plain Reinartz reaction system, and from the correspondent's remarks it is not possible to lay one's finger right on the trouble. You see there may be only one fault or there may be two or three causes which, when added together, give the result indicated—that reaction is so fierce that it is of no use attempting to employ it.

Apparently the set is on the verge of oscillation all the time, so that the slightest touch of the reaction condenser throws the set into oscillation immediately.

H.F. Feed-Back.

The screened-grid valve may have something to do with the trouble. It may not be operating at its best owing to inadequate screening—there may be feed-back between aerial coil and the detector coil, that is the coil in the grid circuit of the detector valve—or there may be reaction between the grid coil of the screened-grid valve and its own tuned anode, if the tuned-anode system is employed. I would advise our reader to take care that no feed-back between the H.F. circuits is occurring, for if this is the case the set will always be on the verge of oscillation.

The next thing to look at is the reaction condenser itself and the winding of the reaction coil. Fewer turns on the reaction coil might cure the trouble, but if this is a standard coil, then a .0001 mfd. in series with the reaction condenser may give some slight assistance. This will bring the total maximum capacity from the plate of the detector circuit to the grid circuit down to .00005 mfd., instead of .0001 mfd.,

assuming that the present reaction condenser is only .0001 mfd., and also reduce the minimum capacity somewhat. If this condenser is of a higher value, then it would be advisable to substitute one of a lower maximum capacity. Our reader might try using a .0001-mfd. variable condenser between the plate of the valve and the filament negative lead.

The H.F. choke also may be at fault, having peaks on certain wave-lengths.

No information is given as to the type of detector valve in use, or as to the H.T. voltages employed. It is possible, of course, that a lively type of valve is the cause, or too much H.T. may be used, while it is also possible that there is a fault of some description in the grid-leak circuit, so that the grid of the valve is "floating," and thus causing the instability.

Careful Screening Essential.

Another value of grid leak may materially assist, a value of say 1-megohm being employed, the constructor being careful to see that it goes to the L.T. positive lead, and that it really makes good connection.

If the set is completely unstable, however, I should be very inclined to suspect the

to interact, so experiments in the screening of this stage by means of completely covering the coils with metal screens should be carried out to ensure that the screened-grid valve is not causing the trouble.

Incidentally, while dealing with this end of the set it might be worth while to find out the exact condition of the earth plate. If this is not up to scratch then instability may occur and the constructor will do well to make himself conversant with this point, as well as on the point regarding the screening.

Battery Coupling Effects.

We are concluding, of course, for the purpose of this article, that the H.T. battery or eliminator is above reproach, and that no resistance-coupling effects between circuits are occurring here. Resistance-coupling effects between the detector and the other circuits might quite reasonably cause instability, the set tending to burst into oscillation upon the slightest provocation.

In order to make absolutely sure the set shall be stable, it should be well screened where necessary, and bypass condensers should be placed between earth and places such as the following: The screening grid of the screened-grid valve; such places as the H.T. side of the tuned-anode coil; an anti-motor boating device from the H.T. lead of the detector valve may also be of assistance.

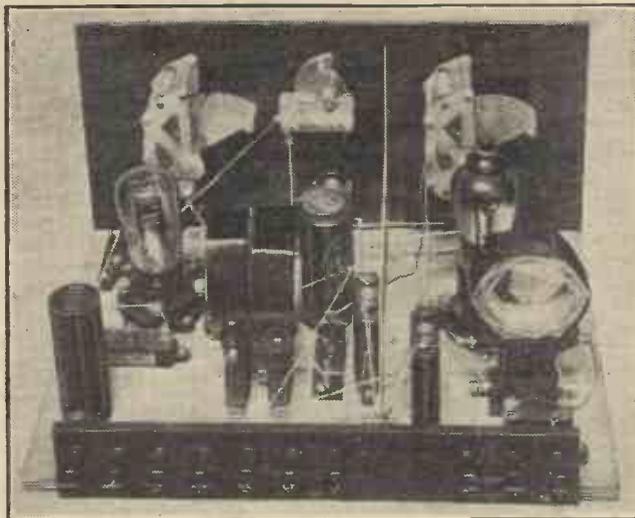
The Output.

Finally it must not be forgotten that if the loud-speaker wires are taken close to the H.F. end, this may cause sufficient feed-back for instability to occur and upset the handling and reproduction of the set.

It is always advisable to have a filter-output circuit or an output transformer to isolate the loud

speaker from the set and to keep the speaker well away from the H.F. end of the receiver.

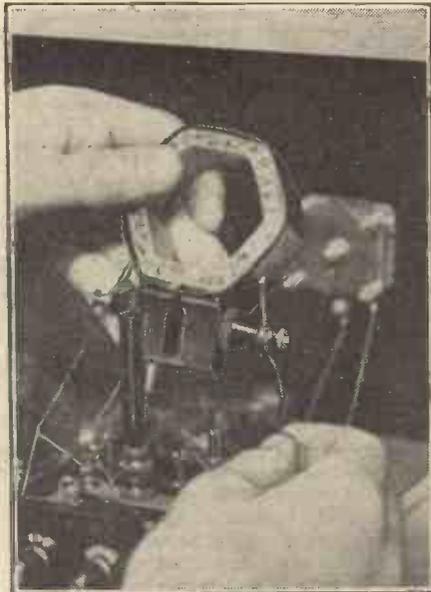
If an output transformer is used it will not act as a decoupling device as will the output-filter circuit, so it is preferable to employ the latter in a set that is prone to instability.



The careful screening of the S.G. valve and the aerial coil from the rest of the set is essential if stability is to be obtained.

screened-grid H.F. valve. This valve may be on the verge of oscillation always, owing to feed-back, especially if an ordinary vertical screen is employed and one of the latest upright types of screened-grid valve, and the coils on either side of the screen are not too carefully placed.

Six-pin coils placed vertically are prone



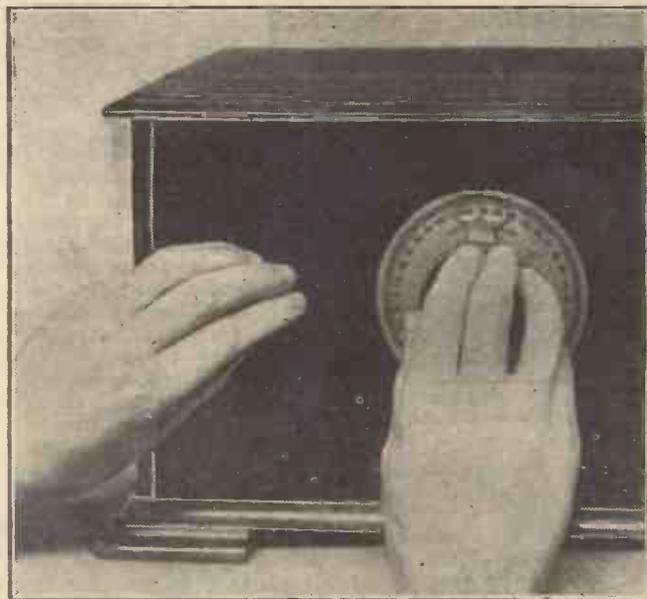
Where the flex tapping lead goes on a Lissen "X" coil.

OUR original idea was to devote the greater part of this article to instructions for operating and getting the best from the "Magic" Three, but the set has turned out to be so simple to work that we could not possibly occupy three pages in telling you how to do it!

We will give you all the details you are likely to need, but we shall not by any means fill our space in that way, and so shall have a welcome opportunity of discussing a number of other quite interesting little points for which we could not find room last week.

Why It Is So Stable.

First we should like to explain a few points about the stability of the L.F. side of the "Magic" Three. We took a great deal of pains over this part of the set, and the margin of safety of any good copy of the original design should be very considerable. Since, however, some constructors may want to make little modifications of their



This is one of the things you do NOT have to do with the "Magic" Three: constant checking and re-checking of tuning and reaction adjustments.

own, in the way of using up components which they may have on hand and so on, it may be as well to explain briefly what makes the L.F. side so stable, so that they may be sure of similar good behaviour in their own models.

First of all there is what is called an anti-motor-boating filter in the H.T. lead to the detector valve. This takes the form of the usual series resistance, which was of 25,000 ohms in the original set, with a large reservoir condenser shunted down to the L.T. circuit from the junction point of this resistance and the primary of the first L.F. transformer. The value of this resistance is not at all critical, and anything from 25,000 to about 60,000 ohms is quite suitable. The lower value, as a rule, gives a slightly smoother reaction control.

A Point for Mains Users.

The reservoir condenser has a capacity of 2 mfd., and this is quite large enough for all general purposes. The arrangement as it stands is a very good preventive of trouble from battery-coupling effects, but it is interesting to note that where a very old and high-resistance battery may be causing a little trouble, a slightly better decoupling effect can be obtained by increasing the capacity of the condenser C_5 to 4 mfd. by placing another 2 mfd. in parallel therewith. This point is chiefly of importance to those who use mains units of a type which may be a little prone to motor-boating.

The careful layout of the L.F. side has a good deal to do with the stability obtained, and here all we can say is that you should make a rather careful copy. It is not as a rule desirable, by the way, to use exactly the same type of transformer in both stages, and you will note that in the original set we used specimens of two different makes. This is rather a good plan, and the reader is advised to do likewise, unless he is sure that the particular pair he intends to use are stable when used in conjunction with one another. There are certain makes in which two exactly similar specimens can be used in cascade with entire safety, of course.

Another important little point in connection with the L.F. transformers is this. Some makes are provided with a means of earthing the metal core of the transformer, and where this is present it should certainly be used on at least one of the two transformers. In the original set we found it quite sufficient to earth the core of the second transformer, which is of a type which has a little soldering lug projecting near one of the feet for the purpose. This connection you will see on the blue print and also in the circuit diagram. In the case of some other makes you will find that the manufacturers tell you how to make this connection by soldering a wire to one of the screws with which the transformer is fastened down to the baseboard.

It may be of assist-



More About
THE
MAGIC
THREE

ance to explain just which wire does the earthing of the second transformer which we have mentioned, and this is how you can spot the lead in question. It is shown in the blue print, and you will notice that the two filament terminals of the valve sockets V2 and V3 towards the back of the set are wired almost directly together, but the wire diverges slightly from the straight line and is soldered in passing to the earthing tag of the transformer.

Before we leave this L.F. stability question, here is a hint for the benefit of those who may happen to try out an odd pair of transformers they chance to have and find them tending to give a low-frequency howl. Such a tendency is very rare in this design and can only result from the use of a rather unusual combination of transformers, but an almost certain cure is to be found in the connection of a resistance of about 250,000 ohms (for example, a quarter-megohm grid leak) across the secondary terminals of the second L.F. transformer.

That Space on the Panel.

Next, there is a detail about the panel layout we should like to explain. You may have wondered why we crowded the parts upon the panel up towards the two ends, leaving a blank space in the middle of the set. Well, this was done deliberately in order to leave room for the later addition of certain little refinements which we shall be telling you about in a future issue. We realised at the beginning that it was not possible to produce a single design which would please everybody, and so we have adopted the scheme of giving you first of all a quite simple version of the set, and we intend later to go on and show you how to add a number of little refinements such as a volume control, a built-in output filter, and so on, so that you can if you like turn it into quite a de luxe affair fitted with all the little refinements so dear to the heart of the more advanced constructor.

We have already worked out these details, and we shall be showing you later how to add them with the very minimum of alteration and without any scrapping.

Some further details concerning three-valve design.

By THE "P.W. DEPARTMENT"

SHORT WAVES, LONG WAVES

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C"
E

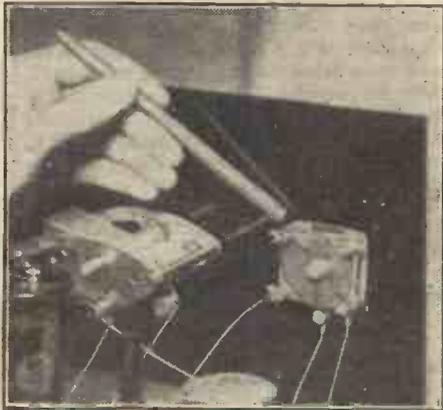


is and operating the remarkable bed last week. RESEARCH MENT.

The choice of valves for use in the "Magic" Three is quite a simple matter; 2-, 4-, and 6-volters all work excellently in this receiver, and the decision here rests entirely with yourself. The 2-volters are much the more economical, but, of course, the 6-volt

types possess slightly better characteristics, and so you will decide simply in the usual way between economy with good results or the super results to be obtained with the 6-volt class.

As a matter of fact, however, this set is not one of those which show up the difference between 2-volters and 6-volters very



Decidedly a "key" component. The differential reaction condenser.

clearly, and you need not be afraid that if you use the economical 2-volters it will give you results short of those we have claimed.

The Valves to Use.

For the detector you want a valve of the H.F. type, which usually has an impedance of from 20,000 to 30,000 ohms or thereabouts. There is nothing critical here, and any good make such as Cossor, Ediswan, Marconi or Osram, Dario, Mullard, etc., will give you the desired results. In the second socket, that is to say in the first L.F. stage, you want either a valve of the same type as before or one of the "L.F."

or "G.P." type; these latter usually have an impedance of from 10,000 to 18,000 ohms. The choice here is to be made as follows. The H.F. type of valve when used for V2 gives slightly more amplification and so is rather desirable where distant listening is regarded as being of the greater importance. The other type generally gives slightly better quality on really powerful signals such as those of the local station, 5 G B and 5 X X, and enables you to handle slightly more volume without overloading. For all general purposes, however, we recommend the H.F. type, since there is little risk of overloading this stage unless you are trying to get tremendous volume with a very large super-power valve in the output stage.

For the last valve, namely, V3, you want as large a power valve as you think your H.T. battery is capable of supplying in an economical manner. The set is capable of giving you very powerful signals indeed on the local station, 5 G B, and 5 X X, and so you can make really good use of a super-power type. However, these valves require a considerable anode current, and so this type should only be used by those who are employing a mains H.T. unit or very large capacity dry batteries, or of course, H.T. accumulators.

For the smaller type of H.T. battery, such as the single and double capacity, we advise you to use an ordinary power valve here, and so get a reasonably long life from your battery. Such a valve will enable you to get quite a good output, but of course you must not expect to fill a large hall with it and must avoid overloading by keeping down the volume to reasonable limits by de-tuning, etc.

The Battery Voltages.

Grid-bias voltages should be arranged in this way: if you are using an ordinary power valve in the last stage a 9-volt unit should serve quite well. Insert the G.B. + plug in the positive socket and the G.B. -1 in a socket 1½- or 3-volts negative. The G.B. -2 plug will usually go into the 6- or 7½-volt socket, but this will depend upon the amount of H.T. you are using. You must therefore look up the makers' recommendations on the information slip supplied with the valve and proceed accordingly.

Super-power valves require considerably more grid bias, and since they vary considerably in their characteristics as between different makes you should refer to the slip you will receive with the valve.

The H.T. voltages are very simply adjusted on this set. Connect up the H.T. - terminal to the negative socket of the battery and take a lead from H.T. +1 to one of the intermediate sockets round about 60 volts. This supplies the detector valve, and a little adjustment here in conjunction with a suitable setting of the potentiometer will soon find you a voltage which gives you beautifully smooth reaction.

Mention of the potentiometer reminds us that we had better give you some instructions about the use of this valuable device. If you try the arm in various positions you will probably find that signals are strongest with it fairly well over to the positive end, that is to say round towards the grid leak. Right round at this end, however, reaction is usually not quite smooth, and so you should take it a little



A very important feature is the anti-battery-coupling filter.

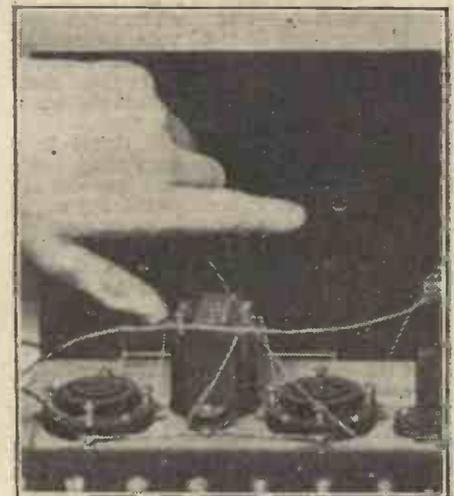
way towards the negative until you find that reaction becomes quite smooth.

Be careful not to go too far, however, since once you have passed the smooth reaction point signals usually begin to get a little weaker, although you will probably only notice the difference on very distant stations. A suitable adjustment of the voltage on H.T. +1 usually helps you to find a setting for the potentiometer slider which is fairly well towards the positive end.

When You Want Power.

The other H.T. terminal (H.T. +2) supplies the two L.F. valves, and here you really want about 120 volts, although less will serve at a pinch. The best results from the point of view of enabling you to handle full volume are naturally obtained with plenty of voltage here, and if you have it available you should go right up to the maximum rating permitted by the makers of your valves, which is usually about 140 or 150 volts.

(Continued on next page.)



The blank space in the middle of the panel is intended to allow a volume control to be fitted later.

ES, POWER AND PURITY

MORE ABOUT THE "MAGIC" THREE.

(Continued from previous page.)

There are only two coils in use at any one time in the "Magic" Three, and so the question of sizes is quickly settled. For L_1 you require a No. 60 "X" coil for the ordinary broadcast waves and a No. 250 "X" for the long waves. For L_2 , which is the reaction coil, you will require about a No. 35 or 50 for the lower wave-band and a No. 100 for the upper range.

The exact size of reaction coil for the very best results should really be determined by trial, since it depends to some extent upon the particular detector valve you are using. It is a very simple matter to find one which gives you a good control of reaction over the whole tuning range, and this will not take you long.

Selectivity Adjustment.

Two degrees of selectivity can be obtained with the set on each wave-band, by means of the flex lead which is marked on the wiring diagram as going to the tap on L_1 . The "X" coil, as you probably know, is provided with two tapping points, and by connection to one or other of these you can get either normal selectivity and full volume, or else very high selectivity and slightly less volume.

It is therefore best to find out by test which suits different conditions. In very extreme cases where you are very close to a local station and must have an abnormal degree of selectivity, it is worth noting that you can sharpen up tuning still further by connecting a fixed condenser of .0002 mfd., or thereabouts, in series with the aerial lead to the set, but we do not expect that many people will need to adopt this expedient. The set is actually a very selective specimen of its class, and in all normal use we do not think you will experience any difficulty on this score. Of course, in the very difficult areas close to a local station the usual wave-trap can be used, but this should very rarely be necessary.

Operating instructions for such a delightfully simple set are scarcely necessary. All that you have to do is to learn the knack of adjusting the reaction to keep the set just below oscillation point, and then very slowly turn the dial of the tuning condenser, a trick you will learn in a few moments, whereupon you can proceed to astonish yourself with the number of stations which will roll in every few degrees on the dial so long as your aerial is reasonably efficient.

Now about short waves. The set as it stands will give an excellent account of itself on the short waves, and it is far easier to handle here than any normal short-waver. It is so much easier that the quite average broadcast listener will soon get the hang of it. Just a little patience in learning the extra delicacy of touch needed on the tuning condensers and the reaction control, and you should be able to bring in transatlantic stations at good volume whenever conditions are at all passable. You will find if you look up a list that there are any number of short-wave broadcasting stations working nowadays, and the "Magic" Three will open up quite a new world of broadcasting to you, and you will get a new range of stations to listen to.

Getting Easier Tuning.

As the set stands it has a full .0005-mfd. tuning condenser, and although this is a little large for short-wave work, it is still quite workable with the aid of a really good slow-motion dial. Just a little delicacy of touch on the tuning control is needed, but even this will be unnecessary when you add a very simple little device which we shall be describing in our article next week.

For the short waves you want a set of the special short-wave plug-in coils now sold by a number of manufacturers (Atlas, Igranic, etc.), and for the L_1 socket you require a No. 4 for the interesting band of waves from about 20 to 40 metres. For L_2 a No. 6 is usually suitable. A little experimenting with this coil (the reaction) is needed, just as on the broadcast band.

For the next interesting wave-band, namely the range from about 40 to 60 metres, you will require a No. 6 coil for L_1 and a No. 9 for L_2 , and with these two pairs you will be able to cover practically

the whole of the short-wave broadcasting stations. On this second pair you will also be able to pick up the amateur stations on 45 metres, and quite an interesting time you will have listening to them.

The aerial coupling arrangement is slightly different on short waves, and you will find that in general the most convenient operation will be with the aerial connected to No. 1 terminal. This brings the series condenser C_3 into circuit, and it will usually suffice to keep this at maximum. If you have any difficulty in getting reaction at some particular place on the tuning dial, however, try altering the capacity of C_3 . On small aerials, by the way, you may not need to use C_3 at all and can keep the aerial on terminal No. 2 permanently.

Aerial Coupling on Short Waves.

The tapping lead to the coil L_1 should be provided with a crocodile clip for use on the short waves (quite convenient for the "X" coils also), and this clip should be connected to a suitable turn on the coil. If you use the bare wire coils it is quite a simple matter to make the connection, bending the turns apart slightly if necessary, to make sure that the clip does not touch more than one turn at a time. You will not injure the coil in any way by doing this. The best position for the clip is usually at 1, 2 or 3 turns from the earthed end of the winding, but when the aerial lead is on terminal No. 1 you can take it as a general rule that the clip should be somewhere about the centre of the coil, and no particular adjustment will be needed.

By the way, you may wonder how you are to find out which is the earthed end of the winding. This is how you can do it. Notice which end of the wire composing the coil winding goes to the socket of the plug. That is the earthed end.

We shall have a little more to say about short-wave work in our article next week when we discuss the little modification mentioned which makes tuning less critical on short waves, but until then we must leave you. You now have before you complete details for getting the best from the set, and we think there is not much doubt about what your verdict will be when you have given it a try-out.

WORKING DATA IN BRIEF.

1.—H.T. VOLTAGES : Detector is supplied by H.T. + 1 terminal, for which plug-in from about 40 to 80 volts, adjusted for smooth reaction. Terminal H.T. + 2 feeds the L.F. stages and should be given about 120 volts for best results on loud stations.

2.—COILS : Tuning coil should be a No. 60 X for ordinary wave range and a No. 250 X for long waves. Reaction coil should be a No. 35 or 50 for ordinary waves, and a No. 75 or 100 for long waves. For short waves, use a No. 4 for tuning and a No. 6 for reaction for 20- to 40-metre band and a No. 6 and No. 9 for 40 to 60 metres.

3.—VALVES : 2-, 4- and 6-volt types all work well in this receiver. Suitable types are: detector, H.F. type of about 20,000 ohms. First L.F., similar valve or one of L.F. or G.P. type of from 10,000 to 18,000 ohms impedance. Third valve, power or super power.

4.—SELECTIVITY CONTROL : Two different degrees of selectivity can be obtained by placing the flex lead on one or other of the tapping points on the "X" coil. The one giving the best selectivity usually gives slightly less volume.

5.—REACTION CONTROL : To get perfectly smooth reaction adjust H.T. on detector suitably, and set potentiometer arm carefully. Try to keep it as far round towards positive end (nearest grid leak) as possible without making reaction poppy.

If there are "flat spots" on the reaction on short waves transfer aerial lead to A_1 , so bringing small series condenser into circuit. Keep this at maximum if possible, but try other settings if necessary.

6.—LOUD-SPEAKER CONNECTIONS : With ordinary power valve loud speaker can be connected to L.S. terminals of set

in its original form (see Blue Print). With a super-power valve it is better to use an output filter, either as a separate unit or built into the set in the manner described in one of the later articles.

7.—KEY TO CONTROLS : Left-hand knob is reaction, which INCREASES by turning to right (clockwise). Use this sparingly and keep at minimum (turned to the left) for local station. Middle knob (large dial) is the tuning control. Lowest waves of each range by turning to the left (anti-clockwise) and higher waves by turning to the right (clockwise). Small knob at right-hand end of panel is the on-off switch.

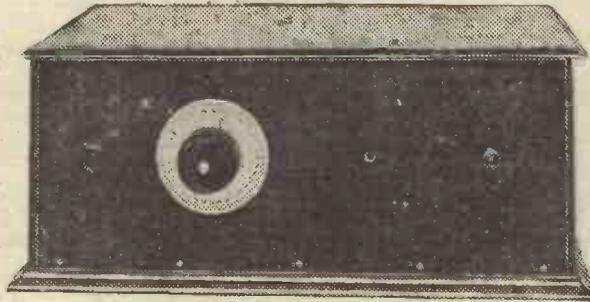
NOTE.—On the "de luxe" version incorporating refinements described in later issues there is another small knob near the middle of the panel. This is the volume control.

NEVER ALLOW THE SET TO OSCILLATE.

BUILD The MAGIC 3

and listen to the
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Build*



Ready Radio
FOR
SERVICE
AND
SATISFACTION

AVAILABLE IN COMPLETE KITS OF PARTS

READY FOR IMMEDIATE DESPATCH

LIST OF SPECIFIED PARTS

	#	s.	d.
1 Panel 18 in. x 7 in. drilled (Resiston)		8	0
1 Cabinet to fit, with baseboard (Ready Radio)	1	10	0
1 0005 mfd. variable condenser (Lissen)		6	6
1 Vernier dial (Jackson)		5	8
1 differential reaction condenser		5	0
1 L.T. on-off switch		1	3
3 Sprung valve holders		3	9
2 Single-coil sockets (Lotus)		1	4
1 400-ohm baseboard mounting potentiometer (Igranic)		2	6
1 Baseboard-mounting neotrodyne type condenser (Magnum)		5	6
1 H.F. choke (Varley)		9	6
1 L.F. transformer (R.I. "Hypermu")	1	1	0
1 L.F. transformer (Igranic J.)		17	6
1 0003 mfd. fixed condenser (Igranic)		1	3
1 2-mfd. Mansbridge type condenser (Lissen)		3	6
1 2-megohm grid leak and holder (Ediswan)		2	0
1 2,000-ohm resistance and holder (Cosmos)		2	5
1 Terminal strip, 18 in. x 2 in. (drilled)		2	0
10 Terminals (Belling & Lee)		2	6
1 Set of valves as specified (Cosson or Mullard, as desired)	1	13	6
1 Lewcos No. 6a X coil		4	9
1 No. 49 coil		3	6
1 No. 250 X coil		6	6
1 No. 100 coil		4	6
1 Set of short-wave coils (2 : 4 : 6 : 9)		10	6
1 Set of MAGIC insulated connecting links		2	0
Screws, nuts, etc.			3
TOTAL (INCLUDING VALVES)		£9	16 6

Any of the above components can be supplied separately if desired.

KIT A	less valves and cabinet	£6 : 13 : 0
KIT B	with valves less cabinet	£8 : 6 : 6
KIT C	with valves and cabinet	£9 : 16 : 6

All Kits include special Ready Radio connecting links.

NO SOLDERING REQUIRED!

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(Three minutes from London Bridge Station.)

FROM THE TECHNICAL EDITOR'S NOTE BOOK

Tested and Found-?

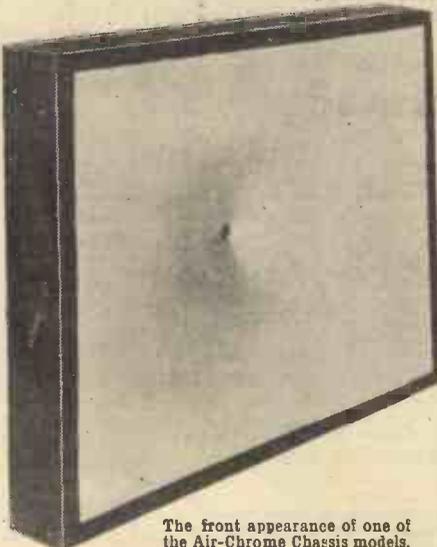


ULTRA "AIR CHROME" LOUD SPEAKERS.

One of the most interesting radio accessories we have come across for some time is the Ultra "Air Chrome" Loud Speaker. We have recently had two of the chassis models on test, and can say right away that we consider the results impressive. The design of the "Air Chrome" is a complete break away from the conventional.

It has two diaphragms, and these are made of specially treated linen. One diaphragm is large and this is intended to deal with the low frequencies and, of course, the small diaphragm deals with the upper register. The diaphragms are driven by a balanced-armature movement.

The diaphragms are stiff and do not appear capable of free movement, although there is no suspicion of drumminess. Indeed, the response is distinctly clean cut,



The front appearance of one of the Air-Chrome Chassis models.

although, it must be mentioned, there is ample continuance. In fact, in this regard the "Air Chrome" has qualities that have hitherto been almost peculiar to the moving-coil class. Bass notes come through excellently, while the harmonic range is so well embraced that high notes retain their individuality. Speech is crisp and natural.

Altogether, the "Air Chrome" is a fine proposition, especially as the prices are of a very attractive nature. There are chassis models available for portable sets or for large cabinet models and radio-gramophones.

ANOTHER "EKCO" MAINS UNIT.

The "Ekco" H.T. mains unit 2 A.10 comes in the 10-milliamp range, and is suitable for one- to three-valve sets not needing more anode current than that. Its two output voltages are 60 and 120. A Westinghouse metal rectifier is used. The price of the 2 A.10 is £3 10s., and at this it is as good value for money as anything in radio we have come across.

The "Ekco" people say that they use in their units a liberal quantity of best quality transformer steel laminations, over-size coils, enamelled wire of ample gauge, and safe insulation between each layer, etc. This is evident by a close examination of the interior of any one of their productions, and that remarkably skilful design and construction is bestowed on them is proved by the consistently high standard of performance they give.

Although they are compact and completely free from complexities, they are wonderfully silent in operation. This we have mentioned several times before in connection with "Ekco" mains units, and it is a point well worth emphasising and one that is very much to the credit of the manufacturers.

The model 2 A.10 is no exception, and is as sturdy and satisfactory a device as any other bearing the same name. It is said that over 70 per cent of the total sales of radio mains devices in the British Isles to-day are "Ekco," and this in itself is an excellent commentary on the satisfactory service they give.

THREE INTERESTING PUBLICATIONS.

From the General Electric Co., Ltd., we have received copies of the "Osram Wireless Guide," "Gecophone Radio Receivers," and "Stork Loud Speakers." The Osram Wireless Guide is full of valuable information concerning valves. In this book there is also a list of broadcasting stations.

TWO WEARITE COMPONENTS.

One of the neatest and most useful components I have seen for some time is the new Wearite C.A.T. switch. This device has the appearance of an ordinary push-pull panel switch. There is a small plunger knob, the usual screwed bush for one-hole panel mounting, and a circular insulating plate on which are mounted two small nickel terminals.

But the circular plate is divided, and sandwiched in it is a small fixed condenser. The one terminal goes straight to the aerial, and the other terminal to the aerial point in the circuit of the set. When the switch is in the off position the small condenser comes into operation and it is shorted out of circuit when the switch is closed. There-

fore, you can operate your C.A.T. adjustment without, as is usually the case, having to change the aerial lead from one terminal to another. A further attractive point in regard to this latest Wright & Weaire production is its price which is only 2s. 3d. The article is really well made, too, and the switching movement is perfect. There should be a great sale for this component during the coming season.

Another new Wearite line is an iron-cored centre-tapped choke, known as the H.F.O. which has been specially designed for gramophone scratch filters. The price of this well-made and efficient device is 6s. 6d.

S.R.S. SHORT-WAVE COILS.

We have now been able to test a pair of S.R.S. short-wave coils for the Mullard S.G.P.3 receiver, which has been sent us by the Stonehouse Radio Supplies, of Union Street, Plymouth. The coils are wound on ribbed ebonite formers, mounted on the necessary 6-pin bases. Some time ago we published a report on short-wave coils due to the same firm, and readers may remember

Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

the "Keep me clean, Tune me right, I'll Bring you in, The World each night" that was mentioned as having appeared on the box.

The same catchy and appropriate rhyme is in evidence on this occasion. The Mullard S.G.P.3 is a particularly suitable design for short-wave work, and with the S.R.S. coils the S.G. H.F. stage undoubtedly gives considerable amplification. Short-wave conditions were not good when we made the tests, but there was no difficulty in bringing



Here you see the reverse side of the Air-Chrome instrument.

in a number of the Americans at excellent strength. Tuning was sharp and the results were appreciably superior to those given by a set not employing H.F. amplification.

THE
VARLEY
 ANTI - MOBO



PRICE
 9/6

PRICE
 9/6

The Varley Anti-Mobo is one of the components specified in the Mullard "Orgola" Senior Receiver. This alone affords convincing proof of its quality, for only proved products are used in this efficient receiver. It has been selected for its effectiveness in eliminating "motor-boating." For this reason, too, it is indispensable in any set which tends towards this form of oscillation.

Like all Varley products, its manufacture is the result of careful design and painstaking workmanship. It is finished in bakelite moulding with terminals and soldering tags ready for connection.

Write for Sections B and C of the Varley Catalogue.



Outside view of portion of Works.

A corner of the Coil-Winding Shop, where over 300 girls are employed.

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The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Eric, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

CONNECTIONS FOR A SELECTIVE DET.-L.F.

D. D. T. (Beckenham, Kent).—"Can you give me the wiring in words of a good Det.-L.F. receiver—employing three plug-in coils (separate aerial coil for selectivity) and an L.F. transformer—preferably one with throttle control of reaction?"

You will require the usual tuning and reaction condensers, an H.F. choke, grid condenser and leak,

valve holders, on-off switch and terminals, etc. The connections are: aerial terminal to aerial coil. Remaining side of aerial coil to earth, to the grid coil, to tuning condenser, to one filament tag on each valve holder, moving vanes of reaction condenser, to grid-bias positive, H.T.— and L.T.—

The L.T. positive terminal goes to on-off switch, and the remaining side of this switch to remaining filament terminals on valve holders and to one end of the grid leak. The remaining side of the grid leak to grid terminal on the detector valve holder and to one side of the grid condenser. The other side of the grid condenser is joined to the vacant terminal on the grid coil holder and to the variable tuning condenser (fixed vanes).

Plate terminal on the detector valve holder is joined to one side of the reaction coil, and to one end of the H.F. choke. The remaining side of the reaction coil goes to a .001-mfd. fixed condenser. The

fixed vanes of the reaction condenser are connected to the remaining side of this .001-mfd. condenser.

The vacant side of this H.F. choke is then joined to the A terminal on the L.F. transformer, H.T. positive terminal on which goes to H.T. positive about 60 volts.

The G terminal on the transformer is joined to the grid of the second valve holder and G.B.—terminal is fitted with a flexible lead with black plug for putting into the correct grid-bias voltage on this battery. The plate terminal of the last valve holder is joined to the L.S.— terminal (or to the choke output if this is employed), the final connection being from the other loud-speaker or choke-output terminal to maximum H.T. positive. (See "P.W." No. 377, page 751.)

RESISTANCE FOR VOLUME CONTROL.

L. J. T. (Hatfield).—"When Brookman's Park gets going my H.F. stages are going to be hopelessly overloaded (on both of his wave-lengths), and I am contemplating a one-turn aerial coil or something of that kind. Seriously though, do you think it will be sufficient to have a many-tapped aerial coil, and alter this to a very low value when in the neighbourhood of Brookman's wave-length, or is there some easy way of experimenting with a volume control in the H.F. stage which will not entail much alteration to the receiver?"

One of the most interesting methods is to try to use a high-resistance potentiometer to govern the input to the aerial coil. A non-inductive potentiometer having a value of say anything between 20,000 to 60,000 ohms would be suitable, and this should be joined between the aerial and earth terminals of the receiver.

The end of the aerial coil should not be taken to the aerial terminal, but should be joined to the slider of this potentiometer, and the input of the set will obviously be governed by the position of this slider, being at a maximum when the slider is at the aerial end of the coil and at the minimum (short-circuited position) when the slider is taken to the earth end of the potentiometer.

IMPROVING REINARTZ REACTION.

L. B. F. (Manchester).—"It is the Reinartz reaction set built from Blue Print No. 42, and (Continued on page 340.)"

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THE POPULAR HIGH TENSION

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and 3-1

Ratios 5-1
and 3-1



TRANSFORMERS

TELSEN ELECTRIC CO., LTD., MILLER STREET, BIRMINGHAM.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 338.)

although it is delightfully smooth to handle and so on, I sometimes feel this condenser-control is not quite as good on distant stations as the old swinging-coil method. I have put a .001 mfd. in series with the reaction condenser to prevent shorting, etc., and I have found this a great improvement, for it stopped a little scratching noise which the set had previously been subjected to. Can you make any other suggestion for improving reception?"

The Research Department have recently been recommending extra bypassing, for they find that when this is provided there is a very decided rise in sensitivity in many cases, which brings the circuit very much more nearly up to the level of the equivalent swinging-coil type of receiver, without any sacrifice of the ease of handling for which the Reinartz and similar types are justly famed.

The alteration is very easily made, and all that you require in the way of extra components is a Formo-denser, or one of the Pre-set Igranics, or a similar type, having a maximum capacity of about .0001 or .00015 mfd. Screw this condenser down on the base-board in a convenient position quite close to the plate socket of the detector valve holder.

Then wire up one of the terminals on this extra condenser to the anode terminal of this valve socket and the other terminal of the condenser to the negative filament. To adjust, start with the condenser fully unscrewed, that is to say at the minimum capacity, and gradually screw it down until you find you can only just obtain reaction effects over the whole tuning range when the reaction condenser is full in.

After this you can leave the added condenser alone and tune on the set as usual and you will find that there is a very definite improvement in sensitivity, particularly on the long waves.

WHEN A CHEAP TRANSFORMER IS BEST.

"PUZZLED" (Leigh-on-Sea).—"Finding that this short-wave work gets more and more interesting, I determined this year to build a special two-valver for it, keeping my other set for use of the family.

"At first I was very disappointed, for I struck a threshold howl which I could not cure, and was regretting the time and trouble taken. However, I happened to mention this to a friend who suggested that my L.F. transformer was too good, and, at his suggestion, and without much hope of success, I changed over the transformer I had for an old one which I have had standing by ever since I dismantled my first set.

"The remarkable thing was that it completely cured the trouble, as he said, and though I have tried putting the best transformer back again, it always results in the return of the howl; so I have come to the conclusion that the old one deserves the job. Why is it that the more expensive type fails to function satisfactorily?"

So much depends upon the exact circuit, and there are so many other factors that affect threshold howl that it is impossible to say off hand why one transformer works better than the other. However, it is quite a common experience to find that, where there is a tendency to threshold howl, an old-fashioned and rather high-capacity L.F. transformer is better than a more modern transformer, which generally has a much lower self-capacity and a much greater efficiency in an ordinary broadcast-wave-length set.

Sometimes it is possible to use the more modern transformer if a high-resistance is shunted across the primary of this; whilst, in other cases, a cure is effected if the output of the receiver is wired for choke coupling instead of direct output. We do not think, however, that your results will necessarily be better if you persuaded the high-quality transformer to work instead of the older one; so, in the circumstances, we should be inclined to leave well alone unless, like many short-wave enthusiasts, you are fascinated by the problem and would like to work out for yourself what are the factors affecting the short-wave set's efficiency.

STARTING SHORT-WAVE WORK.

G. M. (Guildford).—"I have always been tempted by the short waves, and although I have now built two receivers for this class of work I never manage to get them to oscillate.

"For ordinary broadcasting I must have built at least a dozen sets and as I never had any

trouble with these at all I am quite at a loss to understand why I cannot oscillate on low waves, even when sets, batteries, and everything appear to be O.K. How do you account for this?"

We should suspect that you have been up against the old fault of coupling the aerial too tightly.

For successful short-wave work it is essential that the coupling between the aerial and the grid circuit should be really loose, and we do not doubt that if you remember this in your next short-waver, you will have no difficulty in getting oscillation on very low wave-lengths. If your set has to employ a separate aerial coil, remember that if you place a coil of too many turns in this coil holder you will be coupling the aerial too tightly to the grid coil, and this is quite sufficient to prevent reaction effects. Consequently you must use a few-turn (say two-turn) coil in the aerial and do not put up with unsatisfactory reaction effects without trying alterations in the size of the coil, or a much shorter aerial.

If the set has an aerial lead terminating in a clip for putting on to one of the turns of the grid coil remember that loose coupling is obtained if this clip is adjusted near to the earth end, and not to the grid end, of the coil. By varying the position of the clip, you will soon learn to obtain just the right degree of coupling to give satisfactory reaction effects over the whole tuning range.

Finally, if this set should be used with a small variable condenser between the aerial lead and the aerial terminal to vary the coupling, this condenser must be set towards its minimum in order to give loose-coupling effects, as if a fairly long aerial is employed and the aerial coupling condenser is set "all in" the set may refuse to oscillate even though everything else is in perfect order.

Remember also that the H.T. applied to the detector valve has an important effect upon the oscillation control, which is to some extent also dependent upon the value of the grid leak.

SWITCHING THE "P.W." FOUR FOR LONG AND SHORT WAVES.

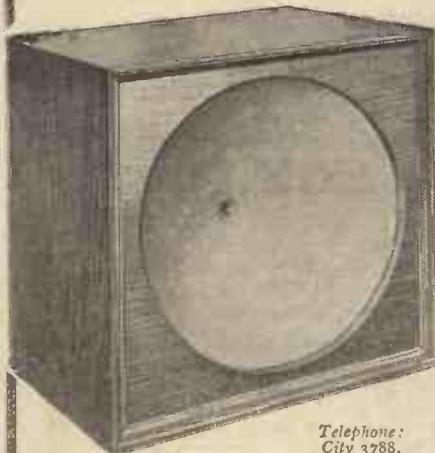
L. S. (Bolton).—"In the 'P.W.' Four, where does the short-wave X coil go—in the holder near the reaction condenser, or near the anode tuning condenser? And which side does the corresponding switch move to, for short and for long waves?"

(Continued on page 342.)

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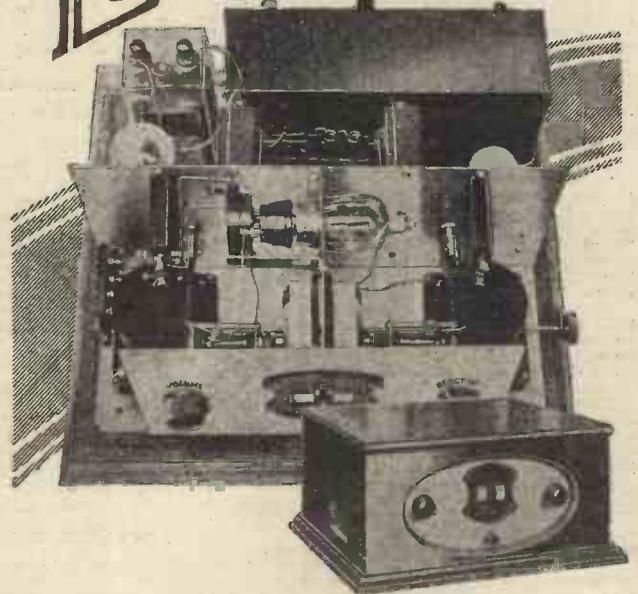
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P.W. 19/10/29

Caution

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 340.)

It does not matter in the least whether you put the short-wave X coil in the holder near the reaction condenser and screen, or in the other holder, near the L.F. transformer.

In either case, one coil is disconnected when the other is used, so we suggest you put the short-wave X coil in the holder near the screen, and the 250 coil in the holder behind the anode tuning condenser.

If you set the knob of the second wave-change switch so that its pointer is upright when in the central (off) position, the turning of the knob to the left will switch over to short waves. And, when the knob is tuned to point towards the right-hand (big) coil, the switch will join up the long-wave coil instead.

HOW TO TUNE THE "P.W." FOUR.

J. M. (Falkirk).—"What size 'X' coils should be used in the 'P.W.' Four, and what is the best way to handle this set to bring in distant stations?"

The long-wave coil for the "P.W." Four should be an X No. 250, and for the short waves either a 60 or a 75 X coil may be employed.

The operation of the set is really quite simple if a little trouble is taken to learn the correct use of reaction. This is only necessary if you wish to go in for real long-distance work; for, as a matter of fact, the "P.W." Four is so sensitive that the reaction condenser can be set almost at zero and left alone if desired, the correct operation of the two tuning dials being all that is necessary to bring in alternative programmes; but with the reaction the range of the set is enormously increased, provided that the reaction is handled properly.

Looking at the set from the front, there will be seen the first wave-change switch towards the left of the panel, the other controls being the aerial tuning condenser, potentiometer, reaction, second wave-change switch, H.F. tuning, and on-off switch in the order named. To run the set for ordinary reception you pull out the on-off switch, set the reaction at zero position, place both wave-change switches to cover either long or short waves, as desired, and then adjust either of the tuning dials so that not very strong signals are received.

Now adjust the potentiometer for maximum signal strength, the idea being to tune-in to a fairly weak

signal and, leaving all the controls alone except the potentiometer, bring it up to maximum strength with that. The potentiometer having been adjusted to the most sensitive position, it can be left alone and attention turned to the tuning.

The only point to watch with these dials is to see that they are both "in step"; for, unless both circuits are tuned to the same wave-length, there will be a large drop in signal strength, and many stations will be missed. The ideal condition, of course, would be for the wave-length always to be in step if

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

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Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: On receipt of this an Application Form will be sent to you free and post free immediately. This application will place you under no obligation whatever, but having the form you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS PLEASE NOTE: Applications should NOT be made in person at Fleetway House or Tallis House.

the tuning dials were in step; that is to say, that if the aerial tuning condenser is adjusted to 5 degrees, the anode condenser should be adjusted to 5 degrees also, and any station on that wave-length would automatically be received. If the aerial dial is then turned to 50 the anode dial would be turned to 50 also, when stations on that wave-length should automatically come in.

Unfortunately, owing to small differences in coils, etc., the matching of the dial readings does not usually mean that the circuits are necessarily in tune; although, of course, the dial readings will correspond, more or less, with the tuning.

Probably the easiest way for a novice to tune a set of this kind is to set both condensers at "0," and if there is no programme there, to first of all tune the anode condenser to 5 degrees, leaving it in that position for a moment. Slowly turn the aerial condenser from 0 and 10 or 12 degrees, and if any weak transmissions are brought in on the aerial condenser, leave this set for maximum strength and turn the attention to the anode condenser, when a slight alteration will be bound to improve or weaken the transmission being heard.

If it is still too weak to be enjoyable, then gently increase the reaction a very little way, readjusting slightly the aerial, and then the other condenser, to make sure that maximum strength is being obtained. When you have had enough of this station, slacken off the reaction again and set the anode condenser first at 10 degrees, then at 15 degrees, then at 20, and so on, pausing each time it is reset to search round with the aerial dial for 5 or 10 degrees around the corresponding number.

For instance, if the anode condenser is set at 20, the aerial condenser may need to be rotated slowly between about 10 and 30. When a weak signal is heard do not swing both dials, but do as formerly—i.e. first of all tune the aerial, until the signals are at maximum. Then, leaving that alone, turn attention to the anode condenser till the station is tuned in satisfactorily on that also, and then finally bring up the reaction a little until the required strength is obtained or until the station is found to be too weak to be worth listening to.

The point to watch in tuning a set of this kind is that first one dial should be set to wave-length and then left alone, whilst the other dial is rotated until the best signal strength has been found. If you keep a log of the station positions you will soon be able to tune in lots of stations, for it will be found that neither of the tuning dials "varies," but they always have to be set at exactly the same positions for the same wave-length; though, of course, very delicate adjustments may be necessary to get absolutely the last ounce from a very distant station.

ADDING AN EXTRA L.F. VALVE

P. N. G. (Glamorgan).—"What I had in mind was a resistance stage added to a two valver, and I have on hand a .01 fixed

(Continued on page 344.)

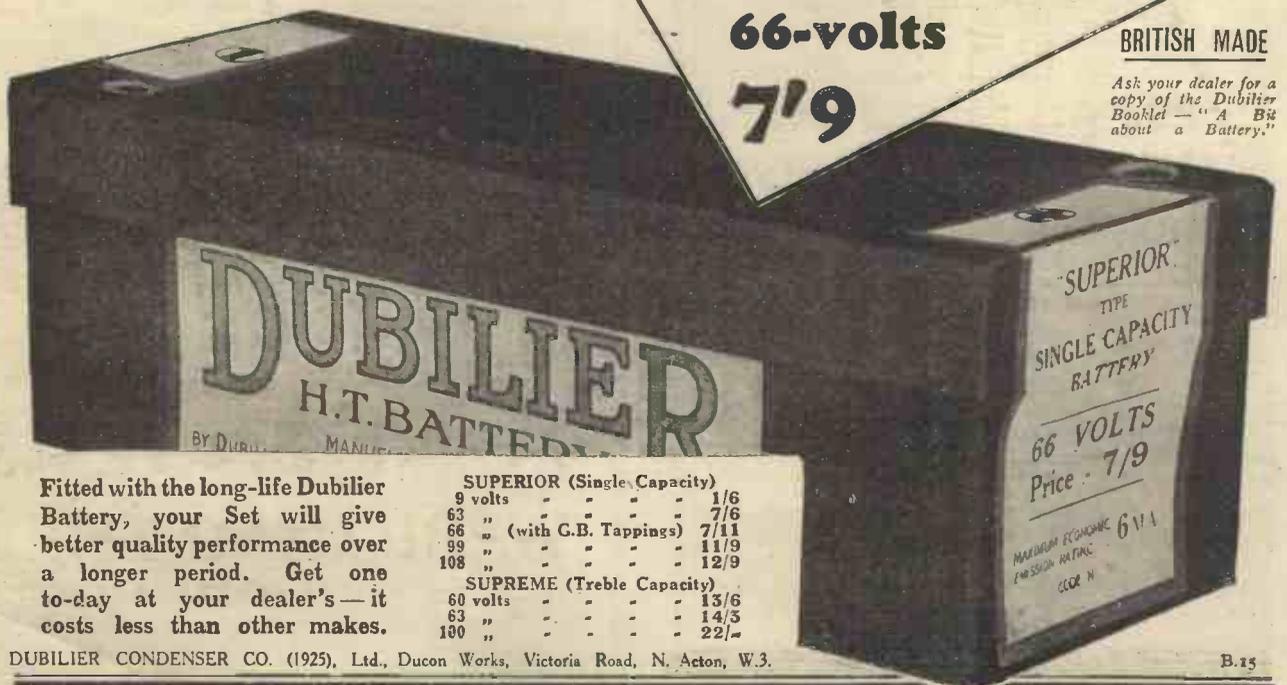
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99 "	-	-	11/9
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60 volts	-	-	13/6
63 "	-	-	14/3
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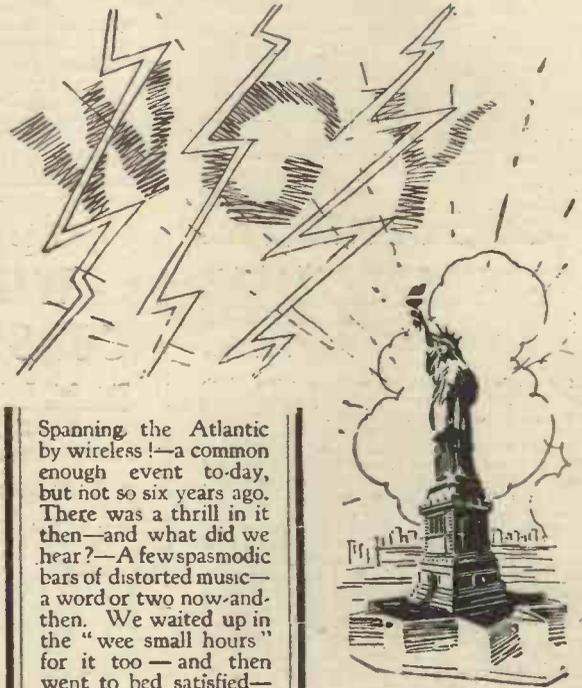
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B.A.9	1.9	0.05	General Purpose -	5/6
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We marvel to-day that we managed to do anything at all with such elementary gear—it was a good performance for those days, however commonplace it may be now. Many things have changed since then but T.C.C. Condensers were used—as a standard—then, and are still the standard to-day. Be guided by the veterans of radio and use a T.C.C. wherever a condenser is specified.

Here is a .0003 mfd. Mica Condenser Price 1s. 3d. each, other capacities from .0001 to .01 mfd. Prices 1s. 3d. to 2s. 6d.



T.C.C. CONDENSERS

WERE USED THEN

Adv. Telegraph Condenser Co., Ltd., Wales Farm Rd., N. Acton, London, W.3

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 342.)

condenser, mica, an anode resistance, grid leak valve holder, etc. So, if you can give me the necessary wiring in words, I think I can make a good job of it. As the set is good and strong at present, I have got a power valve in the last stage, and I suppose I shall have to increase my grid-bias battery?"

Yes, you will need higher grid bias when you get the power valve going, and we advise you to use as much high tension as you can manage. If you look at the valve-maker's curve for the power valve, you will see the number of grid volts that are necessary for use with the H.T. voltage you intend to employ.

Having purchased a suitable grid-bias battery, you can connect up as follows: First of all, mount the valve holder in a suitable position on the baseboard, arranging the holder for the anode resistance near to this. Close to the grid of the valve holder mount the .01-mica condenser and the grid leak. You will require an extra H.T.+ terminal.

Join the anode resistance across those wires which now go the loud-speaker positive and negative terminals. The loud speaker, of course, is disconnected from these, and two other loud-speaker terminals are provided near to the near H.T. positive terminal.

Having inserted the anode resistance across the points which previously went to the loud speaker, connect that end of the resistance which is now joined to the plate of V2 to one side of the new coupling condenser (.01 mfd.). The other side of this condenser is joined to the grid socket of the new valve holder and also to one end of the grid leak.

To the other end of the grid leak is connected a flexible lead terminating in a black plug which is inserted in the grid-bias battery at the required negative voltage. One of the filament terminals on the new valve holder can be taken to the lead on the old set which at present joins the grid-bias positive and the two-valve filament sockets together, and which also goes to earth, etc.

The other filament socket on the new valve holder is joined to the lead which connects L.T. positive to the remaining two filament sockets on the valve holders, etc. Finally, join up the plate socket of the new valve holder to one of the new loud-speaker terminals (negative), and then join the positive

L.S. terminal to the new H.T. positive. This completes the wiring. (See also "P.W.," September 28th issue.)

GRID-BIAS CONNECTIONS.

W. N. (Peterboro').—"Blue-print connections show an R.C. coupling unit with one of its terminals marked H.T.+, one marked P, one marked G, and one marked G.B.— My own resistance-capacity unit, which is an old one, has no G.B.— terminal, but is marked as

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follows: H.T.+, P, G, and L.T. Is it correct to take L.T. to grid-bias negative? If so, how many volts?"

Yes, it is quite correct to take the L.T. terminal as though it were marked G.B. and provide it with a flexible lead terminating in a black plug for negative grid bias. The amount of grid bias necessary will depend upon the valve you are using and upon the H.T. you are applying to this.

HAND-CAPACITY ON SHORT-WAVER.

"CURIOUS" (Manchester).—"Why is it that hand-capacity effects are so noticeable on short waves whilst with the same set, working

on long waves with different coils, there is no trouble in this respect at all?"

All short-wave work is more "finicky" and touchy than work on the longer wave-lengths, owing to the fact that the frequencies being dealt with are enormously greater and the high-frequency current has many peculiarities which are not noticeable on lower frequencies.

The amazing thing is not that hand-capacity effects occasionally show themselves, but that wave-lengths representing a frequency of millions per second can be dealt with at all with quite simple receiving apparatus and without the long extension handles or ultra care that were thought to be necessary a year or so ago.

PROTECTING THE VALVE.

H. P. (Sittingbourne).—"Being informed that an ordinary flashlamp bulb of the low-consumption type will act as a fuse to protect the valve from being accidentally burnt out, if fitted in the H.T.— lead, I inserted a flashlamp bulb of this type in my own flexible lead, and found that results were just as good as formerly, although the lamp does not light up. Is it a fact that this affords a good protection against short-circuit or similar troubles, and, if so, can I make a permanent job of the fuse inside the set instead of having it dangling about in the flexible lead, as at present?"

A flashlamp of the low-consumption type makes quite a good fuse to protect the H.T. circuits, saving the H.T. battery and the filament of the valves in case of a short. But as the current passing through the lamp in such circumstances is very small it will not light. (This will only happen if excessive current flows, when it acts as a warning signal that something is wrong.)

You can easily insert the fuse in the permanent wiring of the set instead of bothering with it in the flexible lead. Disconnect all batteries, etc., and examine the wiring on the inside of the H.T. negative terminal.

Probably this is connected to the L.T. negative terminal by a short, straight wire (most sets are arranged in this way as the two points are nearly always connected directly together), and if it is so in this instance all you have to do is to break the wire and insert the flashlamp bulb in series with it. If, however, this lead goes to a switch, or to some other point on the circuit, insert the flashlamp bulb holder between the main H.T.— terminal and the switch, when the effect will be the same.



The SQUIRE UNIVERSAL No. 97 b.

THE new Universal (No. 97 b) and the new Power Model (No. 98) fitted with 9" and 12" cones respectively will take every unit at present on the market including the new Amplion BA2. They will take yours. In each case the cradle is of aluminium, cone of the latest Vellume type and the beautifully polished octagonal front gives the speaker a really finished appearance. This is entirely in keeping with the magnificent reproduction afforded. See them at the Manchester Radio Exhibition, Stand 116 (Gallery), or drop us a postcard for a fully descriptive leaflet.

- 97b Aluminium Cradle, Enamelled and Polished, fitted with Vellume cone and octagonal front, back leg and bracket also included 15/-
- 98 Similar in every respect to the above, Universal Fitting, etc., with 12" Vellume Cone and Octagonal Front, back legs and bracket included 18/6

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P & T

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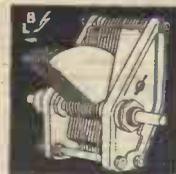


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UNIVERSAL LOG CONDENSER
For panel mounting with dial control, or for drum control. Very easily ganged. Single hole fixing.



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ANOTHER LEAD BY FERRANTI

Recent developments in Radio have created a demand for a new transformer of the same quality and reliability as the AF5, but capable of greater L.F. amplification. In their class of medium ratio, the Ferranti AF3, AF4 and AF5 are still supreme; but changed conditions—notably the advent of the Screened Grid Valve—have rendered this a necessary addition to the standard range.

THE AF5 RATIO 1/7

Designed to ensure the maximum volume where only ONE L.F. stage is employed with Grid Leak rectification. It is particularly suitable for sets of the S.G.3 type, where greater amplification is desired than is usually obtained from one L.F. stage. The curve is better than that of the AF3, and the amplification is twice as great. This new transformer is not intended for use in receivers employing more than ONE stage of L.F.

PRICE 30/-

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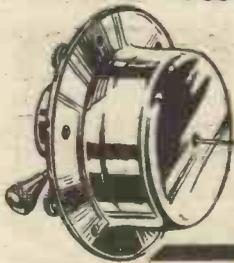
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HART BROS. ELECTRICAL MFG. Co., Ltd.
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The type H.T.3

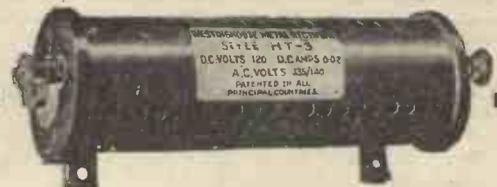


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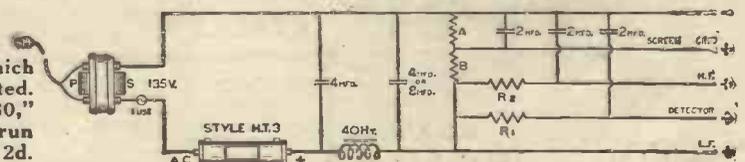
suitable for incorporation in high-tension eliminators requiring up to 20 milliamps at 120 volts.

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There are a number of other types also, from which any type of eliminator or charger can be constructed. Full details are given in "The All-Metal Way 1930," our new 32-page book which shows you how to run your set entirely from your A.C. mains. Send 2d. stamp with your name and address to :-

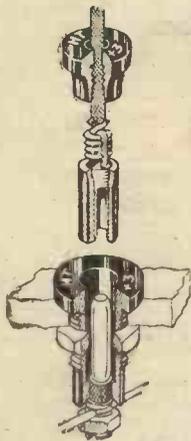


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SAFEST — BEST CHEAPEST.

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MODERN CRYSTAL SETS

Although the crystal receiver is being rather badly neglected by the world's radio laboratories, its uses and its possibilities should not be forgotten. In this article some cheery information for crystal enthusiasts is given.

By G. V. DOWDING, Grad.I.E.E.

THE first set described in "P.W." was a crystal set, and, for a long time, this type of receiver was by far the most widely used. Then, by degrees, there filtered through rumours of the building up of an enormous percentage of valve sets. Eventually, I now speak of to-day, and, judging by authentic figures, crystal receivers form a small minority.

Maybe, the declining popularity of the crystal set is only a comparative one. It is possible that there are to-day just as many crystal-set users as ever, but that more new-comers have been attracted by valve sets than by the battery-less, power-less type of outfit.

Question of Quality.

This is as may be; but, undoubtedly, the crystal set has lost its erstwhile position as the provider of the best quality of reproduction. In the early days of broadcasting there were many who were driven from the valve to the crystal in order to obtain something that the critical ear could stand. Nowadays the crystal set does not provide the purest quality.

To start with, all crystal detectors distort, while the response curve of the average pair of telephone receivers compares un-

favourably with that of the average cone loud speaker. In passing, I must say that it is a pity that more research has not been carried out in regard to the design of "phones." I once started to take the response curve of a pair of headphones I have by me at home, but was so alarmed by its undulations that I desisted.

Ideal for Some Purposes.

Yet, while the quality of a crystal set of to-day, or yesterday for that matter—for the crystal set has made but little material advance—is barely equal to that of an average valve set, the small volume and freedom from extraneous noises makes the listening very pleasurable. There is no local power to generate harsh resonances and to amplify other distortion effects.

Also, a crystal set still has its applications and must not be neglected. It is ideal for a listener fairly close to a broadcasting station who does not wish to be bothered by batteries or mains connections. Again, it must be remembered that you can build a crystal set for two or three shillings; the cost of a whole installation, including the licence and a pair of telephone receivers can be kept within the thirty-

(Continued on page 348.)

Begin building the NEW COSSOR Melody Maker!

Don't delay another day! Begin building the wonderful new COSSOR Melody Maker! Enjoy the advantages of this amazing three-valve screened grid Receiver! You can build it in under an hour. WARNER'S—Britain's Biggest Radio Stockists can supply you with the complete COSSOR Kit including valves for a first payment of 14/2 only. There are 12 further payments of 14/2 to complete purchase. But remember: you need pay only 14/2 to begin building this super set! Payments are as simple as construction under the WARNER system. Fill in the coupon below NOW!

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and all worry of replacements is gone for good. Proved reliable, efficient non-creeping, neat and compact. Eliminates 'background.' Improves reception. In every way to be recommended as sound H.T. Before you buy another dry battery seriously consider the STANDARD Permanent Wet H.T. first.



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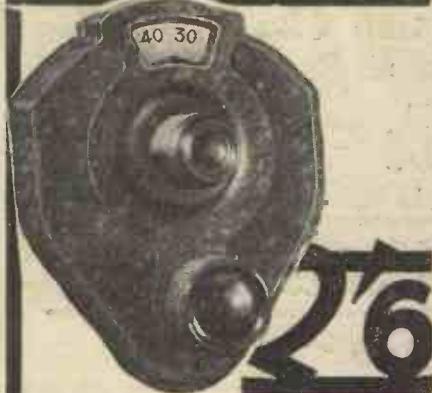


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BROWNIE are now producing 2,000 Dominion Vernier Dials a day. That is why it is possible to offer this high-grade dial at the wonderful price of 2/6.

The mechanism is a special non-backlash design with a reduction ratio which makes fine tuning easy without becoming tedious.

Finished in plain black or beautifully grained mahogany Bakelite.

BROWNIE ♦♦ WIRELESS

Nelson Street Works, London, N.W.1.

MODERN CRYSTAL SETS.

(Continued from page 346.)

shilling mark, and this is the price of but a very cheap loud speaker indeed.

A crystal set, again, makes a very good standby for a valve set. It requires no maintenance whatever, and can be stored away in a cupboard, and will be available for use any time it is required. I have always had a crystal set and it has certainly proved very useful. Complete break-downs in my valve installation have been few, but the crystal set has filled some awkward gaps caused by these rare occurrences. During the general strike, for instance, I was able to listen to train bulletins despite the fact that I had not a charged accumulator in the house.

The progress of the crystal receiver was slow and sure up to the time of the introduction of the "oscillating" crystal circuits. These were thought in some quarters to be precursors of a new era in radio reception; but, unfortunately, they did not prove practical propositions, and in due course fizzled out.

blem of Selectivity.

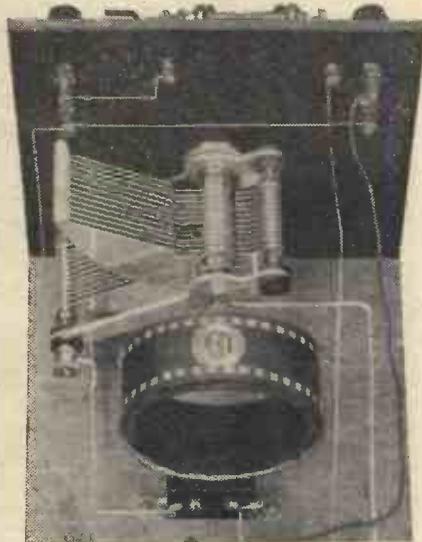
Since then, there has been very little doing in the way of crystal-set innovations. There has been one step forward in the evolution of the "100%" design on the part of Mr. G. P. Kendall and his staff. This circuit gives a better combination of selectivity and sensitivity than any other arrangement.

The question of selectivity has been the main problem confronting the designer of crystal sets. In this instrument you have

no local power on which to draw to supplement any losses that may occur. Until the inception of the 100% crystal set selectivity was only to be achieved by sacrifice of power, and compromises between the two qualities had to be made.

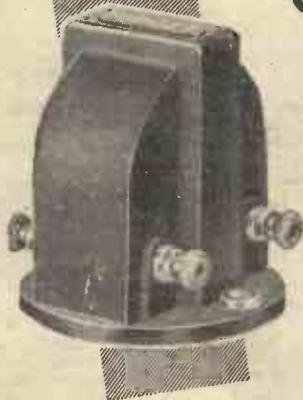
There are, of course, some other very good circuits, and from time to time no doubt fresh ones will be placed before you, but, at present, there is no indication that there will be any material advance in this rather minor stage of radio.

For one thing, the big radio concerns no (Continued on page 350.)



A coil, condenser and detector comprises a crystal set, the simplest of all radio receivers.

*One of the
outstanding
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Olympia*



The new British General Midget Transformer created remarkable interest. In accordance with modern practice of economising in weight and space this transformer has been produced in a remarkably small size. The core is of the latest Nickel Alloy (specially treated) and the performance is as good as many transformers at three times the price.

11/6

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Ask for

EDISWAN

VACUUM RESISTANCES

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CARTRIDGE CONDENSERS.

These condensers are ideal for the man who likes to experiment. In a second, you can pull one out of the clips and put in another of a different value. They are made in values from .0001 mfd. to .001 mfd. Overall length, 45 mm.

For the best results.



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For best results
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"MAGIC THREE"
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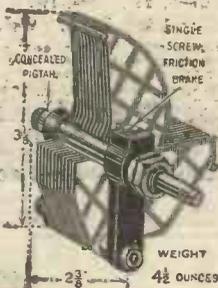
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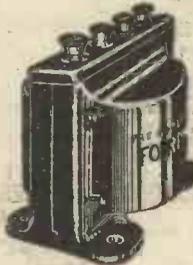


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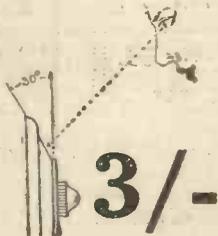
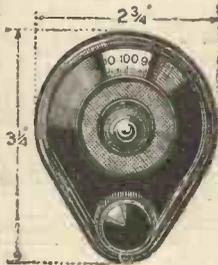
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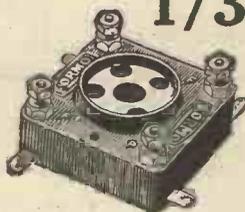
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DIAL



VALVE
HOLDER

1/3

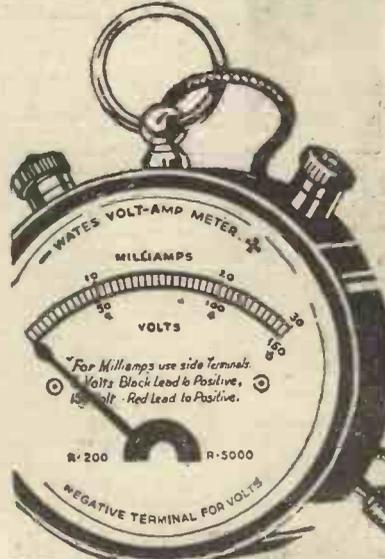


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"three in one"
VOLT-AMP
RADIO TEST METER



READINGS

0-150 VOLTS

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0-30 MILLIAMPS

Res.: 5,000 Ohms.

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Price 8/6. Case 2/6 extra.
Panel-Mounting Three-in-One Model 13/9. Panel-Mounting Milliammeters with jewel bearings, 0-50 or 0-25 M.A., 9/6.

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8/6

M.B.

Three in One

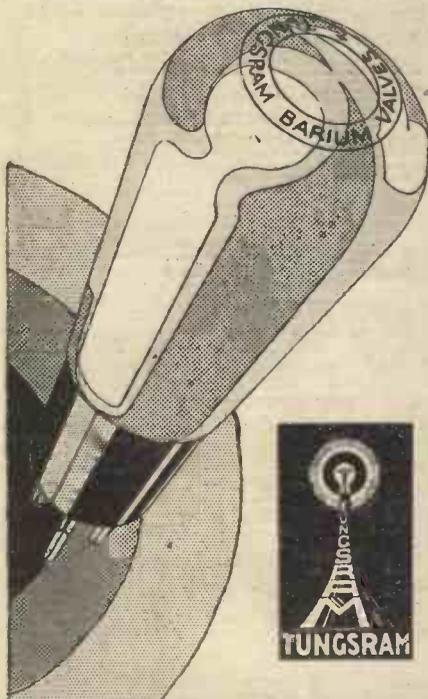
They cost less

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Your dealer stocks a full range of 2, 4 and 6 volt types.

Prices - 5/6 to 10/-

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72, Oxford Street, London, W.1
Branches: Belfast, Birmingham, Bristol, Cardiff,
Leeds, Manchester, Newcastle, Nottingham and
Glasgow.

MODERN CRYSTAL SETS.

(Continued from page 348.)

longer entertain crystal-receivers in their laboratories. I doubt if there is one commercial radio laboratory in the world that is spending any real time on the development of the crystal. On the other hand there are thousands of scientists concentrating on the valve.

The "P.W." Research Department.

We must look to the remaining amateur enthusiasts for any further crystal-set progress and, I must not forget to add, the "P.W." Research Department. This will not fail to devote time to crystal-set research while there is still evidence that there are people who want to use these instruments.

I, personally, think there is still much that can be done and that round the corner of the future there is something waiting that will give the crystal set a real fillip. "P.W." readers will no doubt agree with

The NOVEMBER WIRELESS CONSTRUCTOR

is NOW ON SALE

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FULL CONSTRUCTIONAL DETAILS

of

THREE FINE SETS

as well as a wealth of other informative and interesting articles.

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Obtainable everywhere. Price 6d.

me that if a simple crystal set could be designed which would, with, perhaps, the assistance of a flashlamp battery, give really good loud-speaker signals, if from only one station, its popularity would be enormous.

PERTINENT PARAGRAPHS.

If you have not done much set building remember when making a set that you should occasionally insert the valves and the coils into their respective places, so as to make sure that none of the wires will fou! them.

It often pays to insert a variable filament resistance for the short-wave detector valve when reaction control is not perfect, as slight adjustments of this will often overcome difficulties in the control of oscillation.

A pair of dividers makes an excellent instrument for marking out a panel.

THE MODERN MODE IN HOME MUSIC



The Instrument which converts your existing Radio Receiver into a modern Radio Gramophone

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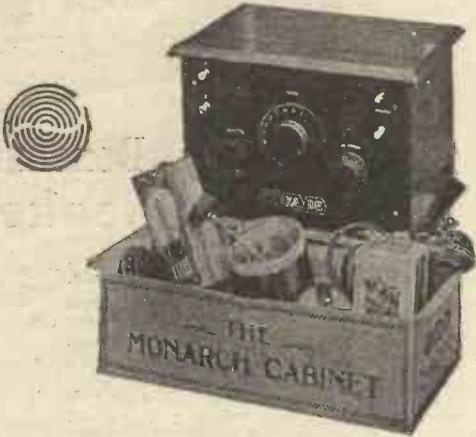
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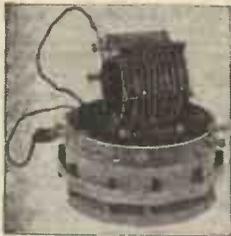
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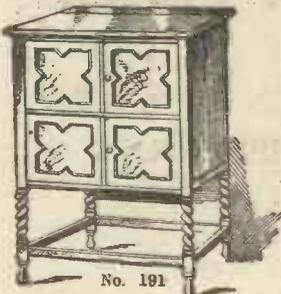
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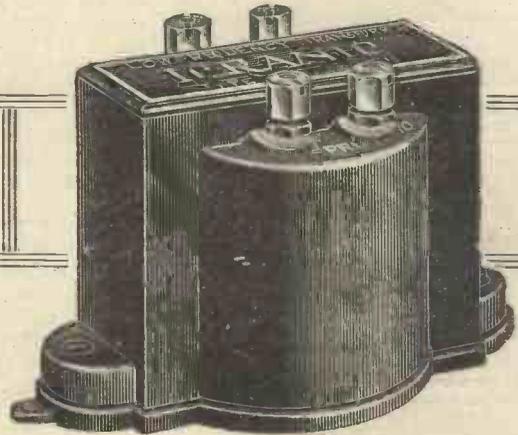
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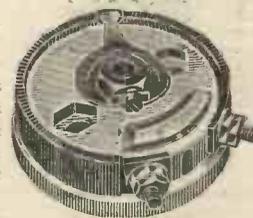


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COUNTERPOISE EARTHS.

By C. RADFORD

THERE are two reasons why people use counterpoise earths. In some cases, the more conventional earths, such as buried plates and water-pipes, are not available, while there are instances where the only cure for serious interference is to employ the counterpoise variety. But before going any further, I must point out that counterpoise earths, buried aerials and all other such devices are useless for the elimination of atmospherics.

There are many ways of reducing the strength of static, but invariably, you also reduce the strength of the station you want to listen to. If a radio station can get its transmission through to your loud speaker, so can atmospherics arrive as well. Fortunately we do not in this country suffer from static to the same extent as they do in many other parts of the world.

Reducing Atmospherics.

Nevertheless, it can be troublesome at times, especially during the summer. The thing to remember is that the greater the ratio of signal to static that you can get, the less will be the effective interference. A great deal can be done by taking advantage of the threshold or relay action of most detector circuits.

If you can arrange conditions so that the static falls just below the "efficiency line" of the detector while the signals from your desired station remain above, the interference is going to be negligible. You can play on this point in complement with something else which is not generally realised. This is, that some proportion of static is tunable.

This means that atmospherics are less troublesome in the case of sharp tuning circuits than with inselective sets of equal sensitivity. If you have a high-frequency volume control, tune in the station as closely as possible, running the set all out, and then reduce volume with the appropriate control. A similar effect, although not so marked, can be obtained by close tuning followed by volume control in the L.F. stages.

Quite Efficient.

When atmospherics are very bad, such as when a local thunderstorm is raging, nothing can be done, and it is best to safeguard the house and set by earthing the aerial outside the house. The real purpose of this article, however, despite the diversions regarding static, is to discuss counterpoise earths, or counterpoise aerials as they are frequently termed.

I prefer to call them counterpoise earths, even although the term is somewhat paradoxical. Nevertheless, inasmuch as they replace ordinary earth connections, it must be misleading to amateurs to have them styled "aerials."

A properly arranged counterpoise is just as efficient as a buried plate in the ground; in fact, it is distinctly more effective. By avoiding a connection to the ground, you get away from earth currents

(Continued on page 354.)



A New Whiteley Boneham Loud Speaker

This is the new model which proved so popular at Olympia. The Mellow Tone and Full Volume of this Speaker are things to marvel at. It brings out the low and the high notes to exceptional advantage without overloading. The case is beautifully made and finished in mottled bakelite. At 42/- this new Whiteley Boneham Speaker is one of the big things in present-day speaker value.

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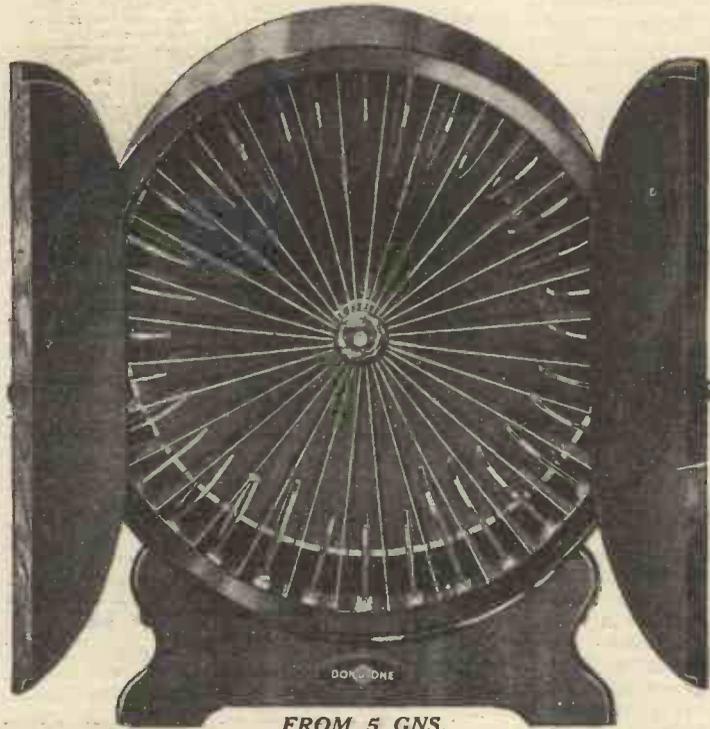
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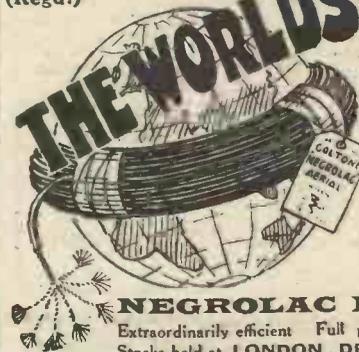
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"I think it is just wonderful—the results are simply amazing. It has improved my 3-valve set 100 per cent. All stations come in now so much purer, and certainly they are nearer to one."

Mr. S. H. H., Trowbridge, writes:—

"Really the result is simply marvellous, and all that have heard my set since putting the aerial up think it splendid."



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For the SENIOR ORGOLA RECEIVER

Oak - 36/-
Mahog. 40/-

COUNTERPOISE EARTH

(Continued from page 352.)

which are particularly troublesome in the close neighbourhood of some electric railways and power stations.

You can always test for this source of interference by disconnecting the earth-lead from your set and, if crackling or other noises which have been troubling you cease, it is clearly indicated that a counterpoise should be used and as carefully insulated from earth as is the aerial.

It can take the form of another wire or wires of the same length as the aerial, and run underneath it, but only a few feet from the ground. It is a distinct advantage to extend the counterpoise wires in the other direction for a few yards, if this can be arranged.

It should not be forgotten that if you earth your aerial to a counterpoise during a thunderstorm, complete protection is not afforded you against lightning. A direct earth should be available in the shape of a buried plate or such-like, for precautionary earthing purposes.

For Flat Dwellers.

I have said that there are people who are unable to make water-pipe connections or bury plates or metal in the ground in order to obtain conventional earths. For instance, a listener may be using an indoor aerial in an upper flat in an apartment building, a long way from a water-pipe. It is not often that one meets these conditions, but even where a water-pipe is handy from a domestic point of view there may be objections to running wires to it.

I can visualise polished floors or thick walls that would form obstacles. Although a gas-pipe makes a good earth connection, despite what has often been said to the contrary, it is not wise to tinker with these. Also the pipes through which electric wires trail around the house are always very efficiently earthed, but I do not think that electric-light supply companies regard with favour radio connections to their apparatus (by the way, it is always as well to get the company's permission to use mains devices).

But any fairly big expanse of metal will make a good earth. A lead-covered roof is admirable, while fireplaces, fireguards, iron bedsteads and other such objects have very successfully been employed by many listeners. Failing these, wire netting can be laid down underneath carpets.

Area Is Wanted.

Something fairly expansive is needed. You should remember that you want area rather than bulk. Such things as I have been referring to are frequently styled capacity earths. With an instable frame aerial set, it is frequently a gain to bring in an earth connection, and you generally find that it considerably adds to the efficiency of the receiver.

It should be noted that quite a number of frame-aerial sets, particularly portable types, have their otherwise efficient circuits highly damped in order to attain the stability which more invariably accompanies a conventional earth.

Where the mains are used either for H.T. or for supplying all the local power needed, these, the mains, can be automatically brought in to operate as an earth, inasmuch as the filament circuits of the set via H.T. minus are connected to them.



NOTHING LIKE IT SINCE THE MOVING COIL!

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NEW OSRAM MUSIC MAGNET, CASH £9.0.0. Send only 16/6, bal. by 11 monthly payments of 16/6.
MULLARD ORGOLA KIT, including Oak Cabinet. Send only 14/3, bal. by 11 monthly payments of 14/3.
EKCO MODEL 3 F.20 (A.C.), CASH £3.19.6. Send only 7/3, bal. by 11 monthly payments of 7/3.
CELESTION C.12 (Oak), CASH £5.12.6. Send only 10/4, bal. by 11 monthly payments of 10/4.
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AN INTERESTING FILM.

THE action of electric currents in actual circuits is not easy to understand, because current flow, unfortunately, is not visible to the eye. Text-book explanations and diagrams are apt to leave the student with a confused impression of what really happens.

We were recently privileged to attend a demonstration at which a novel and interesting film was shown. This film is entitled "Rectification," and has been produced by the technical department of the Westinghouse Brake & Saxby Signal Co. to show the action of the Westinghouse Metal Rectifier.

The film explains the difference between alternating, direct, half-wave and full-wave rectified currents. The effects of transformation, and the use of a reservoir condenser are made clear with the aid of moving diagrams.

The film is both highly interesting and instructive, and we were informed that it is likely to be included in the series of lectures which will be given by the Westinghouse Co. to a selected number of radio societies.

FOR YOUR NOTEBOOK.

Careful maintenance and cleanliness are just as important to good results when running a set as when running a motor-car or bicycle.

Many an obscure fault has been traced to a faulty flex connection.

If your earth consists of a clip around the water-pipe, improved contact can often be obtained by giving this clip a sharp blow from a punch or nail so as to form little projecting teeth that will bite through any non-conductive film on the water-pipe into the metal beneath.

Enthusiastic gardeners should remember that wire stays from the aerial mast should not be run through the foliage of valuable fruit trees, as charges due to nearby lightning might easily damage the trees.

FOR PORTABLE SETS

If you are building a portable set remember that the modern anti-microphonic valve holder allows of considerable movement of the valves, and that to protect these sponge rubber, or some similar shock-absorbing material, will be necessary.

Owing to the possibility of short circuits, positive H.T. leads carried very near to screening boxes should be guarded with extra insulation besides that provided by the insulation covering the wire itself.

WET H.T. BATTERIES

If the zinc for wet batteries is amalgamated at home it should be remembered that it must not be allowed to come into contact with wounds or broken skins, or the results may be serious, for the solution is very poisonous.

Generally speaking, better results are obtainable with a small reaction coil closely coupled to the grid circuit than with a larger reaction coil placed at a great distance.

The Easy Way TO PERFECT RADIO

In addition to their own extensive range PETO SCOTT offer YOU every known Radio Receiver or Component. The list given below merely illustrates our terms for a few well-known lines and we ask you to fill in the coupon or send us a list of your requirements for which we shall be pleased to quote for cash or on our famous system of

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THE "P.W." FOUR (as described in issue of Sept. 21st). Complete kit, including polished mahogany cabinet, panel, and all specified components. Send only 17/8, balance in 11 monthly instalments of 17/8.
THE BROOKMAN'S THREE (described in "Modern Wireless," September issue). Complete kit, less valves. Send only 17/5, balance in 11 monthly instalments of 17/5.
NEW OREAM MUSIC MAGNET. Send only 16/6, balance in 11 monthly instalments of 16/6. Valves included.
MCMICHAEL SCREENED GRID THREE. Complete kit of components, including cabinet, valves, etc. Send only 16/3, balance in 11 monthly instalments of 16/3.

FERRANTI ELIMINATOR KIT for home construction, using Westinghouse Metal Rectifier. Output 200 volts, 100 m/a for A.C. Mains. Send only 16/-, balance in 11 monthly instalments of 22/8.
B.T.H. B.K. UNIT (for 6-volt accumulator or D.O. Mains). Send only 11/7, balance in 11 monthly instalments of 11/7.
REGENTONE W.A.B. S.G. (A.C. Mains). For S.G. and Pentode Sets. Send only 9/2, balance in 11 monthly instalments of 9/2.
EKCO 3 F.20 (A.C. Mains). Also for S.G. and Pentode Sets. Send only 7/4, balance in 11 monthly instalments of 7/4.
ALL LEADING MAKES OF ELIMINATORS from 4/7 first payment.
CELESTION C.10 LOUD SPEAKER in Oak. Send only 6/11, balance in 11 monthly instalments of 6/11. In Mahogany, 7/1.
CELESTION C.12 LOUD SPEAKER in Oak. Send only 10/4, balance in 11 monthly instalments of 10/4; in Mahogany, 10/9.
CELESTION Z.20 LOUD SPEAKER in Oak. Send only 14/3, balance in 11 monthly instalments of 14/3; in Mahogany, 15/2.

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TECHNICAL NOTES.

(Continued from page 316.)

between different coils but it has the drawback that a good deal of the energy may be lost owing to the setting up of "eddy-currents" in the shields themselves. Like so many other remedies, therefore, it is not a complete remedy but brings with it disadvantages peculiar to itself.

Basket Coils.

It is hardly necessary to touch on the coils of the basket type, as I suppose most of you have actually made basket coils yourselves for various purposes. A basket coil, of course, is formed on an arrangement consisting of a centre piece with a number of spokes, after the fashion of a car-wheel without the rim, the centre and spokes being arranged so that they can subsequently be removed, leaving the coil without any "former" at all.

In order that it shall keep its shape when the support has been removed, it is necessary to fix the various turns by means of some form of "dope," which may be shellac varnish, celluloid varnish or something else of the kind. The main drawback to the basket coil is that its high-frequency resistance is generally rather on the high side whilst the need for a coating of, say, celluloid varnish means that the self-capacity of the coil is increased, notwithstanding the fact that the formation of the coil itself is designed to diminish self-capacity. Nevertheless the basket coil has much to be said in its favour, as it is very easy and cheap to make and, being of flat formation, occupies very little space.

The honeycomb coil is in a sense a variant of the basket coil. Honeycomb coils are still considerably used and can be made quite small and still be efficient, although again the high-frequency resistance and self-capacity are both apt to be rather higher than one could wish.

Special Forms.

Coming back to the solenoid type of coil, this has been very considerably improved since the days when it was simply a plain cylindrical coil wound upon a tube. In order to reduce the self-capacity, the type of the former has been changed and solenoids are sometimes wound upon a hexagonal prism, so that the wire touches at only six points per turn.

Various other shapes of "former" may be used and again the coil may be fixed by means of the dope whilst it is on the "former," the latter being then removed, leaving the coil entirely self-supporting.

Fieldless Coils.

There are one or two other points I should just like to touch upon before leaving the question of coils. I mentioned above the importance of limiting the electromagnetic field of the coil and how this may be done with a solenoid by winding the two halves in opposite directions.

The same thing applies in a general way to any type of coil, but there are one or two types which have been designed so that the limitation of field is secured in another way. For instance, there is the so-called "binocular" coil, which consists really of a solenoid coil divided into two halves, the two halves being placed side by side, after

(Continued on next page.)

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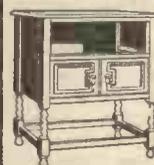
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See Advertisement on Page 343

TECHNICAL NOTES.
(Continued from previous page.)

the fashion of the two telescopes forming a pair of binoculars—hence its name. The electro-magnetic field in this way tends to follow an unbroken circuit through the two coils and the stray field is thereby very much limited.

Toroids.

Carrying this idea to the extreme limit we have the so-called "toroid" coil, which is really a solenoid coil bent round into a circle, the two ends being brought together—not unlike a balloon tyre of a motor-car. The field inside a coil is popularly supposed to be entirely contained within the windings, but a little consideration will show you that this is impossible and, in fact, there is a certain amount of stray field even with a toroidal coil, although the stray field is distributed in a way which causes much less trouble than with a straight solenoid.

Inductive Values.

I think the foregoing remarks, although perhaps very elementary to those of you who are accustomed to make your own coils, will help to clear up any little points as to terminology for the sake of those of my readers who are comparatively new to radio. I find that newcomers sometimes get completely mixed up between basket coils and lattice coils.

There is very little difference in principle between these types and, of course, any coil, no matter what its form, depends upon the principle of magnetic induction. Broadly speaking, the considerations which govern the design of coils are questions of self-capacity, high-frequency resistance, inductive value and stray field or interaction between the coil and other coils or other components in the set.

Bearing these facts in mind, I think you will have no difficulty in seeing why coils are made in special shapes or forms or of special sizes (upon the inductance value, of course, depends the wave-length), and why some constructors prefer one form and some another.

H.F. Amplifiers.

I have more than once touched on the question of the importance of using correct grid bias with any type of valve, more particularly with valves used as low-frequency amplifiers. The proper bias not only has the effect of working the valve at the proper part of its curve, but incidentally of economising anode current and thereby prolonging the life of the H.T. batteries. In other words with the proper grid bias you get better reproduction, less distortion and longer high-tension-battery life.

Now I want to say a word about the matter from the other end, as it were, that is, not the importance of using a sufficient value of grid bias but the importance of not using too much.

I refer more particularly to the case where a valve with a somewhat high magnification factor is used as an H.F. amplifier. A sufficient value of grid bias must be used to counteract the tendency for grid current to flow, as in this way the impedance of the valve is reduced to a minimum and, of course, the amplification obtained with the valve is kept to a maximum.

(Continued on next page.)

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TECHNICAL NOTES. (Continued from previous page.)

G.B. and H.T. Volts.

When dealing with high-frequency amplification the problem is in many ways quite distinct from that of low-frequency amplification, mainly owing to the small signal voltages which are dealt with. In consequence of the fact that the signal voltage in the case we are considering may be extremely small we shall often find that the correct grid-bias voltage is only a fraction of a volt.

Alternatively, if the grid-bias voltage used is too large, it means that we have to employ a correspondingly higher value of H.T. in order to obtain the same result—the increase in H.T. volts being, of course, enormously greater than the increase in grid-bias volts. There are two or three simple ways in which a fraction of a volt may be applied to the grid of the H.F. amplifier. One is to use a simple potentiometer which need not be adjustable but can be "set" once for all (consisting, in fact, simply of a tapped resistance).

Valve Developments.

It is interesting to notice that in the development of receiving valves during the past four or five years, there have been continual reductions in the voltage and current ratings of the filament, until now we have the many excellent examples of receiving valves working from 2 volts and consuming only one-tenth of an ampere. The old bright-emitter valve generally consumed over ½ ampere at 4 volts at least, so that you see the wattage consumed by the modern 2-volt dull-emitter filament is only a small fraction of that consumed by the old 4-volt or 6-volt bright-emitter.

The anode current at the same time has, however, been increased, not only by the greater emissivity of the filament under given conditions, but also by the design of circuits adapted to enable much higher values of H.T. voltage to be used. The net result is that enormously larger anode currents are used to-day than in the receivers of four or five years ago, with consequent increase in output power.

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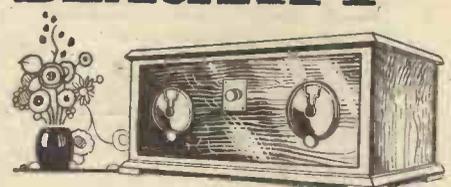
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A RAPID GUIDE TO RADIO

A JUMPING-OFF SERIES FOR THE NEW AMATEUR

By "Pentode"

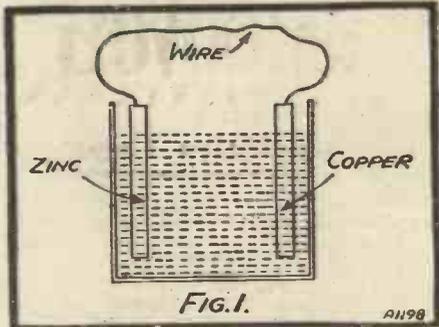


WITH a fair idea of the nature of the electron it is possible to dive into more practical matters. We have seen that a movement of electrons is, in effect, a demonstration of electrical activity. While the electrons confine themselves to their own individual atoms nothing particular happens. It is when they start jostling from atom to atom that noticeable incidents take place.

There are quite a number of ways of causing such to happen. When your local power station started to cause tramcars to crash and rattle about and electric lamps to glow it did this by creating terrific electron activity by means of huge dynamos and communicating this electron activity to distant points via wires.

On a smaller scale a radio battery does the same kind of thing only in a different manner. We will not be touching the subject of dynamos just yet, although when the time comes to make close reference to them you will see how closely linked are all the basic laws and facts of electrical and radio science.

A battery is a mighty interesting thing, for it is an object that transforms chemical



action into electrical action. You put certain metals into a chemical solution, and the magical result is that electricity for ringing door-bells, lighting small lamps, or driving a radio outfit is immediately available.

That is in the case of the primary cell. The primary cell in radio is represented by the H.T. battery.

How Accumulators Work.

The secondary cell, or accumulator as it is more commonly known, works a little differently. Here you have to apply electricity in the first place in order to form a certain chemical condition. And with the reversion of this condition to its original nature electrical activity is caused.

But this is what you have got to learn early and always remember; there can be no flow of electricity without there is a complete circuit. Let me explain this in detail, for it is remarkably important.

The simplest kind of primary cell consists of a piece of copper and a piece of zinc immersed in a solution of sulphuric acid.

And in brief the action is that the chemical activity causes a very large number of electrons to collect on the piece of copper, while the piece of zinc is correspondingly robbed of electrons. These pieces of metal are now out of balance; it is as though there were two water tanks, one having in it a lot of water, and the other having but a small quantity (Fig. 2).

Restoring Balance.

Nature hates anything to be out of balance, and if you gave this primitive electrical cell the chance it would endeavour to restore its equilibrium. You can do it by joining the two pieces of metal together with a length of wire just as you could help

It is a common belief that the theory of wireless is dry-as-dust sort of stuff that concerns only the engineer and scientist. This is quite wrong, for, told in the right way it makes fascinating reading. Further, even a superficial knowledge of the subject will prove invaluable to either listener or constructor and make the tasks of set-building and maintenance easier and more interesting. But it should be noted that this series is not confined to theory alone. Skillfully welded into the articles will be a vast amount of information directly relative to the assembling and operation of radio receivers. Hints and tips concerning all phases of "household wireless" will be given, and it is our firm belief that every reader of "P.W." will find something in the series of individual interest.

2. CONCERNING BATTERIES.

the two water tanks to achieve a level height of water by joining them together by a water pipe (Fig 3). And in the case of the cell the excess of electrons on the copper jostle the electrons forward in the piece of wire so as to make way for them until eventually they are jostled through to the zinc.

The wire is already full of electrons, all revolving around in their atoms, and this pushing forward does not upset the electron arrangements of the atoms. This you must carefully note.

Supposing this wire were a drainpipe completely filled with peas. If you pushed a hundred more in one end, a hundred would roll out of the other. The electrons are not packed tightly in so that they are all cheek by jowl, as it were, but they are electrically packed very tightly, for you cannot push an extra electron in an atom's anatomy without very special methods.

This is a hard point to grasp, and cannot easily be explained, but you must conceive of an electron needing a certain amount of elbow-room.

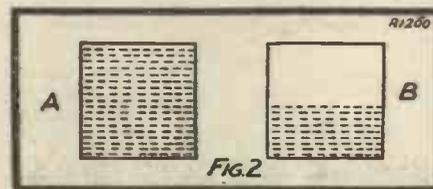
To get back to our cell. In order to sustain a flow of electrons through the wire the chemical action must continue to cause a lack of electron equilibrium, and the more sustained it is the greater the efficiency of the device as a producer of electricity.

A cell based on the simple zinc and copper

scheme would not be much good for practical work. A satisfactory cell is rather more complicated in construction.

The "dry" cell used in radio is a good example. By the way, this is not really dry, because it has a chemical paste in it which does not operate at all when it dries up.

Besides this paste are zinc and carbon,



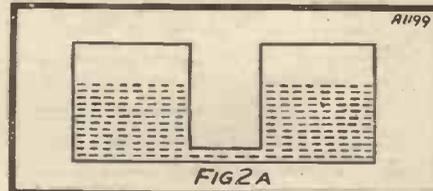
which form the two "electron tanks," and another ingredient, the purpose of which is to put a stop to a chemical activity which would otherwise impede the action of the cell.

The accumulator cell has lead plates and here sulphuric acid solution is used. The "charging" of the accumulator (or secondary cell) is the application of electricity in order to make the cell take up a chemical form suitable for the causing of electron movement. In a way, the cell is brought to the condition in which a primary cell starts by this means.

Unhappily a primary cell cannot be restored by the application of a charging current of electricity.

Conductors and Insulators.

But we're jumping ahead a little too far. Let us go back to Fig. 1. This illustrates a complete electrical circuit. While the chemical activity continues in the jar containing the metals and acid solution the electron balance continues to be upset, and a compensating flow of electrons passes through the wire.

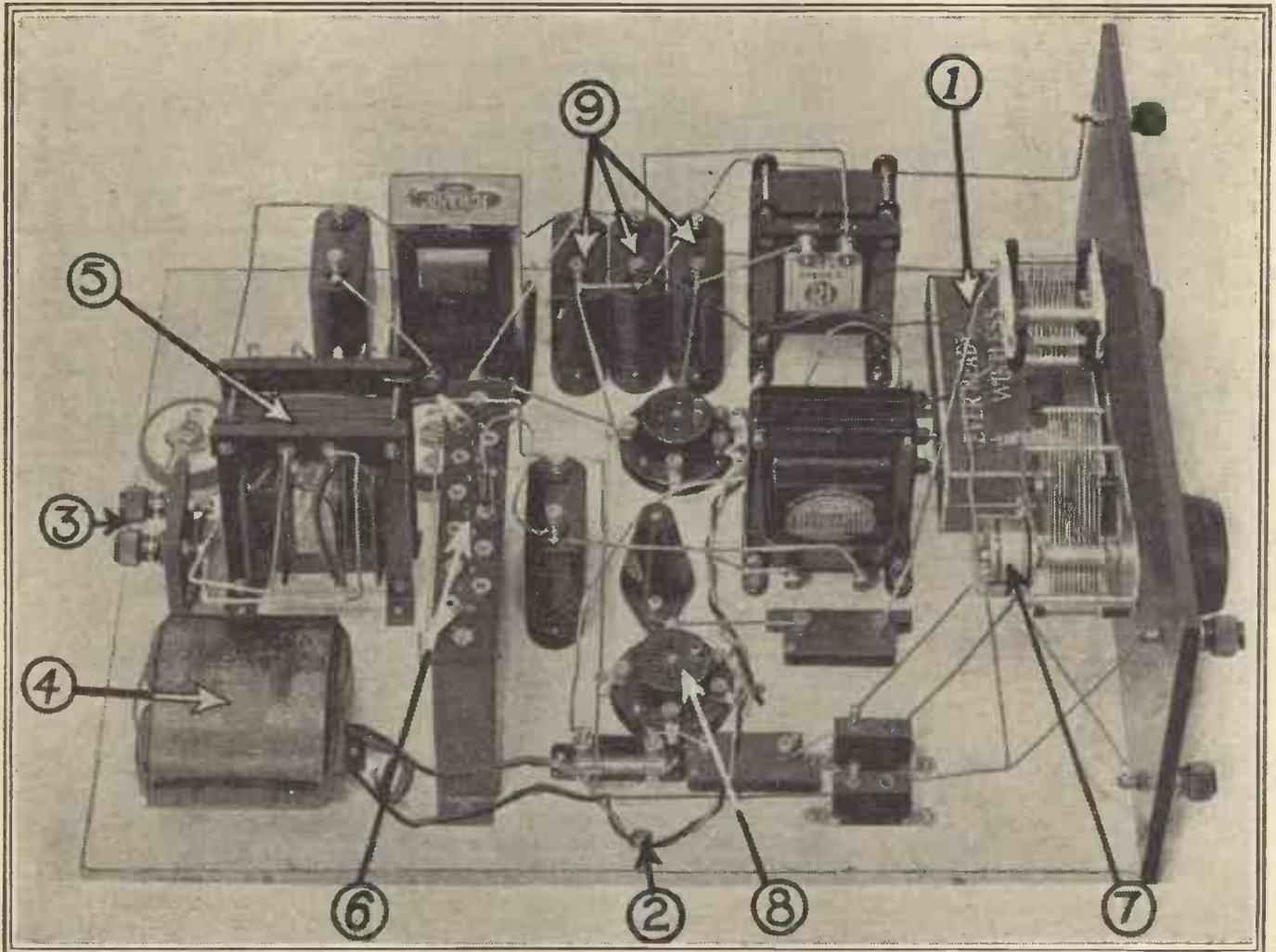


It is, of course, a metal wire. A piece of string would not serve the purpose, for string is not a conductor of electricity. True, it is composed of atoms comprising little solar systems of electrons, but its electrons are so grouped that they strongly resist any kind of jostling forward.

All metals are conductors, while such substances as paper, wool, mica, wood, glass, rubber, jute, ebonite, and so on, are non-conductors or insulators.

CLOSE-UPS FOR CONSTRUCTORS.

THE SECOND OF A NEW PICTORIAL SERIES.



THIS week we are jumping ahead a little and dealing with a set which, although only a two-valver, is slightly involved in design, as it derives its H.T. and L.T. from the mains. Newcomers to radio who know little or nothing about the "innards" of sets will, in due course, have the opportunity of examining "analysed hook-ups" of simpler characters. In the meantime they must acquire a little knowledge about electrons and so on by reading the article overleaf.

Indirectly-heated A.C. valves are arranged for in the above set. There are several interesting things to note in this particular design, some of which are points applicable to many other types of home-constructed receivers.

Points Concerning the Wiring.

At (1) you see how the grid-bias battery is tucked away on the baseboard. It is lying on its side under the variable condensers.

With mains sets great care must be taken with the wiring, and (2) indicates how the well-insulated flexible wire, which takes the A.C. along to the valve holders, is held to the baseboard to keep it clear of the components.

The terminals indicated at (3) are the mains input terminals and as such should be of the insulated variety, (4) is the L.T. step-down transformer which reduces the mains voltage to the lower value needed for the A.C. valves, and (5) is the H.T. transformer. (6) is the "potential divider" that enables various values of H.T. to be selected.

Notes on the Variables.

A slow-motion or geared type of variable condenser is used for tuning in this set and (7) indicates the gearing of this particular component. You will notice that the other variable is a smaller one and that, apparently, it has no gearing. A geared movement in this variable is not really needed as it is the reaction condenser.

The new A.C. valves have five pins, four of which are arranged similarly to those on ordinary valves, the extra pin being centrally disposed. As you will see at (8) the old type holders figure in this set. The two raised sockets are for the heater connections.

At (9) you see how the large fixed condensers used for smoothing purposes are neatly grouped to facilitate wiring and make the baseboard layout neat.

Better reception—easier assembling if you use Lotus components

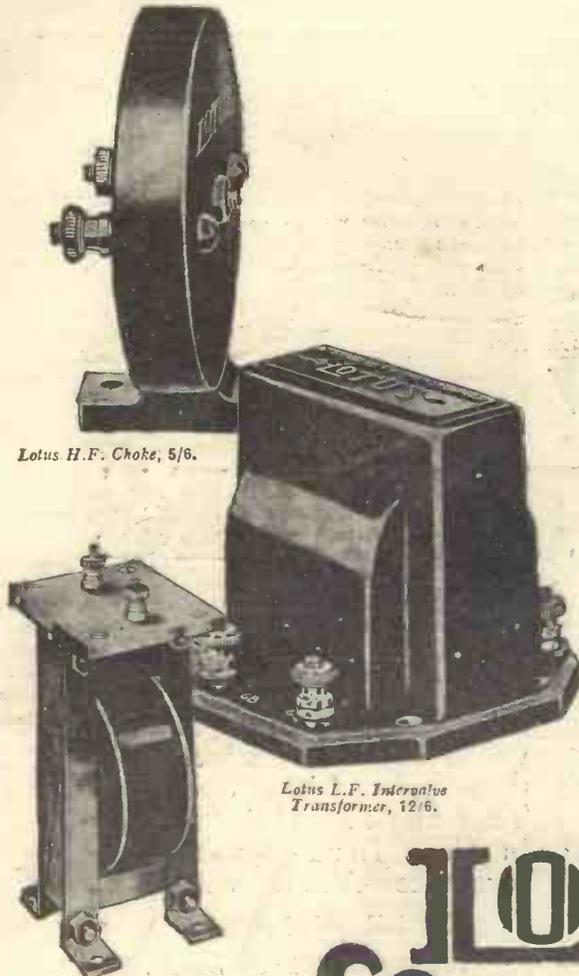
The strength of the receiver you build is like the strength of a chain—as strong only as the weakest link.

That is why it matters so much to you what components you build into your set.

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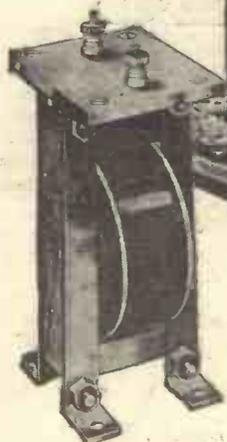
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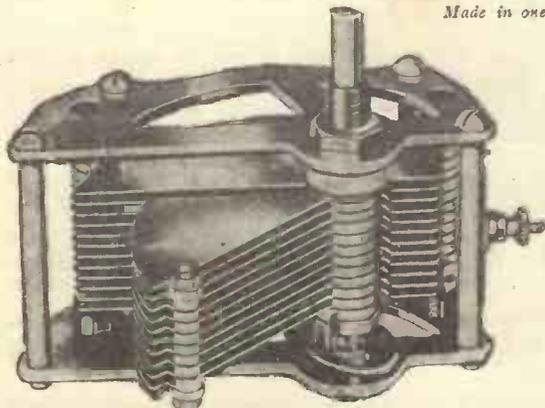
Lotus L.F. Interolvo
Transformer, 12/6.



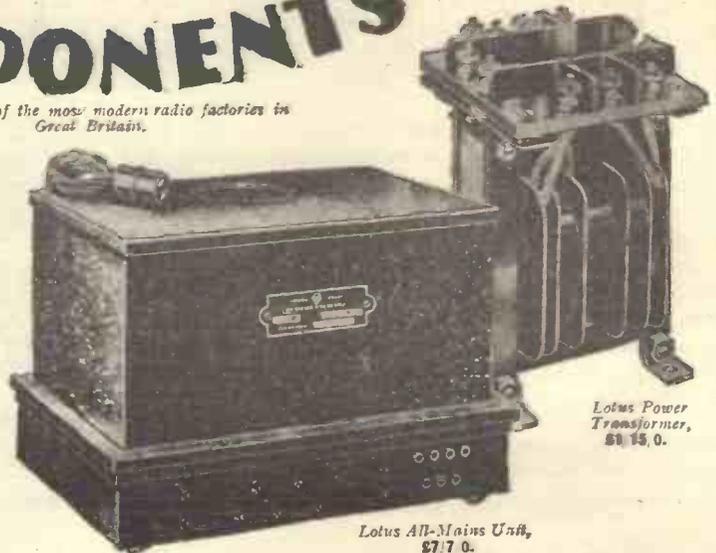
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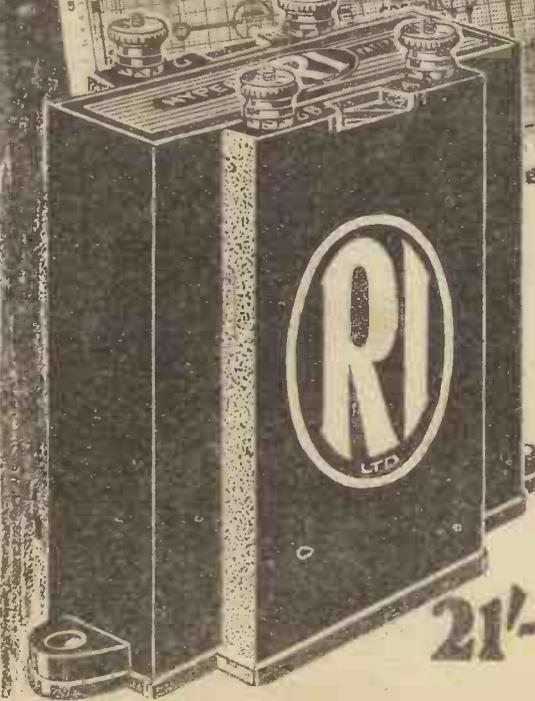
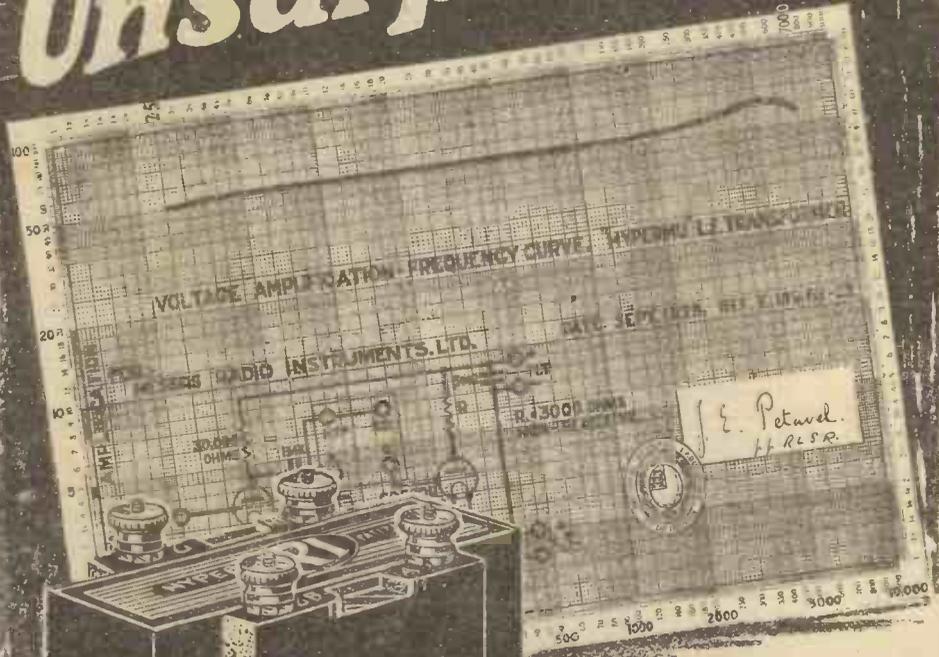
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Radio Handbook

Contents Include:

Selected Radio Definitions.
Components For Your Set.
Aerials and Earths.
All About Loud Speakers.
Choosing Circuits.
The Valves To Use.
Variable Condenser Values.
Twenty-one Selected
Circuits.
A Full List of Broadcasting
Stations.
Your Tuning Controls.
How To Make The "Titan"
Coil,
etc., etc., etc.

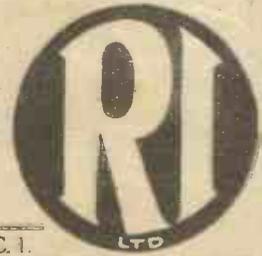
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THE "P.W." RADIO HANDBOOK

A Complete Guide for Listeners and Amateurs
specially compiled by the Technical Staff of
"P.W." and presented free with "Popular
Wireless," week ending October 19th, 1929.

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AN EVENTFUL RADIO YEAR

A brief summary of some recent outstanding wireless happenings at home and abroad.

The Baird Co. gave demonstrations to a Special Committee and the P.M.G. recommended that the B.B.C. should offer facilities for experimental television transmissions. There was a failure to reach agreement between the B.B.C. and the Baird people regarding the times of transmissions. The B.B.C. were unable to offer more than three quarter-of-an-hour periods per week out of programme hours. Eventually, experimental transmissions were arranged on the basis of five periods of half-an-hour each per week.

The new high-power broadcaster at Brookman's Park, which is to be London's Regional Station, started experimental transmissions.

Work was commenced on Broadcasting House, the new headquarters of the B.B.C.

The Pragu Plan of wave-lengths allocation was brought into operation.

B.B.C. RESIGNATIONS.

Capt. P. P. Eckersley, Mr. R. E. Jeffrey, Capt. West, Mr. K. A. Wright, Mr. Eric Dunstan, and other well known B.B.C. officials resigned. Capt. Eckersley joined the staffs of "Popular Wireless," "Modern Wireless" and the "Wireless Constructor."

It was calculated that in 1922 there were 30,000 radio receiving sets in use, and that the trade turnover was about £500,000. At the end of 1928 the turnover for the year was reckoned to be £25,000,000, and the sets in use 3,000,000.

Professor E. V. Appleton, Professor of Physics, King's College, London, disclosed details early in the year of his Heaviside Layer experiments. He was able to penetrate this with very short waves and located another similar layer many miles above it.

MARCONI ROYALTIES.

The Marconi Royalty question was thrashed out in Courts of Law and, after several interesting phases, an agreement was reached between the Marconi Co. and the R.M.A. on a 5s. per valve royalty basis. Contracts are to be for 5 years, the trade benefiting by getting the use of a very large number of existing patents and of any future patents eventuating in this period.

Broadcasting played a leading part in the General Election. There were pre-Dissolution speeches by all parties and the results were broadcast far into the early hours of the day following polling day.

Better valves than ever became available for listeners and constructors, notable newcomers being the remarkable Cossor New Process Valves.

PORTABLE SETS.

Portable sets attained a remarkable popularity which at the time of writing shows no signs of waning.

The combination of electric gramophone and radio set in the one instrument has created great interest, and manufacturers selling them report heavy demands.

Attention was at last turned by the listening public to the electric-supply mains as sources of radio power. The result has been exceptionally good trade in all kinds of mains devices.

A long-standing difference between the important cable companies (Compagnie Française des Câbles Téléphoniques and La Compagnie Radio France, Cables P Q) has been removed by what is described as a "co-ordination of technical means."

RAILROAD RADIO.

The Federal Radio Commission of U.S.A. allotted five short-wave channels especially for use in connection with railway trains.

The Brazilian Government has made it compulsory for every vessel leaving a Brazilian port to be equipped with a radio set in proper working order. Unless this condition is complied with the clearing of the vessel will be refused.

Radio developments started taking place very actively in Russia. A party of Soviet engineers went over to New York to engage in Technical Conference with the engineers of the Radio Corporation of America.

It was announced that five new Russian stations are in the course of construction.

NEW BROADCASTING STATIONS.

New broadcasting stations were being built in practically every country.

The Czecho-Slovakian Government placed orders with the International Standard Electric Corporation of Prague for a broadcasting station which it is expected will be the largest in the world. The new station will have a power of 120 kilowatts.

A German wireless company secured a contract from the National Government of Nanking for the erection of high-power radio stations in Canton, Tientsin, Shanghai and Hankow.

Mr. Aylesworth, President of the National Broadcasting Company of America, paid visits to England, France, Germany and other European countries. His object was to endeavour to arrange an ambitious scheme of programme exchanges on an international basis. It is calculated that the N.B.C. chain of broadcasting stations serves 50,000,000 American listeners.

A RADIO MUSEUM.

What was claimed to be the very first museum devoted entirely to radio was opened in America.

Great strides in the development of broadcasting were stated to have been made in Sweden, it being reckoned that there are now 66 sets per 1,000 inhabitants.

Radio-Paris and Radio Toulouse were voted by French listeners as the two most popular stations in France. Bordeaux Sud Ouest, Limoges, Nimes and Toulouse P.T.T. were found to be of little interest.

CHOOSING CIRCUITS

There are literally scores of different circuit arrangements, all with attractive features, and to choose any particular type is a perplexing problem. Here is some really practical advice on the subject.

There are three standard detector circuit arrangements, three very well-known forms of L.F. coupling, and about eight more or less completely different H.F. circuit arrangements. You will see from this that an H.F.-Det.-L.F. set lends itself to some sixty different variations. How many different versions of a five-stage arrangement it would be possible to tabulate would need some working out. Anyhow, it would be a very great number. Therefore, we can extend our sympathies to the constructor who, having dug down into the theory of radio more or less superficially, scratches his head in puzzlement and says: "Which will be my ideal arrangement?"

HAPHAZARD SET SELECTION.

And we can picture him wandering among a maze of split-primaries, split-secondaries, tuned grids, and so on and so forth, with the horizon getting farther and farther away from him. Of course, a very great number of constructors pay little or no attention to the circuit of a set. They note that the designer or designers of the "Standard" Three, or whatever it is, say that the hook-up has these or those qualities and can accomplish certain things under certain conditions, and, if the story as a whole appeals to them, then they make their choice by this means.

But a study of the circuit, however superficial it may be, will be worth while, for it will enable the constructor more easily to make his mind up for himself and not to rely completely upon the directions of others. You see, designers of sets are notoriously optimistic people, at least the majority are. A notable few are remarkably modest in regard to their productions.

We must add in parenthesis that every receiver described in POPULAR WIRELESS is independently tested by the "P.W." Research and Construction Department. We have always recognised the necessity for some such department, but it was only about two years ago that it was constituted, under the able control of Mr. G. P. Kendall, B.Sc. Every set forming the basis of a prospective constructional article for POPULAR WIRELESS is very carefully tested and all its claims verified, whoever may be the designer. And it is worth noting that very, very few sets indeed pass through without suggested modifications being made.

However, to get back to this circuit business.

First of all, let us take rectification. In these days the crystal detector should be confined to the simple

crystal set. If any valves at all are to be used, then it is just as well to eliminate crystal detection. Even the best crystal detectors are liable to pack up in the middle of a concert. Remember that providing the batteries are O.K. nothing short of the house falling down is likely to stop a first-class valve set operating.

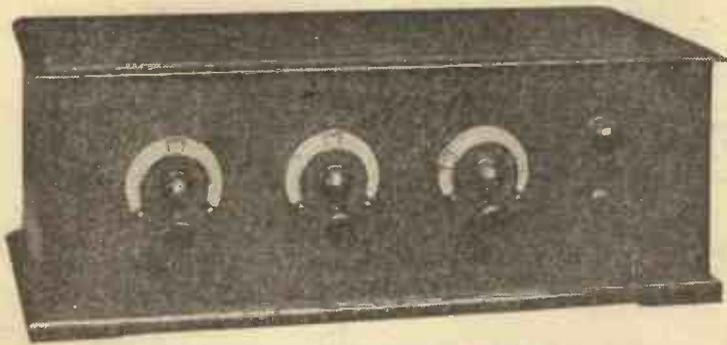
GRID LEAK v. ANODE BEND.

There are two well-known methods of valve rectification. The one is known as the leaky-grid method (grid leak and condenser) and the other is anode-bend. Undoubtedly the anode-bend method enables a greater purity of reproduction to be obtained, but, despite anything which you may hear or read to the contrary, you can take it from us that a fairly careful choice of valves and a moderately skilful adjustment of conditions are needed in order to obtain this superior quality.

None of these complications occurs in leaky-grid rectification, and this is the scheme we would recommend to the average constructor, for unless he uses a moving-coil loud speaker and first-class gear throughout, he is not going to benefit very much in point of quality by adopting the anode-bend method, and, on the other hand, it is probable that he would lose considerably in point of sensitivity.

Very few people can afford to ignore the sensitivity obtained through the use of reaction, although the careful operator uses only the minimum degree.

Regarding L.F. amplification the issue is less clear, but nevertheless it is really quite straightforward. Here we have choke capacity, resistance capacity and transformer coupling. These are the three best-known arrangements, but, additionally, there is the push-pull scheme and



You must bear in mind that the circuit will govern the controls. Two stages of tuned H.F. coupling will mean three variable condensers or elaborate "ganging."

what is known as dual impedance coupling.

L.F. AMPLIFICATION.

The choice of the average constructor will range between the first three mentioned methods and combinations of these. We think it is a mistake to strive for very high amplification per valve on the low-frequency side. In our opinion, it is better to aim for more stages and lower amplification per valve. But, unfortunately, only the fortunate few could afford to carry this idea through thoroughly; the majority find it financially necessary to limit the number of valves.

For one stage of L.F. amplification it is safe to say that the transformer method of coupling has the most

points in its favour. Useful amplification and very passable quality can be obtained with but moderate high-tension voltage. But to get really loud-speaker signals, even from the local station two stages of amplification are needed. An arrangement which has much to commend it and is much used is a stage of resistance-capacity coupling followed by a transformer-coupled valve.

Somewhat superior results might be achieved by the employment of resistance-capacity coupling throughout, but you would need three valves instead of two unless you were to force the magnification up by using high values of coupling resistances and high-magnification valves, but in doing so you would endanger the quality of results.

With choke-capacity coupling one is not able to get the magnification possible by the transformer method, although an approach to the quality obtainable with resistance capacity is possible with lower H.T. But there seems to be a "settling down" towards resistance capacity and transformer methods and it is easy to summarise the most popular arrangements.

TRANSFORMER COUPLING.

For one valve, transformer coupling; for two stages of L.F., resistance capacity followed by transformer; for three stages, resistance capacity throughout with two valves in parallel in the output position.

The pentode is easily dealt with. This needs a high H.T. voltage, takes a moderately high H.T. current and, even so, cannot handle the input that is "money-for-jam" for an ordinary super-power valve. On the other hand, it gives the magnification of two ordinary L.F. valves. You save a valve and an L.F. transformer or R.C. coupler, but you must use a special output transformer (for good results), and you must pay a good bit for the one valve (25s.).

So you see the pentode v. ordinary L.F. issue is not as straightforward as it should be. Examined in the hard, cold light of dawn, as it were, the pentode stands to lose a little of its romance; but, whatever the anti-pentode school says, it still has the solid advantage of great magnification.

H.F. amplification seems to lend itself more readily to circuit variations. The screened-grid valve has been very prominent of late, and it is a fact that a screened-grid stage will provide the greatest possible amplification together with a remarkable stability and freedom from extraneous neutralising devices and all their complications.

On the H.F. side every extra valve generally means so much additional tendency to instability and difficulty in tuning. The S.G. valve gives you greater amplification, and is stable in operation by virtue of its capacity-eliminating construction and operation.

But although one S.G. valve may give you one and a half times the effective amplification of one ordinary valve (we think one and a half is nearer correct than the popular two), don't forget that you lose a valuable tuned circuit by replacing two ordinary valves for one S.G. You get the magnification without the selectivity to make the best use of it.

THE SCREENED-GRID VALVE.

Incidentally, you get a trifle more background, or mush, accompanying your music or speech.

Here again cost comes well to the fore, as the S.G. costs twice as much as an ordinary valve and consumes two or more times the H.T. current. Further, it necessitates a high H.T. voltage.

The S.G. comes definitely into its own where immense sensitivity is required. Two stages of S.G. H.F. give you "super-hot" results with surprising stability. Of course, they are somewhat "noisy," but you expect noise with enormous magnification.

A point well worth bearing in mind is that the

pleasant reception of distant stations depends upon the normal ratio of static or mush to the music. You might have heard a station on a three-valve set, not loudly but just sufficiently powerful to hear all his speech. On a five-valve set you might collect so much "mush" with that station that you would never care to listen to it.

Other types of H.F. circuits offer compromises between selectivity and sensitivity. Others, again, are more stable and less sensitive, and so on. In fact, there are so many considerations, or varying combinations of considerations, that it is impossible to lay down hard and fast rules. To add to the complexity we are always coming up against special schemes which individually appear to be extraordinarily attractive. These are generally modifications of better known arrangements, and we could do little better than to confine ourselves to a consideration of the more standard hook-ups.

R.C. H.F. COUPLING.

Resistance-capacity H.F. coupling can be dismissed in a few words. This appears to be of value only on the longer wave-lengths and, although it enables one to dispense with tuning, it will not meet the average constructor's needs.

The old-fashioned but very simple tuned-anode coupling can likewise be put aside as being more or less obsolescent. The simple tuned-grid circuit, however, has its points. An H.F. choke is placed in series with the plate circuit of the "H.F. valve," and the feed to the detector is via a fixed condenser. The detector has a straightforward tuned-grid circuit. We would only advise the use of this scheme for one stage of H.F. amplification. The input to the detector can be tapped down the grid coil in order to achieve quite a useful degree of selectivity. Not a remarkable degree of amplification can be effected, but at the same time, in this respect it does not fall very far short of the best of some of the best of other methods. Neutralisation can be introduced, when the arrangement becomes even more attractive and it certainly lends itself remarkably well to the design of wave-change sets.

Of the two forms of H.F. transformer-coupling, i.e. split-primary and split-secondary, practically everybody these days is of the opinion that the split-primary is the better both in point of stability and magnification. Nevertheless, special split-secondaries have been invented which have very great advantages, but the future of H.F. amplification lies in the screened-grid valve. One day it will be as cheap as an ordinary valve now is, at least we hope so, but at present the subject of H.F. amplification is a very difficult one.

AMPLIFICATION PER VALVE.

On the L.F. side the only compromise that needs to be made is that between amplification per valve and quality of reproduction. Here one is not up against such problems as selectivity, operation and, in any way to the same degree, stability. Additionally to these we still have on the H.F. side amplification per valve and quality. You must not forget that quality of reproduction can be ruined before the detector just as easily as after it.

And with this rather unsatisfactory conclusion we are afraid we must leave you to use a great deal of your own judgment.

The almost perfect circuit would provide the highest possible amplification per valve plus great selectivity, complete stability, remarkable ease of operation, perfect quality of reproduction, and very low maintenance costs, but there is, of course, no almost perfect circuit and one has to choose the arrangement which appeals to one as being the nearest approach to it, all things considered.

THE "P.W." "TITAN" COIL

Constructional details of one of the most famous tuner units ever developed. It is the "key" component of the well-known "P.W." "Titan" Sets and it has figured and is being used in many other effective receiver designs.

This unit, the reader will remember, was produced by the "P.W." Research Department after lengthy experimental work and it has been used with great success in the "Titan" Three, the "Titan" Two, the "Titan" Tuner, etc.

The basis of the coil is a piece of insulating tube 4 in. in diameter and 2½ in. long. This can be of any good insulating material, such as Pirtoid, Paxolin, ebonite, etc. Round the upper edge are arranged seven small terminals, and for the placing of these and their lettering you should refer to the wiring diagram of any of the "Titan" sets or units.

The placing of the terminals is not exactly critical, but you should just take a little care to get it roughly right, so that when you put the unit in a set you will be able to follow the wiring easily from the positions of the connections.

METHOD OF MOUNTING.

This main tube should be fixed down with its axis vertical on a piece of ¾-in. thick wood about 4½-in. square in a home-made model (a different method is used in commercial ones, but this is easier). Some little brackets cut from strip brass are an easy way of doing this.

Inside this main tube and raised up a little is fixed a "P.W." standard loading coil in an edgewise position. An easy way of mounting this is by means of a couple of brass brackets, as in the case of the main tube, the desired height being obtained with a block of wood.

Details of this sort, of course, are very much a matter of taste, the important point being the height of the loading coil. This is vital, for if the coil is too low efficiency is lost. In the correct position the centre of the loading coil is at least 1 in. above the upper edge of the main winding. (It can be higher if you like, but not lower.)

THE WINDINGS

Now for the windings. On the main tube there is first of all a secondary winding of 40 turns of No. 24 D.C.C. wire (or 38 turns of No. 24 D.S.C.). The upper end is connected to the G terminal and the lower to the S terminal nearest to R₁. The direction of this winding does not matter.

Continuing on below this winding is the reaction coil (L₂) which has 20 turns of No. 32 D.S.C. in the same direction as the previous winding, i.e. as though

it were a continuation. There is a space of about ¼ in. between these two. The upper end of L₃ goes to R₁ and the lower to R₂.

Put on over the top of the lower part of L₂ (the secondary) there is a tapped primary (aerial) winding (L₁) of 16 turns of No. 24 D.C.C. or D.S.C. This is lifted up slightly above L₂ with a series (10 or 12) of little wooden or ebonite spacers, each about ¼ in. × ⅜ in. × 1 in.

IMPORTANCE OF DIRECTION.

This winding has tapings at 5, 8, and 12 turns, and the upper end (16th turn) is also left projecting to act as another tapping point. The lower end goes to the S terminal nearest to the A terminal.

The direction of this winding is important. It must be as though it were a continuation in a second layer of L₂ working upwards from the bottom. That is, you should imagine that you have started at the top, put on L₂ in a layer working down towards the bottom, and then returned upwards in another layer of 16 turns, revolving the "former" in the same direction the whole time. This forms L₁.

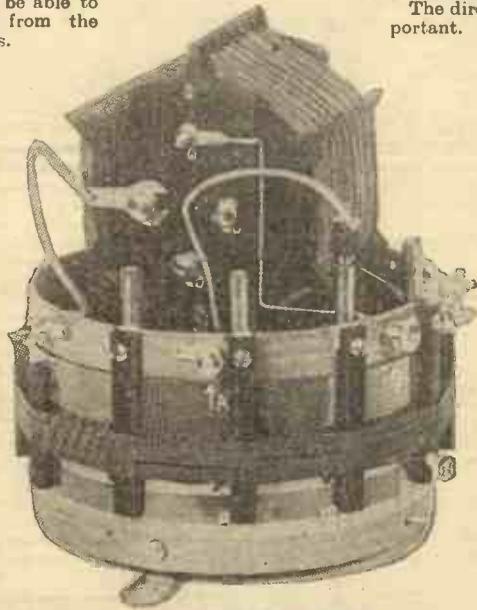
Now for the remainder of the connections, and our coil is done. From the A terminal there comes a short flex lead ending in a tapping clip, and this engages with the various points on L₁. From E comes another similar lead which works on the tapings on the loading coil (L₄). The "216" terminal of the loading coil is wired to the S terminal nearest to R₁, and the "O" terminal on the loading coil to the S terminal nearest to A.

AN EARLY MODEL.

It is rather a laborious job to wind, but after all it is only a matter of patience, which is called for in any coil-winding work.

Now for some miscellaneous points. First of all, about the unit you see in the photograph. This was a rough model made up in the early stages of the experimental work, and you should note that the loading coil is mounted a little too deep inside the tube. We chose this specimen to emphasise the fault in question.

Then about the spacers between L₁ and L₂. These should be placed on the coil so that the ¼ in. dimension is against the surface of L₂.



A SPECIMEN TITAN COIL.

In this picture, which is of an early model, the loading is mounted a little too deep inside the tube.

THE VALVES TO USE

It is most important that each valve in a set is capable of doing the work allotted to it. A valve that is specially designed for H.F. amplification cannot possibly cope with the work of handling the energy in the last L.F. stage of a set.

OPERATING CHARACTERISTICS.

There is no true "General Purpose" valve. There are valves that are quite suitable for any one of several tasks, but no valve yet designed can equally well perform any function. Upon the selection of the valves the whole effectiveness of a set depends.

Every valve made by a reputable manufacturer is sent out complete with a leaflet giving its characteristics. Generally, there is also ample information concerning the best way to place the accessory in operation.

The two most vital characteristics of a valve are its impedance and its magnification or amplification factor. This last is a direct guide as to the amplifying properties of the accessory. You can safely endeavour to obtain the greatest ampli-

fication factor, providing the impedance of the valve suits the circuit in which it is to work.

The impedance of a valve is always given in ohms. Impedance in itself is no particularly desirable factor, but, in conjunction with the "mag. factor," it indicates the suitability of a valve for a particular job, as the table below shows.

MAINS-OPERATED VALVES.

The figures given do not apply rigidly to mains-operated valves, for the characteristics of these are of a somewhat different nature from those ruling with battery-operated valves. Nevertheless, the table will guide you even in the selection of mains valves, as long as you apply the figures as a basis of comparison between equivalent types in both categories.

It is important that a valve should be able to handle any input it is likely to be given without overloading. The characteristic curve which is supplied with practically every valve sold shows this. There should be an ample area of the straight portion of the curve covering a grid-volts range of adequate dimensions.

Owing to various methods of nomenclature a complete list of manufacturers cannot be given.

Circuit Valve is Required for	Valve Impedance	Mag. Factor.
Grid leak det. (special det. valves are available) ..	7,000-30,000 Highest value if resistance coupled to next stage	13-30
Anode-bend det. (special det. valves are available)	7,000-30,000	15-30
H.F. split primary, neutralised	13,000-30,000	13-30
H.F. tuned anode, neutralised	20,000 upwards	17 upwards
H.F. res.-coupled		
H.F. an-neutralised	Special S.G. circuit for screened grid-valves should be used.	
L.F. res.-coupled to following valve (depends largely upon individual circumstances, such as position of stage in receiver)	With resistance of 250,000 ohms and upwards. 20,000 upwards	20 upwards
	Res. under 250,000 ohms 7,000-30,000	10-30
L.F. trans.-coupled to next valve	7,000-30,000 dependent upon transformer and load	Use as high a mag. as is consistent with good reproduction. Too high a mag. will cause overloading in the next stage.
L.F. last stage	For small sets 6,000-10,000	6-15
	Larger sets 2,400-6,000	3-8
	Very large sets 1,600-3,000	1.5-6

A Pentode valve will often be suitable as an output valve if properly used. If the loud speaker is one with a tendency to over-emphasis of high notes a special Pentode transformer should be used; otherwise the ordinary filter output is suitable.

SELECTED RADIO DEFINITIONS

Here are practically all the wireless names and terms you are likely to meet in "P.W." together with concise and lucid definitions. This list was specially compiled for this book.

By THE "P.W." TECHNICAL STAFF.

AERIAL CIRCUIT.—The circuit containing the aerial, and all apparatus connected between it and the earth, usually comprising a variable condenser and tuning coil.

AERIAL TUNING INDUCTANCE (A.T.I.).—The variable inductance or tuning coil in the aerial circuit, by means of which the wave-length of the circuit can be adjusted. The greater the wave-length required, the greater must be the size or portion of the A.T.I. included in the circuit.

ALTERNATING CURRENT (A.C.).—A current which reverses its direction of flow a definite number of times per second.

AMPERE.—The unit of electric current, being the current that can be driven through a resistance of 1 ohm by a pressure of 1 volt.

AMPLITUDE.—The maximum value which an alternating current or voltage attains in either direction. The current rushes produced by spark signals have an amplitude which decreases towards the end of the wave train.

ANODE.—The terminal by which current enters electrical apparatus. Thus the Plate of the Valve is its anode according to standard electrical practice—not the electron theory.

ANODE-BEND RECTIFICATION.—Detection or Rectification using the bend in the anode current—grid volts characteristic of a valve.

ANODE CURRENT.—The current which is driven, by the high-tension battery round the anode circuit and through the valve.

AUTO-TRANSFORMERS.—A transformer in which the one winding is tapped off the other winding, the connections being exactly the same as those for a potentiometer. The difference lies in the fact that the magnetic effect in the auto-transformer ensures that the primary and secondary currents are in the inverse ratio of the voltages, which is not the case in the potentiometer.

BACK E.M.F.—A voltage acting in opposition to a normal flow of current.

BAFFLE or **BAFFLE-BOARD.**—A wooden or other screen used in conjunction with a loud speaker to prevent the interaction of the sound waves emanating from the front and back of the instrument.

BALANCED ARMATURE.—A type of movement figuring in loud-speaker units. A piece of soft iron acting as an armature is balanced between the poles of a permanent magnet. The balance of this is upset by the operating energy and a diaphragm or cone moved accordingly.

BLASTING.—The distortion which follows the overloading of microphones, valves, loud speakers, etc.

CAPACITY.—The property which enables apparatus to store a quantity of static electricity when electrical pressure is applied. Capacity is measured by the quantity of electricity that can be forced into the apparatus by a pressure of 1 volt. The unit of capacity is called a "Farad."

The capacity of an accumulator is measured in ampere hours. In this case the term is used in a somewhat different sense. Ignition capacity is double actual capacity. One ampere hour means capacity to deliver a current of one ampere for one hour.

CARRIER-WAVE.—The steady H.F. oscillations emitted by a wireless telephony transmitter. These oscillations are varied or modulated by the speech and music.

CATHODE.—The terminal by which current leaves any piece of electrical apparatus. In a thermionic valve the filament is the cathode. In a cell supplying electricity, the cathode is the negative terminal (according to standard electrical practice).

CHOKE.—A coil of wire which offers considerable opposition to varying and alternating currents, but which may have low direct-current resistance.

COUPLING.—The connection by means of which electrical energy is transferred from one circuit to another. The transference may be brought about by means of condensers (capacity coupling), by electro-magnetic induction, as in the transformer (inductance coupling), or by connections similar to those in an auto-transformer (direct coupling).

CURRENT.—An electric current is a movement of negative electrons, driven by an electro-motive force. A current cannot flow unless there is an electro-motive force to drive it, and a conducting path for it to flow along. The unit of electric current is the ampere.

CUT OFF.—The point in the frequency scale at which apparatus, such as a loud speaker, ceases to operate.

CYCLE.—A complete alternating current or voltage wave, extending from one maximum value to the next maximum value in the same direction.

DAMPING.—Loss caused by energy absorption in mechanical or electrical apparatus.

D.C.—Direct Current.

D.C.C.—Double Cotton Covered.

DIELECTRIC.—A substance which will allow practically no electric current to flow through it—i.e. a nearly perfect insulator. The term is usually applied to the insulating material in a condenser.

EDDY CURRENTS.—Currents induced in metal by adjacent varying magnetic fields.

ELECTRODE.—A part of a valve or of a battery.

ELECTROLYTE.—The solution or paste used in a battery.

ELECTRO-MOTIVE FORCE (E.M.F.).—The force which is necessary to produce an electric current, and upon the value of which depends the amount of current, measured in amperes, in any particular circuit. Electro-motive force is measured in volts.

ELECTRON.—The ultimate particle of matter, consisting of an indivisible negative electric charge. A stream of negative electrons constitutes an electric current.

EMISSION.—The stream of electrons thrown off by the heated filament of a valve.

ETHER.—The all-pervading medium through which radio waves are presumed to vibrate.

FARAD.—The unit of electrical capacity, being the capacity of a condenser which will store 1 coulomb of electricity at a pressure of 1 volt, or which will take 1 second to be charged to a pressure of 1 volt by a current of 1 ampere.

FILTER.—An arrangement of inductances and condensers which will pass, or prevent from passing, varying currents of certain frequencies.

FREQUENCY.—The number of times per second that an alternating current or voltage attains its maximum value in one direction; the number of complete wireless waves received per second.

FULL-WAVE RECTIFICATION.—The rectification of alternating current so that both half-cycles are used.

GRID BIAS.—A voltage applied to the grid of a valve in order to bring its operating characteristic to a certain desired condition.

GRID CIRCUIT.—The circuit which externally connects the filament and grid of a valve, and is completed internally by the electron stream between them.

HALF-WAVE RECTIFICATION.—The rectification of alternating current so that only one half-cycle is used.

HARMONICS.—Frequencies which are multiples of other frequencies.

HEAVISIDE LAYER.—An upper layer of atmosphere (60 to 200 miles above the earth) which is presumed to affect the transmission and reception of radio by acting as a reflecting or absorbing screen.

HENRY.—The unit of self-inductance, being that inductance which will so retard any change in the value of a current that it takes 1 second for 1 volt to raise the current in a circuit by 1 ampere.

HIGH FREQUENCY.—A term applied to alternations or waves which occur at frequencies too high for audibility; sometimes called "Radio Frequency." High frequency may be taken to include all frequencies above 20,000.

HIGH-FREQUENCY RESISTANCE.—The resistance which a conducting path offers to high-frequency currents. Skin effect renders this higher than the resistance that would be offered by the same path to a continuous or low-frequency current.

HYSTERESIS.—The lagging effect observed in the magnetising of iron.

IMPEDANCE.—The total opposition offered by a circuit, or a piece of apparatus, to a varying or alternating current, being made up of the combined effects of resistance and reactance.

INDUCTANCE.—The property of a circuit which operates and retards any change in the value of the current flowing. Inductance has the same effect upon an electric current as inertia or momentum has upon a moving body.

INDUCTION.—The production of an electromotive force in an electric circuit through the agency of another circuit, without any direct electrical connection between the two. Induction may be brought about by lines of electric force (electrostatic induction), or by lines of magnetic force (electro-magnetic induction). Upon the latter depends the working of the transformer and the loose coupler.

KILOCYCLE.—One thousand cycles.

KILOWATT (K.W.).—The unit used for measuring large amounts of electric power, being equal to 1,000 watts or $\frac{1}{4}$ horse power.

LAMINATIONS.—Layers or thin sheets. A laminated core in a transformer or choke is a core built up of thin sheets of iron.

LINES OF FORCE.—The paths along which acts the force due to a magnet or electrically-charged body.

LOOSE COUPLING.—The fairly weak magnetic or electric linkage between two coils or circuits.

LOW FREQUENCY.—Frequencies up to about 20,000 cycles.

MAGNETIC FIELD.—The space surrounding a magnet, extending as far as its magnetic influence is appreciable. Any space pervaded by lines of magnetic force is a magnetic field.

MANSBRIDGE CONDENSER.—A type of large capacity fixed condenser.

MEG OHM.—The unit used for measuring high resistance, being equal to 1,000,000 ohms.

METAL RECTIFIER.—A rectifier, consisting of two plates of metal in contact, used mostly in mains units.

MICROFARAD (MFD.).—The practical unit of capacity equal to one millionth of a farad.

MICROHENRY (MH.).—The practical unit of inductance equal to one millionth of a henry.

MILLIAMPERE.—Thousandth part of an ampere.

MOVING-COIL LOUD SPEAKER.—An instrument whose diaphragm is operated by a small coil of wire suspended in a strong magnetic field. The input energy is fed into this Moving Coil.

NATURAL FREQUENCY.—The frequency at which a circuit containing inductance and capacity will most readily oscillate.

NEGATIVE POLE.—A pole that is at a lower potential relatively to another, the positive pole.

NON-INDUCTIVE.—A wire resistance wound so that it has negligible inductance is so described.

OHM'S LAW.—The law which states the relations existing in any circuit between current, voltage, and resistance. These relations are as follow: Amperes = Volts ÷ Ohms. Volts = Amperes × Ohms, and Ohms = Volts ÷ Amperes. Thus, for example, 36 volts are required to send a current of 4 amperes through a resistance of 9 ohms.

OPEN CIRCUIT.—A broken circuit; a circuit through which current cannot flow.

OSCILLATORY CIRCUIT.—A circuit having inductance and capacity and comparatively low resistance.

PARALLEL.—Two or more conductors or pieces of apparatus are in parallel when they are so connected that the current in the circuit divides, and part goes through each of them. Cells are connected in parallel when the required current is equal to the sum of the currents which can be given by each individual cell, and the voltage required is that of a single cell.

PLATE CIRCUIT.—The circuit which externally connects the filament and plate of a valve and is completed internally by the electron stream between them.

PLATE OR ANODE IMPEDANCE.—The internal impedance of a valve.

PLATE OR ANODE VOLTAGE.—The potential difference (voltage) existing between the plate (anode) of a valve and its filament.

POSITIVE POLE.—A pole having a relatively higher potential than another pole, the negative.

POSITIVE AND NEGATIVE (+ and -).—Names given to distinguish the terminals of a source of electric supply. Current is assumed to flow round a circuit from positive to negative, although it actually consists of an electron stream flowing from negative to positive. Positive and negative terminals are often distinguished by the colours red and blue or black respectively.

POTENTIAL DIFFERENCE (P.D.).—The difference of potential or electrical pressure between two points is the electro-motive force trying to send current from one point to the other. (Voltage.)

POWER VALVE.—A valve designed to handle relatively large inputs. A power valve does not necessarily give greater amplification—frequently its amplifying properties are comparatively low.

PRIMARY CELL.—A cell which produces current by chemical activity and which cannot be recharged like an accumulator (secondary cell).

PRIMARY CIRCUIT.—A circuit which hands on applied energy to another (secondary) circuit.

REACTION.—A system of feeding-back the amplified energy from the anode circuit of a valve to its grid circuit for further amplification. Indiscriminately applied, this scheme may result in a receiving set radiating interfering energy.

RESISTANCE.—The opposition offered by an electrical path to the passage of current when no reaction is present. Except in the case of high-frequency currents, resistance depends purely upon the conducting path and is independent of changes in the value of the current. The resistance of any path depends upon the length and sectional area of the path, and upon the material of which it is composed.

RESONANCE.—A circuit is in resonance when its frequency corresponds to that of the applied energy. Resonance in a loud speaker indicates a tendency to vibrate more readily on certain notes.

SATURATION.—In a valve—where further increases in anode voltage produce no corresponding increases in anode current. The maximum amounts in such cases are known as saturation currents.

Magnetic saturation indicates a point when further increases in the magnetising force fail to cause increases in flux density. This condition is met with in L.F. chokes and transformers.

SCREENING.—The separation of components or circuits by metal partitions or boxes in order to prevent coupling effects.

SERIES.—Two or more conductors or pieces of apparatus are in series when the whole of the current in the circuit has to pass through them one after the other. In a simple receiving circuit, for instance, the telephones and crystal detector are connected in series. Cells are connected in series when the required voltage is equal to the sum of the voltages of the individual cells.

SHUNT.—When two portions of a circuit or pieces of apparatus are connected in parallel, one is said to shunt the other.

SIDE-BANDS.—A number of high-frequency waves above and below the frequency of the Carrier-Wave produced by Modulation.

SMOOTHING CIRCUIT.—An arrangement of chokes and condensers designed to suppress the irregularities in a current supply.

SOFT VALVE.—A valve in which a little gas remains. The anode current is carried partly by this gas as well as by the electron stream from the filament.

SOLENOID.—A coil of wire wound in a long spiral, for the purpose of producing a magneto-motive force along its axis.

STALLOY.—A special steel used widely in the construction of L.F. chokes and transformers.

STEP-DOWN TRANSFORMER.—A transformer which steps down voltage—the current in the secondary being proportionately greater.

STEP-UP TRANSFORMER.—This steps up the voltage.

SULPHATING.—A chemical effect in an accumulator caused by neglect or age and which impedes the action of the device.

TIGHT COUPLING.—The strong magnetic or electric linkage between two coils or circuits.

TRICKLE CHARGER.—An accumulator charger which has a very low output. Batteries can be left connected to such a device throughout the day and night.

UNTUNED (or APERIODIC).—A term applied to an aerial and H.F. transformer or coupling coil indicating that such is not tuned to any one particular frequency.

VOLT.—The unit of electro-motive force or electrical pressure, being that pressure which will drive a current of 1 ampere through a resistance of 1 ohm. The electro-motive force of a single accumulator cell is about 2 volts.

VOLTAGE.—Potential difference in volts.

VOLTAGE DROP.—The voltage used in driving current through a circuit or across a piece of apparatus. Voltage Drop across a 10-ohm resistor passing $\frac{1}{2}$ ampere would be 5 volts.

WATT.—The unit of electrical power, being the power exerted by a current of 1 ampere flowing under a pressure of 1 volt. 746 watts are equivalent to 1 horse-power.

WAVE-LENGTH.—The distance travelled by a wireless wave, while it increases from zero to its maximum value in one direction, reverses, attains its maximum value in the other direction, and falls to zero again.

WAVE TRAP.—A device designed to eliminate an interfering station.

WET BATTERY.—A term that used to be applied to an accumulator, but is now more widely applied to the small Leclanché cell batteries employed for H.T. purposes.

Aerial Interaction

Cases of this cannot, as a rule, be cured by one party only, and the co-operation of both parties concerned is desirable.

The trouble generally arises from the use of small sets which necessitate the employment of large amounts of reaction, and, as a rule, the only certain cure is for both parties to build larger sets, preferably employing neutralised H.F. stages.

Sometimes a cure can be effected by making sure that a different earth is used by each receiver, and, again, the use of a small condenser in series with each earth lead will sometimes improve matters.

Aerials That Swing

There is no need to have the aerial absolutely tight unless short-wave work is being indulged in, when it is an advantage, because a swinging aerial may then affect reception. The advantage of a certain amount of "give" in the aerial wire is that there is less strain upon the mast, supporting stays, etc., particularly with a high aerial, and for ordinary reception a certain amount of give is in no way detrimental. It is, however, important to see that the aerial does not kink anywhere, and if this happens it is sure to break sooner or later, which may give rise to noises in the set.

VARIABLE CONDENSER VALUES

Practical information for constructors in regard to one of the most important types of components.

Practically every modern radio receiver uses at least one variable condenser for tuning purposes and another for reaction control. And for the ordinary broadcast band of wave-lengths the tuning variable generally has a maximum capacity of .0005 mfd. It would be possible to extend the range of tuning upwards by using a condenser having a higher maximum value, but a point worth noting is that for best results the inductance-capacity ratio should be as great as possible: that is to say a minimum added capacity is the ideal condition.

But should you use a variable tuning condenser of a low maximum capacity, then the range of adjustment is going to be small and the stations it is possible to tune in without coil changing may be fewer in number.

The .0005 mfd. just mentioned is the sort of compromise we have arrived at after some years of varying from one point to another. But you should always try to keep your stations well down the scale.

STATIONS PER "BAND."

If you find that you receive nothing over the lower dial readings and that 5 G B, for instance, comes in when the variable is practically "all in," a slightly larger coil is indicated and might prove useful.

The lower the band of wave-lengths the greater the number of stations you will be able to squeeze in without coil changing. Let us take for an example, in order to illustrate this, the single tuning circuit arrangement such as exists in an ordinary two- or three-valve receiver employing no high-frequency amplification.

A .0005-mfd. variable condenser could be used for practically any wave-band. On the higher wave-lengths, such as those of 5 X X, Hilversum, and so on, only three or four stations will be tunable on any one coil, but down on fairly short wave-lengths, that is among the tens of metres, dozens of stations might be heard, one for every microscopic adjustment of the dial.

INDUCTANCE-CAPACITY RATIO.

But the inductance-capacity ratio would be all wrong. There would be far too much capacity and far too little inductance. Also, for easy tuning, it is not advisable to have the stations crowded up against each other all round the dial. There is also another point, and that is that the minimum capacity of the condenser might militate against the tuning-in at all of some of the stations.

You see, it is wrong to talk about a variable condenser as having a capacity range of from zero to

something. No variable condenser yet made can provide zero capacity. The average variable has a minimum capacity of about a tenth of its maximum. Thus the minimum of a .0005 mfd. might be somewhere about .00005 mfd.

REACTION VARIABLES.

.0002 mfd. is by no means too small a maximum capacity for a variable that is required for use in short-wave reception, but if the variable has an efficient slow-motion control or a vernier dial is available in order that more or less microscopic adjustment of the vanes can be made, then a larger maximum capacity can be used in order to increase the range of tuning. Under these conditions a value of .00025 mfd. or .0003 mfd. can be recommended.

Regarding reaction control variable condensers, here again it is advisable within limits to keep down the maximum. Generally speaking, the smaller the reaction variable the broader and smoother will be the reaction adjustment. But if the condenser is too small it will be difficult to confine the control to its range of movement. That is to say, it will necessitate a critical adjustment of other conditions in order to enable the condenser to control reaction over the limited capacity range the small condenser possesses.

The circuit may become a little over-vigorous and you will find it impossible to stop it oscillating, or it may go flat owing to declining H.T. or L.T. and the advantages of reaction become lost. A condenser having a larger maximum would provide greater latitude, or, in other words, introduce a margin of safety on either side.

STICK TO SPECIFICATIONS.

The foregoing remarks are intended only as a general guide. If you are building a receiver to a special design then you should adhere to the specification and, whatever anybody else says, do not depart from the various recommended values.

If you depart from the stipulated tuning variable values then you will throw out the tuning ranges, but it is even more important to stick to the specified reaction variable. Supposing you were to use a .0005 mfd. instead of a specified .00005 mfd. say. You might quite conceivably find that the receiver would not stop oscillating even when the variable was at its minimum adjustment. You see, although there might be a 0 on the dial, a variable cannot be turned down to zero capacity. If it is not a particularly well-designed variable its minimum capacity might be more than the maximum of the component value advised.

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Price 1/-

SELECTING A SET

Some invaluable hints and tips for prospective set builders and buyers.

The regular reader of a journal such as "P.W." will have no difficulty whatever in picking out just that set which suits his own purposes and pocket the best. But the casual reader can be forgiven if he finds the problem rather difficult, and it is more particularly to him that the following remarks are addressed.

Obviously your first consideration is going to be a financial one.

If you have any doubts whatever about your constructional ability we hope you will put those aside. Providing you rigidly adhere to a published specification you are not likely to meet with much trouble. Nevertheless, we must make the qualification that if you know nothing at all about radio, and have not at least a general idea of the purposes of the various components employed in the average set, it is going to be worth your while to limit your first venture to the building of a fairly simple outfit, such as a crystal set or a one- or two-valver.

Now, regarding the aforementioned financial question, the cost of the actual set is not, by a long way, the only cost that needs to be considered. There are also the costs of the accessories and of maintenance that have to be reviewed.

THE QUESTION OF COST.

First of all, the cost of any particular design can generally be considerably reduced by using throughout those very cheap foreign components that gain such big displays in suburban radio stores. We are not going to say that every cheap foreign radio component is "dud," for this is by no means the case.

But a vital point that you should remember is that a high-class British component carries with it the guarantee of its maker. Should it at any time break down or develop a serious fault you will find its manufacturer only too pleased to go a long way, and, perhaps all the way, towards saving you the complete cost of a renewal.

And in many cases the higher-priced British components will be definitely worth the money paid for them in regard to their electrical efficiencies. Without mentioning any names, we can say as an absolute fact that we have known cases where two-valve sets made up with quality components have given results as good, if not superior, to those afforded by three-valve receivers employing what are sometimes misleadingly described as "inexpensive" components. Again, we must add that there are notable exceptions to this rule.

Do not put all your money in the set and disregard the accessories. They are every bit as important as the receiver itself. Get good British valves, batteries, loud speakers, etc., for your receiver. A nondescript assembly of valves can ruin an otherwise magnificent set. Likewise it would be incon-

gruously wrong to employ a cheap horn variety of loud speaker with a powerful multi-valver.

STRIKING A BALANCE.

You must strike a careful balance between the cost of the receiver and its accessories; the latter might in many cases mean the greater outlay. The maintenance cost of a five-valve set is going to be very much more than that of a two-valver. First of all, there is the question of H.T. Whether you use dry batteries or an accumulator battery you can write down some few pounds per year on this count. And these pounds are going to be two or three times greater in number in the case of a big set using a super-power valve.

Thanks to the modern dull-emitter valve the L.T. is a comparatively inexpensive item with any set, although you must not forget that accumulators do not last for ever, and that the lives of many, especially when they are handed periodically to some charging stations, do not exceed two years.

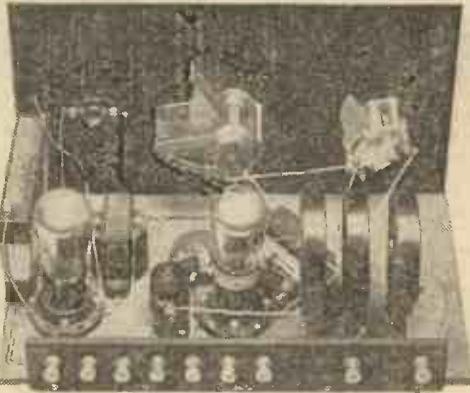
Having imposed upon yourself some sort of arbitrary financial limitation, you can then go a step further and ask yourself exactly what sort of set you need. If you have any ear for quality of reproduction at all, then go for the biggest set possible. Remember, particularly, that the purpose of high-frequency amplification is not only to bring in those far-distant broadcasters, or, at least, we had better say that you should not regard it as its only purpose.

For one thing, H.F. amplification is going to allow you to cut out interference more easily, and the more H.F. amplification you have—that is, the more stages—the easier it is going to be to cut out interference without also affecting the quality of reproduction. Again, H.F. amplification is going to permit you efficiently to operate your detector stage with sufficient energy to make reaction practically unnecessary.

IF YOU ARE MUSICAL—

Remember, if you require pure reproduction you must not resort to reaction. For the reception of the local station or 5 G B, 5 X X, Langenberg, and other such stations, you should regard "zero reaction" as your ideal. Two stages of L.F. amplification even again for the local station is better than one stage, for they will help you to get the requisite volume without distortion.

If you have a keen musical ear and cannot go to the expense of a multi-valver you will be happier with telephone receivers and a simple set. If you want to pick and choose your programme from any one of a dozen of so stations every evening, then you should turn your attention to those sets which incorporate



A straightforward two-valver using plug-in coils and transformer L.F. coupling.

wave-change switches on the panel. On the other hand, you may be prepared to go to the slight trouble of changing coils if and when you need to change the wave-length band of your set.

Some sets, as you will see if you examine the various specifications, are designed so that they are readily adaptable for the reception of short, medium and long waves. It is only the medium and long wave-lengths which will interest the "listening amateur," that is, the constructor whose main interest is the normal published broadcast programmes. The reception of short-wave stations, such as KDKA of America, or 3LO of Australia, cannot be guaranteed at any definite time by any set, and when on favourable opportunities such a station is received there is liable to be considerable fading and atmospheric.

LOCAL CONDITIONS.

We can say, therefore, that the short-wave work is of purely an experimental nature, although many listeners find it absorbing to listen to the sounds of music from distant parts of the earth.

Now we come to the question of local conditions, a vital point indeed! You may, or may not, be situated in what is known as a "blind spot." There are a good many of these in various parts of the country, especially in Wales and in the south-west of England. A blind spot is an area where reception conditions are very bad. There are other localities which are exceptionally kind to radio, and the difference between the two is sometimes staggering. In a few words, it can be said to be almost the difference between a two-valve and a five-valve set, used at any one point. For this reason, it is wise not to judge too hastily the capabilities of a set by the performances recorded by correspondents in various parts of the country, or, at least, note should be taken at which points the various correspondents are situated.

Regarding local conditions again, interference must not be forgotten. In certain parts of the country, especially those near the coast, shipping transmitters play havoc with unselective receivers. If you live right in London, and your main and perhaps only objective is to receive London, then selectivity is not a problem that will interest you, but if you live in the Midlands or on the coast, and many stations actuate your aerial, then selectivity must assume some importance in your choice of a set.

OPERATING A SET.

There is another very important consideration which we have not yet alluded to at all, and that is the operation of the receiver. If you are not prepared to acquire manipulating skill the fewer controls on the panel the better. The same thing applies, of course, if you want the set to be used by inexpert members of the household.

Two tuning dials are not always only twice as difficult to handle as one dial, sometimes they are four or five times as tricky, and, if the set is not calibrated, and unless the dial readings for each station are carefully noted on a chart, the inexpert operator would find three dials quite beyond him. So far we have said nothing at all about circuits. We mean types of circuits. But you will find that another article in this book adequately covers that subject.

In conclusion just a few words about portable sets. During the past year or so a very large number of portable sets have made their appearance on the market, and no doubt a proportionally large number have been sold. Unfortunately, a number of the cheaper ones are undoubtedly very poor propositions, and readers are warned against being led away by glowing claims which are not substantiated. Radio sets are far from being standardised productions.

FINDING FAULTS

How you can trace faults in sets, accessories and components.

Defects in the wiring of a receiver, or those arising from faulty components, may often be detected by a very simple series of tests with a pair of 'phones and a dry cell. One tag of the 'phone should be connected to one terminal of the dry cell and two flex leads should be connected, one to the remaining 'phone tag and the other to the remaining terminal of the dry cell (a flash-lamp battery is quite satisfactory).

These two flex leads, if now touched lightly together, will produce a strong double click in the 'phones, one click when they make contact with each other, and another when they are separated again. They may thus be used for testing for continuity in leads, etc., since the loud double click is ample evidence that everything is satisfactory.

TESTING FOR CONTINUITY.

A fault in a coil-holder, for instance, such as a break between the terminal and the plug or socket to which it is connected, may now easily be detected, since if one flex lead is connected to the terminal and the other to the side of the holder to which the terminal should make connection, absence of the double click is positive evidence that the component is faulty.

On the other hand, if one of the flex leads is connected to the socket of the coil holder and the other to the plug, if a double click is heard, there is a short-circuit across the holder.

Similar tests may be made with valve holders, both for testing for a connection between each terminal and its socket and for testing for short-circuits between the sockets.

Variable condensers may also be tested by this method, a short-circuit between the plates giving rise to the usual double click, which should *not* be present in the usual way.

It is, of course, essential to see that all leads are removed from the components under test and also that no coils are in position in the coil sockets when these are tested.

Complete circuits may be tested in this manner: For example, if the A.T.C. is in parallel with the A.T.I., in a simple tuned aerial circuit, one flex lead placed on the aerial terminal and the other on the earth terminal will give a certain test for continuity between these points.

INTERFERENCE FROM OUTSIDE SOURCES.

Cases of interference from outside sources such as electric railways, tramway systems, power mains, electric motors, X-ray apparatus, etc., are extremely difficult to deal with, and in many cases it is impossible to effect a complete cure.

Sometimes, however, a certain measure of relief may be gained by one or more of these expedients:

1. Use a counterpoise instead of a direct earth. This should be as nearly as possible a replica of the aerial, erected at a height of ten or twelve feet, just as much care being exercised over its insulation as over that of the aerial.
2. Try a different earth, e.g. if you are using the water main, transfer to a buried plate, etc.
3. Connect a small fixed condenser of about 0002 mfd. capacity between the earth terminal and the earth lead.
4. Use an indoor frame aerial and no earth.
5. Use Aperiodic Aerial Coupling.

AERIALS AND EARTHS

All the various practical forms of antenna for home use are dealt with in this informative section.

To all intents and purposes the strength of the rectified signals in a one-valve set is proportional with the square of the strength of the signals as they oscillate in the form of high-frequency currents in the aerial. That is to say, if we double their initial strength we obtain signals in the telephone receivers four times as loud. Therefore, a little loss of energy from the aerial becomes a correspondingly greater loss in the 'phones. On the other hand, a comparatively slight increase in the intensity of the energy we manage to guide on to the grid of the valve might mean a really noticeable increase in volume.

These are proved facts, not theories.

AERIALS FOR BROADCASTING.

The ideal aerial for broadcast reception would be one of 75 ft. in length, including the down lead, with plenty of height and suspended in space, touching nothing but the aerial terminal of the set and being yards away from anything else. But an aerial wire will not float in air, so it must be held up by some means. Insulators are very necessary evils. But we are jumping ahead too fast. First of all, the high-frequency energy generated in our aerials by the ether waves due to the various broadcasting stations can be lost in part either by absorption or by leakage. And there are two kinds of leaks to deal with—capacity leaks and conductive leaks.

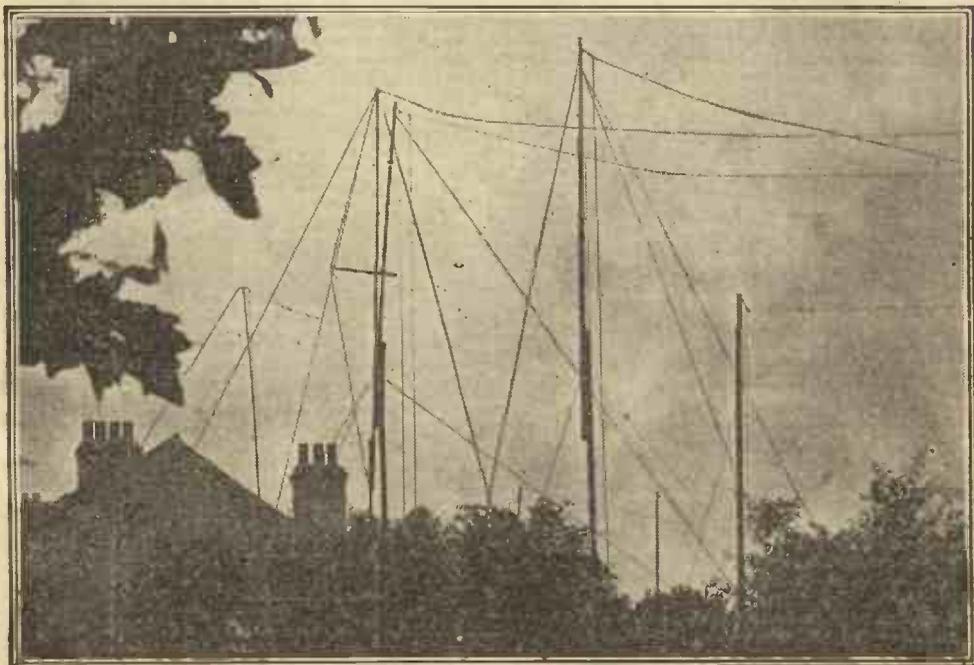
In a sense, absorption is leakage, but we are going to differentiate between the two in this article. Our capacity leaks are going to be purely "series condenser" effects, and our conductive leaks direct leaks through conductive paths.

There will be absorption losses if the aerial is very close to and parallel with another aerial, or if it is run along close to metal gutters, etc. But by now practically every listener, let alone the amateur, will know that an aerial must be kept well away from walls, roofs, trees, and other such objects, and we will take it for granted that it is unnecessary for us to go over all the elementary requirements of an efficient aerial. But a few words must be said regarding height.

EFFECTIVE HEIGHT.

You can have an aerial that at no point in its horizontal length is nearer than 40 ft. from the ground that has an *effective* height of only a few inches. Such an aerial might run along a roof throughout the whole of its length.

By "effective height" is meant the average distance between the aerial wire and all earthed objects, such as roof, trees, and walls. An aerial near to such things will have a higher H.F. resistance than it should, and will not possess a good pick-up. (Not a gramophone pick-up! The term indicates



There are some fine aerials in this typical suburban group, but they are, in some instances, unfortunately close to each other.

the active nature of the aerial—its power to pick up signals from the ether.)

One of the reasons why ships can communicate over such long distances with relatively low power is because their aeriels are high and unscreened. The statement was once frequently made that every foot of aerial height gained is of enormous value, and so it is; but you may not notice much improvement in results if you only raise your aerial 12 in. at one end. If you can put it up 12 ft. throughout the whole of its length, then you may add as many more stations to your nightly collection.

REGARDING SELECTIVITY.

There has been of late a tendency to advise the deliberate use of inefficient aeriels in the interests of selectivity. Personally, we should say that this is rather an unhappy solution to the jamming problem. Far better it would be to add to the efficiency of the aerial, and to do the same in regard to the selective qualities of the set.

Actually, of course, selectivity as a desirable quality in a radio set is quite valueless unless it is accompanied by adequate sensitivity. The power to select is, in other words, only of use if there are things available from which to choose.

No; if you want to try the desperate plan of reducing the "sensitivity" of your aerial, having tried wave-traps and other such devices, then reduce its length. We would even add, try the experiment of increasing its height simultaneously.

A vertical aerial is, of course, one of the most efficient of all forms of antenna, and as it has no directional qualities, it is an excellent form for broadcast receiving purposes, although difficult to erect.

DIRECTIONAL EFFECTS.

An outdoor aerial can be fairly directional—a point you may have overlooked. Most outdoor aeriels take the form of inverted "L's." That is, there is a horizontal or nearly horizontal wire or wires which continue in a vertical wire, generally termed the "down lead."

Such an aerial receives best from the direction to which the down lead is pointing. Therefore, you can, within limits, add or take away the strength of the signals received from various stations by swinging the free end (the end farthest from the down lead) of the aerial round.

It is the practice of quite a number of people to refer to indoor aeriels disparagingly, as though they were definitely inefficient. But the fact is that a very good indoor aerial can be better than one of an outdoor type that may look as though it should be good.

INDOOR ARRANGEMENTS.

There are many different ways of arranging an indoor aerial. If possible, it should be fixed up in one of the higher rooms in the house, or in a loft or attic. Height is the initial requirement, and it must not twist about down stairways and through passages. The best plan is to have the set in the upper room wherein is fixed the aerial, and then from the set run extension leads to the downstairs room for the loud-speaker or telephone receivers.

If you happen to be very close to the local station, and this is the only one from which you desire to receive, then there is no reason why you should not sacrifice a certain degree of efficiency and fix up the aerial in a downstairs room, if you so desire and it is more convenient to do so. Practically any kind of wire of the insulated kind can be used, although

very excellent material specially manufactured for the purpose is obtainable from such firms as Ward & Goldstone, The London Electric Wire Co., and Smiths, Ltd., etc. Ordinary bell wire will serve quite well. No elaborate insulating need be carried out, as the wire is to be indoors.

EARTH CONNECTIONS.

First of all, however, a good earth connection is required. A lead must run directly from the earth terminal of the receiver to some point such as a main water-pipe. A buried outdoor earth is a very excellent device, but it is an indisputable fact that for consistency and general efficiency a good water-pipe earth has many claims for general attention. Keeping the earth lead as short as possible, and of stout wire, take it, if possible, to a main water-pipe—one which does not go to a tank.

And here is a tip worth remembering. When the plumber comes along to do a repair, get him to solder the earth lead to the water-pipe. Without a great deal of experience, and a proper blow-lamp and tools, you will find it a difficult and even almost impossible task to do such a thing yourself. A good temporary joint can be made by scraping the pipe clean and then very tightly wrapping the cleaned wire round it. Proper earthing clips for making such earth-lead joints can be purchased for a few pence each, but these cannot give you the permanence that a well-soldered connection can. Failing a water-pipe, a gas-pipe can be used as an earth; but, generally speaking, this gives only poor results.

ROUND PICTURE RAILS.

The wire can be strung across the room just below the ceiling between two opposite picture-hooks, but unless it is a very large room the length will prove inadequate. Therefore, four or five separate lengths, widely separated, can be stretched across, the ends terminating in one down lead at the side nearest the set. The other ends are left free, and better reception will be obtained if these ends are pointing away from the station you most often desire to receive.

If this scheme is considered an unsightly one, a wire can be run around the back of the picture-rail; but the wire should not be taken the whole distance around the room. From the centre of one wall, it can be run around the picture-rail until it comes to the centre of the opposite wall, where it must terminate, or an extension be made through the door along a corridor. This extension must be kept in as straight a line as possible, and if it comes to such a point where it has to deviate greatly from a straight line, here it should be terminated.

AN INDOOR EXTENSION.

And, by the way, here is a tip worth noting on the part of those listeners having very small and poor outdoor aeriels. If you have only a few feet of outdoor aerial, you can try an extension from the point of entry indoors right across the room. In many cases this will definitely result in an increase of the pick-up qualities of your aerial system.

Many commercial sets are now being made with built-in frame aeriels. Frame aeriels are, of course, very inefficient, but their wide use has been made possible by the S.G. valve which is capable of giving enormous amplification. (For ordinary sets of only medium power, frame aeriels are not likely to prove particularly satisfactory.)

The point to remember in connection with a frame aerial is that it will be highly directional. Unless it is placed correctly in regard to the geographical position of a station, that station might not be heard at all,

MAKING AND USING MAINS UNITS

The Institution of Electrical Engineers issues "Regulations for the Electrical Equipment of Buildings." As an addition to the Ninth Edition they give certain rules governing the design and installation of radio mains devices. Mains units and sets due to reputable manufacturers, such as Radio Instruments Ltd., are built in conformation with these I.E.E. regulations, but there are some makes which are very widely at variance with them. Safe and reliable use of the power mains can be made possible only by strict adherence to such regulations.

129. Protection of Live Parts.—All parts (including the terminals and connections of batteries) which are alive or are intended to become alive from the supply mains shall be so guarded as to prevent accidental contact with such parts under normal conditions of use.

130. Construction of Cases.—

(A) Where the apparatus is enclosed the containing case shall be substantially constructed and shall be of (a) metal or non-ignitable material, (b) mahogany, teak, oak (English) or walnut, or (c) other material if a non-ignitable and non-hygroscopic lining is used. All holes for the passage of cables shall be so made as to avoid abrasion of the cables.

(B) Any containing case made of conducting material shall be earthed in accordance with Regulations 101 and 102, and shall be provided with a suitable terminal for that purpose.

(C) The apparatus shall be so proportioned and installed that under normal working conditions no part of it can rise to such a local temperature as will impair its durability, and that the general temperature of the air inside the main containing case does not exceed 120° F.

131. Protection against Excess Current.—The apparatus shall be adequately protected by fuses on both poles of the circuit supplying it. The size of such fuses (see Tables XIII and XIV) shall be based on the normal working current of the apparatus, provided that where the working current is less than 2 amperes no fuse smaller than No. 25 S.W.G. lead-tin alloy need be used.

132. External Cable Connections to Radio Apparatus.

—Where the conductor of any cable connected to a radio apparatus is in direct connection with the supply mains, such cable shall be of one of the types specified in Regulations 76 to 81 and shall be installed in accordance with Regulation 87.

133. Isolation from Supply Mains.—

(A) *Earthing Lead.*—There shall be no connection, except through a condenser, between any conductor directly connected to the supply mains and the earthing lead of the radio apparatus which is connected to the earth plate, waterpipe, or other earthing system. The above condenser should preferably be incorporated in the radio apparatus or should be placed as close as possible to it.

(B) *Aerial.*—Where radio apparatus is connected to direct-current supply mains the aerial shall only be connected to the apparatus through a double-wound high-frequency coupling transformer adequately insulated for a test pressure of 600 volts, or through a condenser inserted in series with the aerial circuit and immediately adjacent to the aerial terminal. The above transformer or condenser should preferably be incorporated in the apparatus or should be placed as close as possible to it.

Where radio apparatus is connected to alternating-current supply mains without the use of a double-wound "mains" transformer, the aerial shall be connected as described above, but the condenser referred to shall have a capacity not greater than .001 microfarad.

For either direct-current or alternating-current supply, the insulation-resistance test specified in Regulation 136 A shall be applied to the high-frequency coupling transformer or to the condenser, whichever be employed.

(C) *Head Telephones and Loud Speakers.* These shall be connected to the radio apparatus either through a double-wound transformer or, alternatively, through a circuit which includes a condenser in series with each of the outgoing conductors.

NOTE.—The field circuit of a moving-coil loud speaker having a separately-excited field system may be independently connected to the supply mains in accordance with the Regulations which are applicable.

134. Condensers.—The condensers referred to in clauses (A), (B) and (C) of Regulation 133 above shall conform in all respects to British Standard Specification No. 271—1926 and shall be of either the mica-dielectric or the paper-dielectric type mentioned in that Specification for use in circuits in which the pressure does not exceed 300 volts (600 volts direct-current test pressure).

135. "Mains" Transformers.—Every "mains" transformer shall have its core earthed, and shall be of the double-wound type in which the winding that is in direct connection with the supply mains is effectively separated from all other windings either by an earthed metallic screen or by adequate insulation capable of withstanding a test pressure of 1,000 volts (alternating current). The insulation resistance between the above winding and all other windings, when measured after the above pressure test, shall be not less than 20 megohms when tested with a pressure of 500 volts (direct current) or twice the supply pressure, whichever be the greater.

136. Insulation Resistance.—

(A) The terminals or points at which the aerial, earth, and telephone or loud-speaker connection are made to the radio apparatus, or to the transformers or condensers referred to in Regulation 133 where these are external to the apparatus, shall have an insulation resistance from the "mains" input terminals of the apparatus of not less than 2 megohms when tested with a pressure of 500 volts (direct current) or twice the supply pressure, whichever be the greater.

(B) Every battery connected to the radio apparatus and intended to be in metallic connection with the supply mains shall be adequately insulated so as to have an insulation resistance from earth of not less than 2 megohms, when tested as specified in (A) above.

TWO IMPORTANT VALVE FACTORS

Here are easy-to-follow explanations of valve Impedance and the Amplification Factor. Every amateur should know exactly what these factors are and how they affect the operation of a set.

A few years ago comparatively little importance was attached to the characteristics of valves even by really enthusiastic amateurs. And perhaps it was just as well, for in those days valves were much more inconsistent than they are to-day. Standardisation was attempted, of course, but the processes and the machinery involved in their production were both insufficiently advanced to render the attempts at all successful.

HOW VALVES VARY.

Therefore, the result was that individual valves of similar types varied quite considerably. Even now perfection in this respect has not been attained. As a matter of absolute fact, it never could be, for no two or more manufactured articles ever can be absolutely identical, whether they be made by hand or machinery.

And in a valve the discrepancy of a microscopical nature can affect its electrical characteristics. But such a wealth of scientific research and endeavour has been directed towards the problem that for all practical purposes standardisation has been achieved. Therefore if the present-day amateur buys a valve of a certain type bearing the name of a reputable manufacturer he can safely depend upon it having those characteristics ascribed to the type in question. And what are the special characteristics which have a direct bearing upon the work it will be called upon to do?

FILAMENT FACTORS.

First of all there are "Fil. volts" and "Fil. amps." And everybody knows all about these for the simple reason that until a certain number of volts are applied across the filament of a valve by means of an accumulator or a dry battery, and until the specified amount of current is flowing through the filament and bringing it to the required temperature, the thing just will not work at all. Therefore, people have been forced to learn about these characteristics; but the same cannot be said about "impedance" and "amplification factor," for the misapplication or an ignorance of these may only mean the difference between bad and good results or between good and very good results!

A great deal has been written about the suitability of valves of certain impedances, and with certain amplification factors for certain specified purposes, and the two terms have been explained briefly many times; but we wonder how many of our readers even now know exactly what they mean. Anyway, what we are going to do on this occasion is to treat the subject from slightly different viewpoints to those usually taken, hoping by doing this that we will be able to leave the least technical reader with a clear idea of the general principles involved.

WHAT IMPEDANCE MEANS.

First of all, let us take impedance. Impedance indicates the resistance of a valve and for that reason is always expressed in ohms. Thus, a valve having an impedance of 20,000 ohms should be no more frightening to the amateur than a pair of telephone receivers stated to have a resistance of, say, 4,000 ohms. It is called impedance in the case of a valve because it is presumed to be the resistance of the

valve to fluctuating currents, and capacity and inductance have to be taken into account as well as plain straightforward ohmic resistance. And impedances calculated from statically prepared characteristic curves do not take these into account simply because such curves are prepared under static conditions with currents and potentials that do not fluctuate. And when it is added that the frequencies of current and potential fluctuations also should be taken into account, it is easy to see where the amateur can be confused.

But a characteristic curve can be a very good guide, and impedances and amplification factors worked out from this will give very close approximations of the capabilities or purposes of valves. But we cannot regard the "impedance" as anything, but plain, straightforward resistance in this case.

"ZERO GRID VOLTS."

And Ohm's Law says that resistance equals voltage divided by current. The current will be the anode current, which is expressed in milliamperes. Our Voltage will be the voltage of the H.T. battery, which will be connected directly across the plate and the filament of the valve with a milliamperemeter in series for measuring purposes. We do not want the grid to affect our readings, so we will leave it connected to the negative pole of the filament lighting battery. Thus, the mystical condition of "Zero Grid Volts" is obtained.

Now, supposing, with an H.T. voltage of 80 volts, 4 milliamperes of current is flowing through the anode circuit, and when the H.T. voltage is increased to 100 volts the anode current jumps up to 5 milliamperes. An increase of 20 volts H.T. has increased the anode current by 1 milliampere. Remembering that "Resistance" equals Voltage divided by Current, all that we have got to do is to reduce our milliamperes to amperes, and to divide this figure into the 20 volts to obtain that mysterious "Impedance" figure. One ampere equals one thousand milliamperes, so we must divide the 20 by .001, which gives us 20,000. Very simple, is it not?

THE AMPLIFICATION FACTOR.

Now the amplification factor is nothing more or less than an expression indicating the amplifying power of a valve. A valve amplifies because variations on its grid cause greater variations in its anode circuit, which includes the H.T. battery and telephone receivers or the primary of a transformer. Signals arrive in the form of voltage fluctuations on the grid and evince themselves in the form of variations in the current flowing in the anode circuit.

A variation of the H.T. battery voltage would also cause a variation in the strength of the anode current. Increase the H.T. by 20 volts and perhaps 1 more milliampere of anode current will flow: reduce the H.T. by 20 volts, and, perhaps, the anode current will drop 1 milliampere. Supposing a 2-volt variation on the grid caused as much variation of anode current as the above 20-volt variation of the H.T. battery voltage—i.e. 1 milliampere more or less, then it has taken ten times the amount of anode voltage to do what a certain grid voltage did, and so 10 is the amplification factor. Very easy, after all, isn't it?

ALL ABOUT LOUD SPEAKERS

The choice of a loud speaker presents a very difficult problem, but here are some practical notes on the subject for your guidance.

One of the knottiest problems with which the radio enthusiast is ever faced is that of choosing a loud speaker. There is first of all the price consideration. You can buy a loud speaker complete for something less than one pound, or you can pay as much as twenty guineas. Once upon a time the loud speaker was regarded as quite an unimportant sort of item. The reason for this was that the average set had such a distorted output that a few more broken notes here and there did not matter.

Nowadays quality of reproduction is, or should be, a primary consideration. With modern components and modern accessories a moderately high degree of tonal purity should be obtainable with even inexpensive hook-ups, and there is not the difference in this respect between the results one can get with a twenty guinea speaker and a fifteen-shilling speaker to-day that there is between the output of the cheapest of modern sets and that of the best set available five or six years ago.

THE THREE GROUPS.

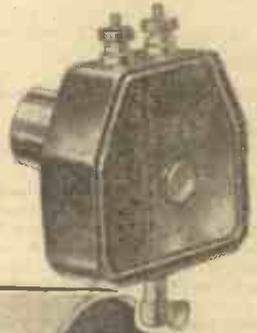
Loud speakers can be roughly divided into three groups. First of all, there is the horn variety, then the cone variety, and finally the moving-coil class. The last will be of interest only to the owner of a de-luxe multi-valve type of set. For the average listener the choice lays between the cone and the horn types. It is a fallacy to imagine that the cheapest of the cones is better than the best of the horn types. It is impossible to draw such an arbitrary distinction. We have in mind one cone speaker which is vastly inferior to a certain horn type of speaker, although it costs exactly twice as much.

Also, it is a startling fact that a large number of cone-type speakers have been credited with a kind of false superiority. The reason for this is to be found

in what is known as coloration. This coloration is, in effect, a sort of mellowing which tends to cover up the slight harshnesses due to imperfect set output. On the other hand, these are liable to be exaggerated by the resonances of horn models.

But there is again the question of bass. Invariably the cone type produces more bass although, again, in instances there is much of what is known as "false" bass. This is a resonance effect due to the employment of a large diaphragm. But there may be

On the right is a Brown Pick-up, specially suited for use with the famous "Vee" unit, while, below, is an excellent example of the horn variety of loud speaker.

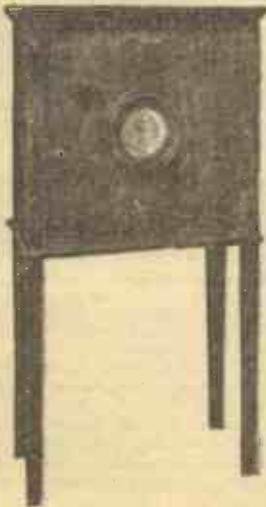


a corresponding loss in the high notes. It may be mentioned in parenthesis that the average listener will notice the loss of the high notes much more readily than the low.

If your set is of the robust character of a Det., 2 L.F. three-valve type, used close to a broadcasting station, say within ten miles or so, then you will probably

find more satisfaction in the larger cone speakers. There are very excellent Amplions available: the Brown family is very representative, and real faithfulness of reproduction is to be found in the Celestion group. Roughly speaking, here you will find quality rises in more or less uniform proportion with price.

Considerable success has accompanied the semi-free edged design of cone mounted on a baffle-board, or in a large cabinet after the fashion of moving-coil practice.



On the left is a moving-coil speaker and, above, a horn model with a wooden flare.

Where the output of the set is of a modest character, similar to that which one would expect from a Det., L.F. two-valver used about fifteen miles from a broadcasting station, then the general sensitivity of the horn variety of speaker will be appreciated, and even with the cheapest of these the results will sound quite pleasing providing the input is small.

A VERY IMPORTANT POINT.

Halve the input and quadruple the purity is the idea that has been propounded. You should always remember that a loud speaker can sound very different when used in different places. Do not judge too much from the demonstrations given to you in radio stores. A loud speaker used on exactly the same set might sound very different when heard in, say, a drawing-room and a shop. But added to this you have, in the usual way, the fact that it will be used with entirely different sets.

The only way you can properly judge a loud speaker is to connect it to your own set in your own home. Unfortunately, few stores will allow you to have speakers on approval. The only alternative is to

endeavour to borrow one or two different types from friends.

OTHER PEOPLE'S IDEAS.

Do not pay too much attention to the recommendations of other enthusiasts. People's tastes in loud speakers and loud-speaker reproduction generally vary to an enormous degree. Some like coloration and plenty of it, while others can detect it immediately and hate it.

You need not buy a complete loud speaker. An economical procedure is to purchase a loud-speaker unit and build up a cone type yourself.

These loud-speaker units are of a moderately uniform degree of excellence. We would certainly recommend the listener who can lay out only shillings on his loud speaker to adopt this course.

Finally, a word in regard to loud speakers fitted with logarithmic horns. These are generally more successful when built on a large scale, as for the "Talkies." Small designs of moderate efficiency have, however, been produced.

Fitting a Potentiometer

Sets employing one stage of H.F. amplification which are inclined to be unstable may be stabilised by the addition of a potentiometer as follows:

Examine the grid of the first valve. You will see that it is connected to one side of a coil, and one side of a variable condenser. The other sides of these two components are joined together and connected either to earth or to the filament circuit.

Disconnect the wire making this connection and, instead, still keeping the condenser joined to the coil, take a lead to the centre or moving arm of potentiometer. The remaining two contacts on the latter must now be connected across the filament terminals of the H.F. valve holder.

If the set now tends to howl or oscillate, it may be stabilised by moving the potentiometer arm towards the positive end. A point will be found where the set stops oscillating, and the best position for general reception is one such that the set has just ceased to oscillate.

How to Neutralise

The following method of neutralising is recommended for use in sets employing one stage of H.F. and provided with a reaction control:

Set the reaction control at minimum and likewise the neutralising condenser. Now, on setting the tuning condensers so that the two tuned circuits are in step with each other it will probably be found that the set is oscillating.

To test for oscillation touch one or other of the sets of plates of the tuning condensers (this may be either the fixed or moving, according to the particular set).

You will probably find that the set will only oscillate under the above conditions when the two circuits are in tune with each other, and this can be used as an indication.

It is convenient to perform the operation at some

point near the middle of the tuning range. Now, increase the capacity of the neutralising condenser. (In the case of some such condensers this means screwing downwards.)

Test at intervals for oscillation as this is done, and you will presently find that the set has ceased to oscillate and will not recommence even when the tuning dials are slightly readjusted.

Now increase the reaction a little, until the set once more oscillates and again increase the neutralising condenser setting until oscillation ceases. Slightly readjust the tuning condensers again to make sure that the set is completely stable once more.

FINAL ADJUSTMENTS.

Proceed in this way until it is found that the correct adjustment of the neurodyne condenser has been over-shot. Once this point has been passed, it will be observed that further increases of the neurodyne condenser setting no longer stop oscillation but cause it to become stronger.

The object is to find such an adjustment of the neutralising condenser as will permit the greatest setting of the reaction condenser to be used without producing oscillation.

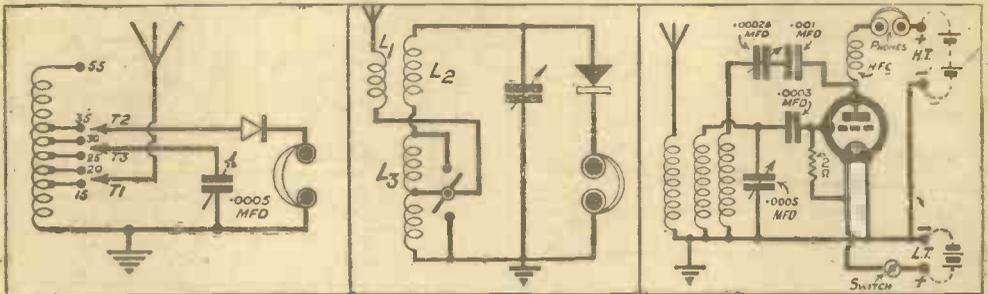
It will then be observed that when the two tuned circuits are in step and the set is brought to the verge of oscillation a slight movement in either direction of the neurodyne condenser will cause the receiver to break into oscillation.

It is to be understood that in the preceding notes, where a reaction condenser is spoken of, any form of reaction control may be understood.

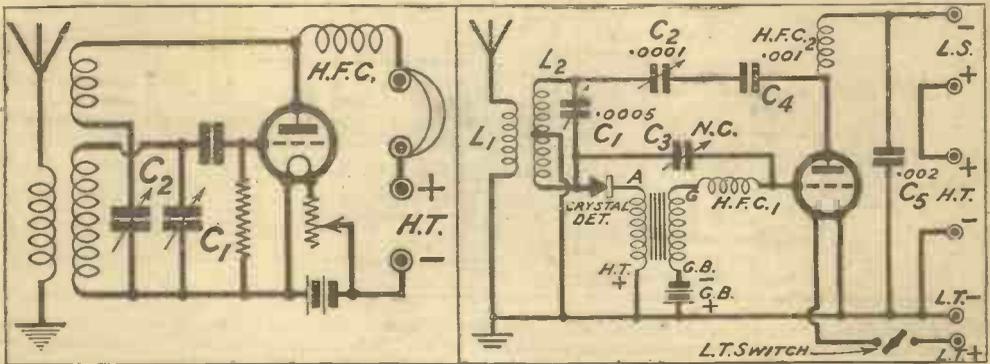
Mains Unit Earths

When an H.T. or L.T. or combined mains unit is used a direct earth connection is inadvisable, especially in the case of D.C. (See article on "Making and Using Mains Units.") The earth terminal of the set should be joined to the one terminal of a one or two mfd. fixed condenser, the other terminal of this being taken to the waterpipe or buried earth. Generally it is unnecessary to have any earth connection at all when the mains are used, as these give the desired earthing effect. Removing altogether the earth often reduces or eliminates interfering "hum."

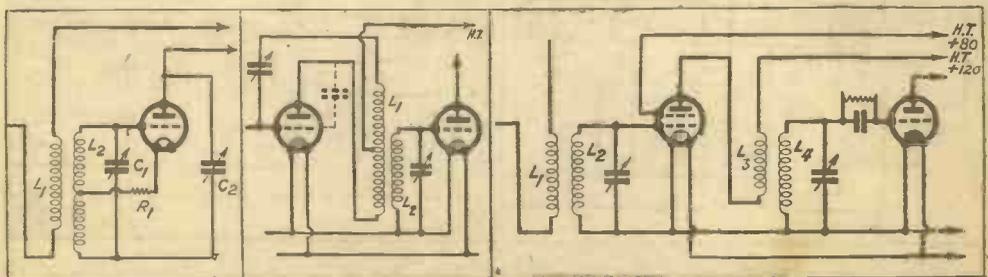
SELECTED "P.W." CIRCUITS



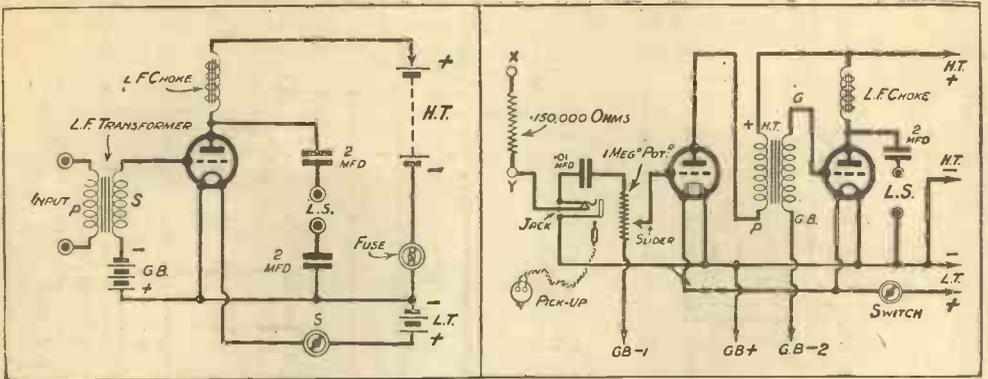
Left, a sensitive and selective type of crystal circuit. Tapping T_3 is normally placed on the 55-turn point, T_1 and T_2 being adjusted for best results. Numbers indicate turns of No. 24 D.C.C. wire on a 3-inch tube. Centre, a standard form of wave-change crystal circuit. L_1 , No. 25 or 35, L_2 , No. 60, L_3 , No. 150 centre-tapped. Right, the popular Reinartz circuit as a single-valver arranged for plug-in coils.



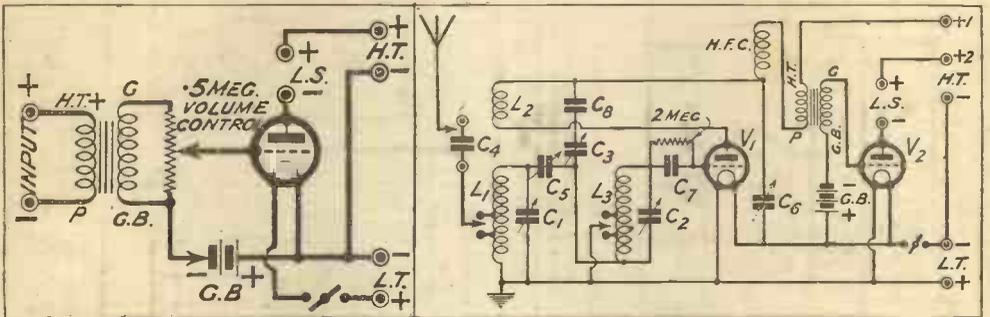
Left, a typical circuit of Reinartz type in which the reaction condenser is placed at the lower end of the reaction coil, thereby reducing hand-capacity effects. Right, a recent development of the "Trinadyne" circuit, employing a crystal detector and a valve which gives reaction and L.F. amplification. L_1 is a centre-tapped coil, C_1 a condenser of the neutrodyne type, and the valve an L.F. or small power. (H.F. type for headphone work.)



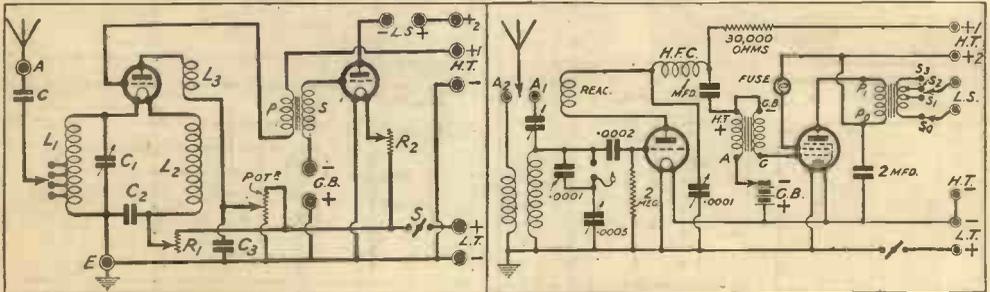
Some typical methods of H.F. inter-valve coupling. Left, split-secondary neutralising circuit. Centre, split-primary neutralising circuit in which the dotted condenser represents the plate-to-grid capacity of the valve. Right, plain transformer coupling as often used with screened grid-valves.



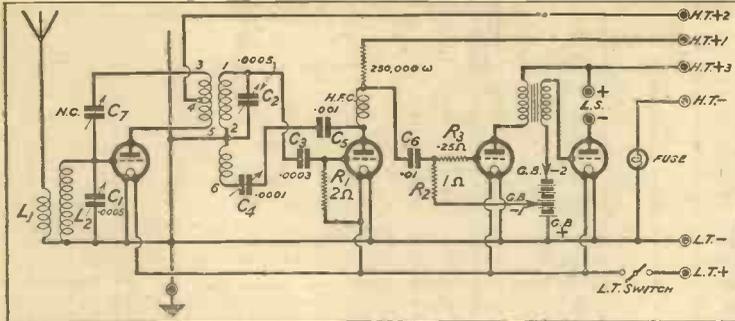
Left, a single-valve L.F. amplifier incorporating a safety fuse and an output filter properly arranged to reduce battery coupling-effects and to isolate the loud speaker completely when a mains unit is used. Right, a two-valve L.F. amplifier for use with any set not already incorporating L.F. stages, and with a jack for the insertion of a plug connected to a gramophone pick-up. Note the volume control marked "1 meg. Potr."



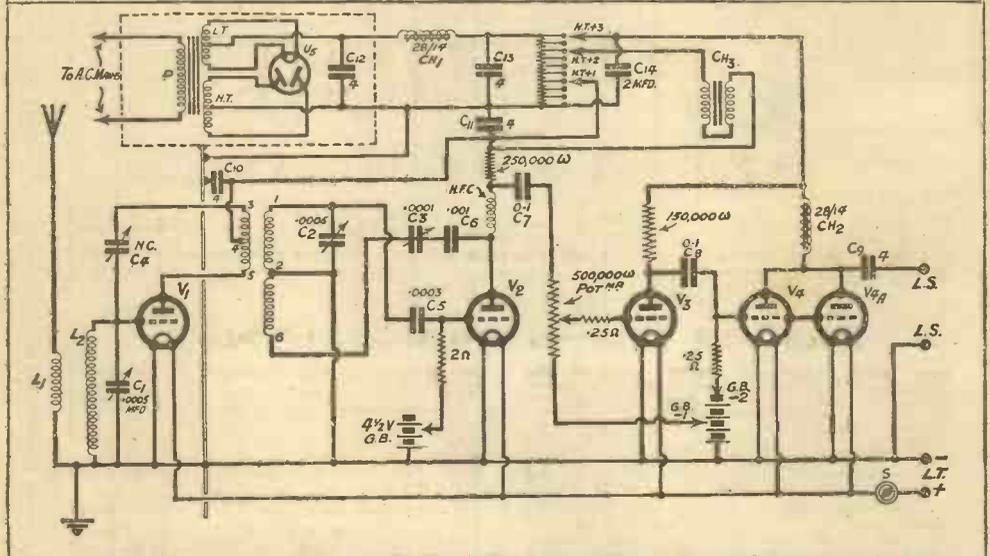
Left, a single-valve L.F. amplifier similar to the one above, but including a volume control and omitting the output filter. Right, an exceptionally high selectivity two-valve circuit for the Regional scheme. Coils L_1 and L_2 are of the "X" type (60 for low waves and 250 for long waves). Note the special reaction scheme: C_2 (.0001 mfd) is the main control, C_1 (.0001 mfd) is a compression-type adjustable condenser giving a preliminary control of reaction. C_3 is a neutrodyne-type condenser providing a small capacity to couple the two circuits together.



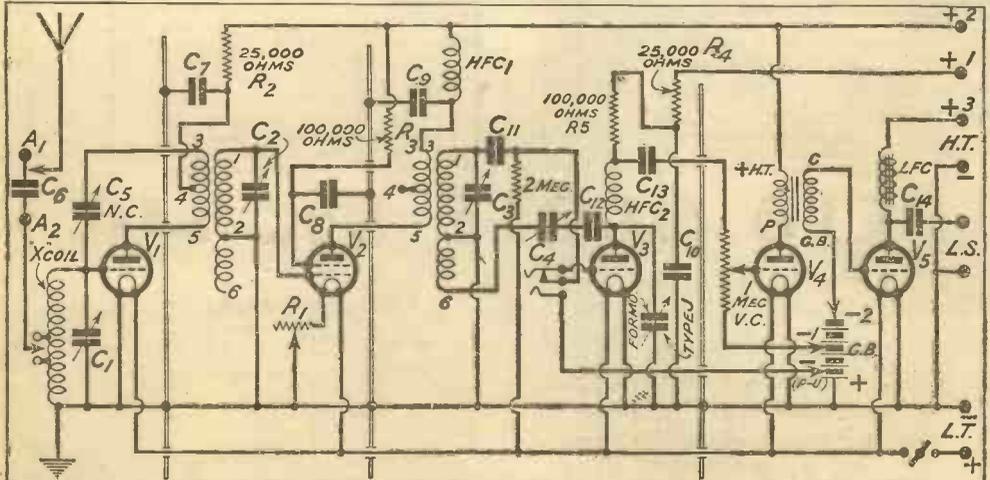
Left, a good example of the Filadyn circuit in one of its later forms. Note the division of the tuning coil into portions so that separate filament chokes are no longer necessary. The potentiometer provides the control of reaction. Right, a good modern form of two-valve short-wave circuit, using a pentode in the L.F. stage (note the special output transformer). The resistance-feed method is used for the L.F. transformer connections, and the set can be used on the broadcast waves by inserting suitable coils.



A good general-purpose four-valve circuit for 6-pin coils. The H.F. stage is of the split-primary neutralized type, followed by a leaky-grid detector, a resistance-coupled L.F. stage, and then a final transformer-coupled stage. A little screening is required for the best results.



A five-valve circuit designed to give very fine quality of reproduction and a large output with suitable valves. Note the built-in mains H.T. circuits (alternating-current mains).



A particularly good five-valve combination consisting of a neutralized H.F. stage, a screened-grid H.F. detector (note the jack for gramophone pick-up), one R.C. coupled L.F. stage and one transformer stage.

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BROADCASTING STATIONS

The wave-length and other details were completely revised and brought right up to date at the time of going to press.

METRES

1935	Kaunas (Lithuania), 7 kw.
1875	Huizen (Holland), 6.5 kw.
1796	Lahti (Finland), 40 kw.
1725	Radio Paris (C F R) (France), 12 kw.
1635	Königswusterhausen (Zeesen) (Germany), 26 kw.
1554	Daventry (5 X X) (Gt. Britain), 25 kw.
1481	Moscow (Old Komintern) (R A 1) (U.S.S.R.), 12 kw.
1444	Eiffel Tower (F L) (France), 12 kw.
1411	Warsaw (Poland), 8 kw.
1348	Motala (Sweden) (relays Stockholm), 30 kw.
1304	Kharkov (U.S.S.R.), 4 kw.
1200	Stamboul (Turkey), 5 kw.
1200	Boden (Sweden), 0.6 kw.
1153	Kalundborg (Denmark), 7.5 kw.
1116	Novosibirsk (U.S.S.R.), R A, 4 kw.
1073	Rostov-Don (U.S.S.R.), 4 kw.
1071	Scheveningen Haven (Holland), 2.5 kw.
1071	Hilversum (Holland), 6.5 kw. After 5.40 p.m. daily.
1010	Basle, 0.25 kw.
1000	Leningrad, 20 kw.
938	Moscow (C C S P), 2 kw.
870	Tiflis, 4 kw.
840	Nijni Novgorod, 1.8 kw.
800	Kiev, 1.2 kw.
778	Petrozavodsk (U.S.S.R.), 2 kw.
770	Ostersund, 0.6 kw. Relays Sundsvall.
760	Geneva (Radio-Genève), 0.25 kw.
700	Minsk (U.S.S.R.), 4 kw.
680	Lausanne (Switzerland), H B 2, 0.6 kw.
570	Freiburg-im-Breisgau (Germany), 0.35 kw.
570	Hamar (relays Oslo), 0.7 kw.
566	Ljubljana (Yugoslavia), 2.5 kw.
565	Smolensk (U.S.S.R.), 2 kw.
560	Augsburg (Germany), 0.25 kw.
560	Hanover, 0.35 kw. Relays Hamburg.
550	Budapest (Hungary), 20 kw.
542	Sundsvall (Sweden), 0.6 kw.
533	Munich (Germany), 1.5 kw.
525	Riga (Latvia), 3 kw.
517	Vienna (Rosenhügel) (Austria), 15 kw.
511	Archangel (U.S.S.R.), 1.2 kw.
509	Brussels No. 1 (Belgium), 1 kw.
501	Milan (Italy), 7 kw.
497	Moscow, 1.2 kw.
493	Oslo (Norway), 1.2 kw.
487	Prague (Czechoslovakia), 5 kw.
479	Daventry (5 G B) (Gt. Britain), 25 kw.
473	Langenberg (Germany), 13 kw.
466	Lyon (La Douai), France. Relays Ecole Sup., 5 kw.
459	Zurich (Switzerland), 0.63 kw.
453	Porsgrund. Relays Oslo, 0.7 kw.
453	Aix-la-Chapelle (Germany), 0.35 kw.
453	Aalesund (Norway), 0.3 kw.
453	Salamanca (Spain), E A J 22, 1 kw.
453	Bolzano (Italy), 1 B Z, 0.2 kw.
453	Danzig, 0.25 kw. Relays Königsberg.
453	Klagenfurt, 0.5 kw. Relays Vienna.
453	Tromsø (Norway), 0.1 kw.
453	Uppsala, 0.15 kw. Relays Stockholm.
453	Tammerfors. Relays Helsingfors, 0.8 kw.
450	Moscow (S P), R A 2, 1 kw.

METRES

447	Paris (P T T) (Ecole Supérieure), France, 0.8 kw.
441	Rome (1 R O) (Italy), 3 kw.
436	Stockholm (Sweden), 1.5 kw.
435	Malmberget. Relays Boden (Sweden), 0.25 kw.
430	Belgrade (Yugoslavia), 2.5 kw.
427	Kharkov (U.S.S.R.), 4 kw.
424	Madrid (Union Radio) E A J 7 Spain, 2 kw.
418	Berlin (Witzleben) (Germany), 1.5 kw.
413	Dublin (2 R N) (Ireland), 1 kw.
412	Rabat (Morocco), 10 kw.
408	Katowice (Poland), 10 kw.
403	Berne (Switzerland), 1 kw.
399	Glasgow (5 S C) (Gt. Britain), 1 kw.
394	Bucarest (Roumania), 0.12 kw.
394	Fredrikstad (Norway). Relays Oslo, 0.7 kw.
390	Frankfurt (Germany), 1.5 kw.
385	Genoa (1 G E) (Italy), 1 kw.
385	Wilno (Poland), 0.5 kw.
381	Toulouse (Radio) (France), 8 kw.
377	Manchester (2 Z Y) (Gt. Britain), 1 kw.
372	Hamburg (Germany), 1.5 kw.
368	Radio L L (France).
368	San Sebastian (E A J 8) (Spain), 0.3 kw.
368	Seville (Union Radio) (E A J 5) (Spain), 1.5 kw.
364	Bergen (Norway), 1 kw.
360	Stuttgart (Germany), 1.5 kw.
356	London (2 L O) (Gt. Britain), 2 kw.
352	Graz (Austria). Usually relays Vienna, 7 kw.
351	Algiers (Algeria).
351	Leningrad (U.S.S.R.), 1.2 kw.
349	Barcelona (Radio Barcelona) (E A J 1) (Spain), 8 kw.
346	Strasbourg (France), 0.1 kw.
342	Brünn (Czechoslovakia) 2.4 kw.
339	Bremen (Germany). Relays Hamburg, 0.35 kw.
335	Cadiz (Spain), 0.5 kw.
335	Posen (Poland), 1.2 kw.
332	Naples (1 N A) (Italy), 1.5 kw.
329	Montpelier (France), 0.2 kw.
329	Paris (Petit Parisien) (France).
325	Breslau (Germany), 2 kw.
322	Göteborg (Sweden), 10 kw.
322	Falun (Sweden), 0.5 kw.
319	Dresden (Germany), 0.25 kw.
316	Marseilles (P T T) (France), 0.5 kw.
314	Oviedo (Spain), 0.7 kw.
313	Cracow (Poland), 0.5 kw.
310	Cardiff (5 W A) (Gt. Britain).
308	Radio-Vitus (France).
308	Zagreb (Yugoslavia), 0.7 kw.
305.6	Agon (France).
304	Bordeaux-Lafayette (P T T), France, 1 kw.
301	Aberdeen (2 B D) (Gt. Britain), 1 kw.
298	Hilversum (Holland), 6.5 kw. Until 5.40 p.m.
295	Tallinn (Estonia), 0.7 kw.
293	Kosice (Czechoslovakia), 2 kw.
293	Limoges (France), 0.5 kw.
291.4	Lyon (Radio) (France), 0.5 kw.
291	Viborg (Finland), 0.4 kw.
288.5	Bournemouth (6 B M) (Gt. Britain), 1 kw.
288.5	Bradford (2 L S) (Gt. Britain), 0.13 kw.
288.5	Dundee (2 D E) (Gt. Britain), 0.13 kw.
288.5	Edinburgh (2 E H) (Gt. Britain), 0.35 kw.

METRES

288.5	Hull (6 K H) (Gt. Britain), 0.13 kw.
288.5	Liverpool (6 L V) (Gt. Britain), 0.13 kw.
288.5	Plymouth (5 P Y) (Gt. Britain), 0.13 kw.
288.5	Sheffield (6 F L) (Gt. Britain), 0.13 kw.
288.5	Stoke-on-Trent (6 S T) (Gt. Britain), 0.13 kw.
288.5	Swansea (6 S X) (Gt. Britain), 0.13 kw.
286	Montpellier, 2 kw.
283	Notodden (Norway), 0.05 kw.
283	Magdoburg (Germany), 0.5 kw.
283	Innsbruck (Austria), 0.5 kw.
283	Stettin (Germany), 0.5 kw.
283	Berlin Relay (Germany), 0.5 kw.
283	Uddevalla (Sweden), 0.05 kw. Relays Göteborg.
283	Varberg (Sweden), 0.3 kw.
281	Copenhagen (Denmark), 0.75 kw.
280	Radio-Liège.
279	Bratislava (Czechoslovakia), 12.5 kw.
276	Königsberg (Germany), 2.5 kw.
274	Turin (Italy), 7 kw.
272	Rennes (France), 0.5 kw.
270	Trollhättan, 0.45 kw. Relays Göteborg.
270	Hudiksvall, 0.15 kw. Relays Sundsvall.
270	Norrköping (Sweden), 0.25 kw. Relays Stockholm.
270	Kaiserslautern (Germany), 0.25 kw.
268	Barcelona (Radio Catalana), EA J 13, 10, kw.
268	Strasbourg, 0.1 kw.
265.4	Lille (P T T) (France), 0.7 kw.
263	Moravska-Ostrava (Czechoslovakia) 10 kw.
261	Newcastle (5 N O) (Gt. Britain), 1 kw.
259	Leipzig (Germany), 1.5 kw.
257	Horby (Sweden), 10 kw.
255	Toulouse (P T T) (France), 1.5 kw.
253	Gleiwitz, 5 kw.
251	Almeria (Spain) EA J 18, 1 kw.
250.9	Schaerbeek (Brussels) (Belgium).
246	Abo (Finland), 0.5 kw.
246	Kalmar, 0.2 kw. Relays Stockholm.

METRES

246	Saffle, 0.4 kw. Relays Stockholm.
246	Eskilstuna (Sweden), 0.2 kw. Relays Stockholm.
246	Jakobstad (Finland), 0.25 kw.
246	Linz (Austria), 0.5 kw.
246	Kiel (Germany). Relays Hamburg, 0.35 kw.
246	Cassel (Germany). Relays Frankfurt, 0.25 kw.
246	Kiruna (Sweden). Relays Boden, 0.2 kw.
246	Cartagena (Spain), 0.4 kw.
242	Belfast (2 B E) (Ireland), 1 kw.
241.3	Rjukan, Relays Oslo, Norway, 0.18 kw.
239	Nimes (France), 1 kw.
239	Nürnberg (Germany). Relays Munich, 2 kw.
238	Bordeaux-Sud-Ouest (France).
237	Juan-les-Pins (Nice) (France).
237	Orebrö. Relays Stockholm (Sweden), 0.2 kw.
235.5	Charleroi (Belgium).
234	Munster (Germany), 0.5 kw.
231	Boras. Relays Göteborg (Sweden), 0.15 kw.
231	Umea (Sweden), 0.2 kw.
231	Malmö (Sweden), 0.6 kw.
231	Hälsingborg (Sweden), 0.2 kw.
228.4	Biarritz (Côte d'Argent, France), 1.5 kw.
227	Cologne (Germany), 2 kw.
224.4	Cork (6 C K) (Ireland), 1 kw.
223	Radio-Luxembourg (Experimental), 2 kw.
221	Helsingfors (Finland), 0.9 kw.
218	Karlstadt (Sweden), 0.25 kw.
218	Flensburg (Germany), 0.5 kw.
218	Ornskoldsvik, 0.2 kw. Relays Sundsvall.
218	Björneborg (Finland), 0.8 kw. Relays Helsingfors.
216	Halmstadt (Sweden), 0.2 kw.
204	Gävle (Sweden). Relays Stockholm, 0.2 kw.
203	Kristinehamn (Sweden), 0.25 kw.
202	Jönköping, 0.25 kw. Relays Stockholm.
200	Leeds (2 L S) (Gt. Britain), 0.13 kw.
196	Karlskrona. Relays Stockholm (Sweden), 0.25 kw.

MAKE YOUR SET SELECTIVE

Details of a simple scheme that can be applied to practically any set.

The use of what is generally termed "Aperiodic Aerial Coupling" is often beneficial in increasing selectivity, cutting out unwanted noises, etc., etc., and old sets can be converted as follows:

Mount another coil socket by the side of the existing aerial coil, so that the coupling between the new coil and the existing one will be as tight as possible. From one of the terminals on the new socket take a wire to a new terminal on the panel or terminal strip; this will be the new aerial terminal. Connect the other terminal on this new socket to earth.

NEW COIL SIZES.

The coil sizes used will now be slightly different, and, in general, will be as follow:

In the old aerial socket, which now becomes the secondary coil, for the broadcast band a No. 60 or 75 coil. For Daventry, a No. 200 or 250.

In the new socket, for the broadcast band, a No. 25,

35 or 50 will be needed, and for Daventry a No. 75 or 100.

In the case of sets employing a stage of H.F. amplification, this improvement may sometimes have the effect of rendering the set a little unstable, in which case a potentiometer should be used. (See "Fitting a Potentiometer" on another page.)

EVEN CHEAPER.

Another simpler and cheaper method of applying aperiodic aerial coupling is as follows. Wind thirty or so turns of 24-gauge cotton covered wire in the form of a hank coil, and secure its turns by tying thread around it. This coil should be of approximately the same diameter as the existing aerial coil. These two coils can be tied together by thread. The connections are exactly the same as in the first case.

The coil described will be suitable for the normal broadcast band; one of seventy or so turns will be needed for the 5 X X range.

YOUR L.T. BATTERY

The selection and maintenance of radio accumulators is dealt with below.

If you are fortunate enough to know of a really good service station for L.T. batteries, your accumulator will be automatically kept in condition by this charging station. The actual condition of the whole battery and its separate cells should be checked there by experts who know just how to cure any little troubles that may arise.

The symptoms by which the condition of a cell is tested are the voltage and the specific gravity. The voltage is tested by means of a voltmeter, before, during, and after the charging, and also while the accumulator is discharging.

Similarly the specific gravity of the electrolyte is tested during the various stages of charging and discharging, and if the tests are scrupulously carried out the slightest disorder in the cells will be detected at its very beginning.

AT CHARGING STATIONS.

The chief points watched in a charging station, apart from the rates of charge, etc., are:

(a) "Topping up" the cells (distilled water is used to make up for any losses of the acid solution due to evaporation)

(b) Scrupulous cleanliness of the connections is essential. The connecting bars should be tight and well fitting, the terminals coated with petroleum jelly to prevent them being attacked by the acid, and in general the battery should be kept clean, cool and dry.

(c) The little filling plugs should always be placed back in position after the electrolyte has been tested or renewed, and it is important that the small holes in the plugs (arranged for allowing gases, etc., to escape) should not become blocked up.

About every twelve months the old electrolyte should be poured away and replaced by new electrolyte of the correct specific gravity.

HYDROMETER TESTS.

The voltage of an accumulator is tested by a voltmeter. The hydrometer, although it is an instrument for testing an accumulator, does not measure the voltage of the accumulator at all.

The use of the hydrometer is simply the measurement of the "density" or "strength" of the accumulator's acid. The conditions of the acid (or, to give it its proper name, the electrolyte) alters according to the condition of the accumulator in very much the same way as the voltage rises when the accumulator is "fresh," and falls when it is discharged.

As testing the voltage across the terminals will indicate whether the cell is fully charged or is run down, so will the strength of the acid indicate whether it has been charged recently or whether it is in need of recharging. When an accumulator which is in ordinary good condition has been recently recharged, the "density," or, again, to give the right name, the "specific gravity" of the acid is 1.2.

DENSITY OF ELECTROLYTE.

After the battery has been in use and is run down (with its voltage down to about 1.85) the specific gravity will be down to 1.17. The fall in the specific gravity from 1.2 to 1.17 is a gradual one, which keeps pace exactly with the condition of the accumulator.

With the hydrometer test we merely find out how

much lower than normal is the density of the liquid in the cell. In fact, the hydrometer tests the electrolyte of each cell (thus giving a reliable indication of the condition of the cell), but it is in no way concerned with the voltage.

CAPACITY OF ACCUMULATOR.

A glance at the maker's figures shows the filament current of each valve, and these must be added together in order to get the total current consumption. Supposing the H.F. valve has a filament current of .1 ampere, the detector valve has a current of .1 ampere, the first L.F. valve has .1 ampere, and the power valve has a current of .15 ampere.

As stated, these must be added together and the total current consumption of the set will then be found to be .45 ampere. The ability of an accumulator to supply current is reckoned in ampere hours. By adding up the current consumption of each valve in the set, you have found out the number of amperes—i.e. .45. The next thing to find out is the number of hours. If the set is to be used for four hours per day for a fortnight, you can reckon the total number of hours for each two weeks will be about sixty.

If this figure (sixty) is multiplied by the figure of the total amperes taken by the set—i.e. .45—you will get the required number of ampere hours.

SIZES TO USE.

Multiplication of 60 by .45 gives an answer of 27. This, then, is the number of ampere hours which you will take out every fortnight, and although there is not an accumulator which gives exactly 27 ampere hours, there is a size "30 actual ampere-hours," made by practically every accumulator manufacturer.

As it is advisable to always have a little in hand this is the size of accumulator you require, and if you instal a "30 actual" accumulator and work it as stated with the valves mentioned you will find that it will keep the filament current supply up properly.

Be sure, however, to note that you purchase an accumulator rated at 30 actual ampere-hours, as the 30 "ignition" rating has a capacity of only about half this figure.

Testing Dry H.T. Batteries

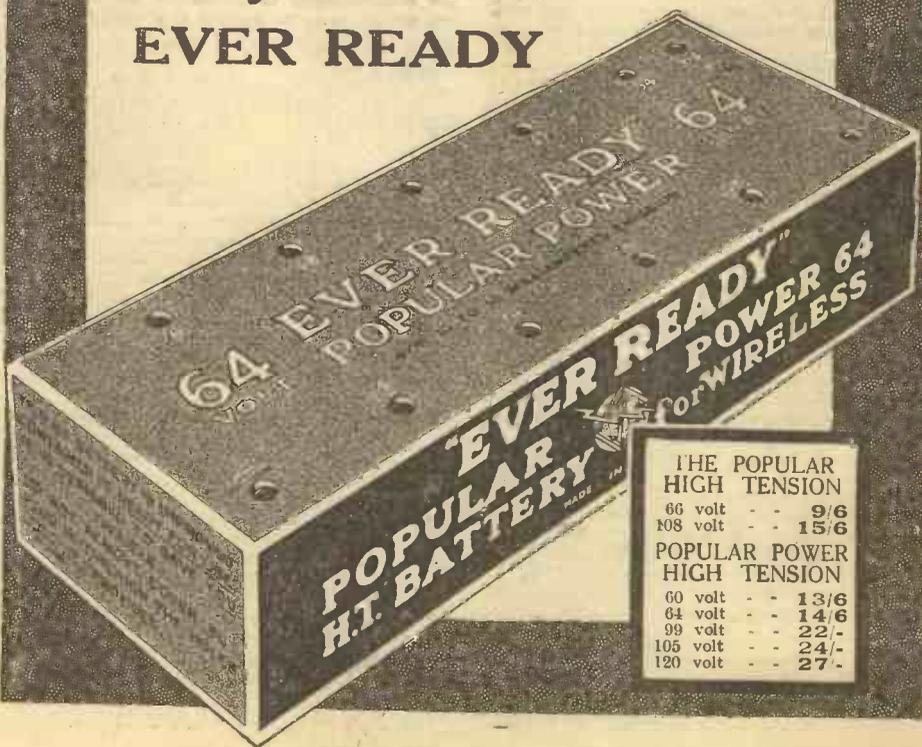
If you have a really good high resistance voltmeter this will give a reliable indication of the condition of the dry battery if it is connected to it after the set has been in use about an hour, i.e. whilst the battery is still on load. If the voltage is tested in this way (about once a week) after the battery has been in service for a month or so, it is the work of only a moment to verify that it is in good condition. But make sure that the voltage is always read while the battery is on load, and has been supplying current for some time, and do not let the total voltage of the battery drop below about 80 per cent of the rated voltage.

EVER READY

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and Long Life—
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66 volt	- - 9/6
88 volt	- - 15/6
POPULAR POWER HIGH TENSION	
60 volt	- - 13/6
64 volt	- - 14/6
99 volt	- - 22/-
105 volt	- - 24/-
120 volt	- - 27/-

LEADING SHORT-WAVERS

The following details of the most important of the short-wave broadcasters were very carefully checked, on the day of going to press, with the very latest available information.

SHORT-WAVE STATIONS.

METRES

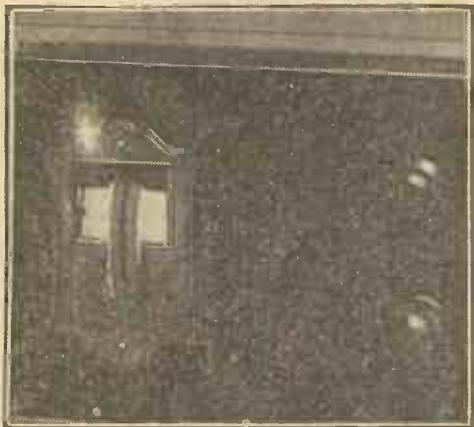
- 104.5 Perth (Australia), 6 W F, 0.25 kw.
- 84-24 Copenhagen (7 R 1). Experimental transmission TUESDAY and FRIDAY, after close of ordinary transmissions.
- 80 Constantine (Tunis) 8 K R. MONDAY and FRIDAY.
- 70 Vienna (O H K 2). (Transmits on SUNDAY for 15 minutes after each hour from 5 p.m. till 11 p.m.)
- 67-65 Döberitz (A F K), 5 kw. MONDAY, WEDNESDAY and FRIDAY, 10 a.m. to 11 a.m. and 6 to 7 p.m.
- 61 Radio L L (France).
- 58 Prague (Czecho-Slovakia).
- 56-7 Nauen (A G J) occasionally after 5 p.m.
- 52 Bergedorf (Germany) A F L, 3 kw.
- 50 Karlsborg (Sweden) S A J.
- 50 Moscow R F N. TUESDAY, THURSDAY and SATURDAY, 1 to 2 p.m.
- 50 Barcelona Radio Club E A J 25. SATURDAY, 8 p.m. to 9 p.m. News and gramophone records.
- 49-83 New York (N.Y.), W 2 X B R. Relays W B N Y, 1 kw.
- 49-5 Cincinnati (Ohio), W 8 X A L, 0.25 kw. Relays W L W from 11.50 p.m., except Friday and Saturday.
- 49-5 Council Bluffs (Iowa), W 9 X U, 0.5 kw. Relays K O I L.
- 49-4 Vienna (U O R 2), 0.4 kw. Testing, TUESDAY and THURSDAY, 12.10 p.m. to 1.10 p.m.; WEDNESDAY and SATURDAY after the evening programme.
- 49-34 Newark (N.J.), W 2 X C X. Relays W O R, 0.5 kw.
- 49-02 New York (N.Y.), W 2 X E. Relays W A B C, 5 kw.
- 49-02 Richmond Hill (N.Y.), W 2 X E. Relays W A B C, WEEKDAYS 11 p.m. to 5 a.m. SUNDAY, 3.50 p.m. to 5.30 p.m.
- 47 Funchal (Madeira), C T 3 A G, 0.3 kw. Test transmissions SATURDAYS, 10 p.m. to 1 a.m.
- 44 San Lazaro (Mexico), X C 51. 8 a.m. and 8 p.m.
- 43-5 Rome (Italy), I M A. SUNDAY, 5 to 7.30 p.m.
- 43 Madrid E A R 110. TUESDAY and SATURDAY, from 10.30 p.m. to 12 midnight.
- 42 Perth (Australia), 6 A G. 11.30 a.m. and 4 p.m.
- 41 Radio Vitus. Testing.
- 40-2 Lyons (Rhône), Y R. DAILY except SUNDAY, from 4.30 p.m. to 5.30 p.m.
- 40 Döberitz, A F K (or D O A), 5 p.m. to 7 p.m. DAILY; occasionally other times.
- 37 Vienna (E A T H). MONDAY and THURSDAY, 9.30 p.m. to 11 p.m.
- 33-7 Posen (Poland), 0.3 kw. Testing MONDAY and THURSDAY, 11 p.m. to 12 midnight.
- 32-5 Sydney (2 B L).
- 32-5 Paris, Eiffel Tower (F L). Time Signal 8.56 a.m. and 8.56 p.m.
- 32 Berne (Switzerland), E H 90 C.
- 31-55 Melbourne, 3 L O.
- 31-48 Denver (Col.), W 9 X A. Relays K O A, 0.75 kw.
- 31-43 Schenectady (General Electric Co.), N.Y., W 2 X A F, 10 kw. (Aer.). MONDAY, 11 p.m. to 5 a.m. TUESDAY, 11 p.m. to 4.30 a.m. THURSDAY, 11 p.m. to 5.30 a.m. SATURDAY, 11 p.m. to 5 a.m. Relays W G Y.
- 31-4 Hilversum, Holland, P C J, 25 kw. THURSDAY, 7 p.m. to 9 p.m., in English; 12 midnight to 1 a.m., in Spanish. FRIDAY, 1 a.m. to 2 a.m., in Portuguese; 2 a.m. to 4 a.m., in Spanish; 7 p.m. to 9 p.m., in English. SATURDAY, 1 a.m. to 2 a.m., in Dutch; 2 a.m. to 5 a.m., in English, French, and Spanish; 5 a.m. to 7 a.m. in English.
- 31-38 Zeeven, Daily, 7 p.m. onwards
- 31-28 Sydney, 2 F C.
- 31 Nairobi (Kenya), 7 L O. DAILY, 5 p.m. to 8 p.m. Relays 5 S W occasionally from 8 p.m. to 9 p.m.
- 30-91 New York (W 2 X A L). TUESDAY, 12 midnight to 5 a.m. WEDNESDAY, 12 midnight to 2 a.m. FRIDAY, 12 midnight to 4 a.m. SATURDAY, 12 midnight to 3 a.m., 0.5 kw.
- 30-75 Agen. TUESDAY and FRIDAY, 10 p.m. to 11.15 p.m.
- 27-27 Posen (Poland), 0.3 kw. Testing MONDAY and THURSDAY, 11 p.m. to 12 midnight.
- 25-6 Winnipeg (Canada), C J R X, 2 kw. DAILY (except SUNDAY), from 10.30 p.m. to 12.30 a.m. SATURDAY, 6 a.m. to 7 a.m.
- 25-53 Chelmsford (5 S W), 15 kw. (Aer.). DAILY (except SATURDAY and SUNDAY), from 12.30 p.m. to 1.30 p.m., and from 7 p.m. to 12 midnt.
- 25-25 Pittsburg East (Westinghouse Electric), W 8 X K. Relays K D K A at intervals.
- 23-35 Oakland (California), W 6 X N. Relays K G O. TUESDAY, WEDNESDAY and FRIDAY, from 5.30 p.m. to 9 p.m., 5 kw. WEDNESDAY also from 2 a.m. to 8 a.m.
- 22-2 Vienna, 0.24 kw.
- 22 Schenectady, W 2 X A F, MONDAY and THURSDAY, 7 p.m. to 9 p.m.
- 19-56 Schenectady, W 2 X O, SUNDAY, 7.30 p.m. to 10.30 p.m. TUESDAY and FRIDAY, 7 p.m. to 8 p.m.
- 19-56 Schenectady (General Electric Co.), W 2 X A D, 6 kw. SUNDAY, 7.30 p.m. to 4 a.m. MONDAY, WEDNESDAY, FRIDAY, and SATURDAY, 11 p.m. to 5 a.m. Relays W G Y.
- 19-6 Lyngby (Denmark) (Experimental).
- 17-35 Schenectady, W 2 X K, TUESDAY, THURSDAY, SATURDAY, 5 p.m. to 10 p.m.
- 17-2 Nauen (A G C).
- 17 Bandoeng, Java (Radio-Malabar), P L F, 30 kw.
- 16-88 Huizen (Holland), P H I, 40 kw. 3 p.m. to 5 p.m.
- 16-3 Kootwyk (Holland), P C K.
- 15-74 Bandoeng, Java (Radio Service), P L E. WEDNESDAY, 1.40 p.m. to 3.40 p.m.
- 15-5 Nauen (France), 9 p.m. to 10 p.m.
- 15-02 Buenos Aires.

YOUR TUNING CONTROLS

Variable condensers, with and without slow-motion movements, "vernier" dials and other such devices are dealt with in this helpful and interesting section.

Some variable condensers have slow-motion mechanisms incorporated in their structures. Good examples of this type are to be seen in various of the Ormond, G.E.C., J.B., Brandes, Ediswan, and other first-class makes; and from many points of view this type is preferable to a straight-forward design having only a direct drive, but which is fitted with a "vernier" dial.

When you have a condenser geared within itself at about a 6:1 ratio—that is, you have to rotate the dial six times in order to rotate the vanes once—then it would be unnecessary to employ any additional fine tuning device. Given a 6:1



Here you see a double drum drive; a quite modern type of control with distinctly attractive features.

ratio and a nice, large, milled dial, the closest possible adjustments can easily be made.

But many of the above-mentioned slow-motion condensers have direct drives as well, and in this case the DX enthusiast is very well served.

It is very irritating to have only a very slow-motion movement, for this means that the knob or dial has to be twisted dozens of times when one wants to move over wide areas. In order to get from 2 L O to 5 G B, for instance, one has to twist and twist until one's fingers ache.

"MICROSCOPIC" MOVEMENTS.

When, however, a moderately low gearing is employed—say, 5 or 6 to 1—this trouble is not encountered. Thus it would seem that a ratio or gearing could be arrived at that would satisfy everyone and dispense with the necessity for a direct drive.

But this is by no means the case, and manufacturers have had a difficult time arriving at a design that would prove universally acceptable. Some enthusiasts like a "microscopic" movement, while others like a slow-motion that isn't too slow. The condenser is a component which, above all others, reacts most strongly to individual manipulators!

The problem is, however, half-way towards solution by providing both direct and vernier controls. The latter can take many forms and adopt many faults. Nowadays there are quite a few very excellent slow-motion condensers and dials on the market, although it is not so long ago that such were remarkably rare.

Whether the mechanism be integral with the condenser or fitted additionally in the form of a dial, both the direct and the vernier controls should preferably be in constant gear. Then the fingers can slip off the dial or knob communicating the direct drive and immediately follow up the movement on the slow-motion dial or knob. Obviously the two knobs and dials can be placed in relation to each other still further to facilitate this operation.

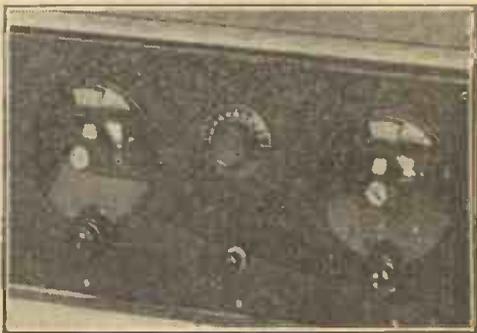
For a very long while we waited in vain for a condenser or dial which provided smooth actions in both their direct-control and geared-down movements. Manufacturers did not seem to encounter much difficulty in getting smooth slow-motion movements, but in doing this the direct drive seemed to become unusually harsh and hard. The reason for this is not difficult to see.

VARIOUS TYPES OF GEARING.

The most obvious way to achieve a slow motion is to fit a large cogwheel on the spindle of the condenser, and to engage a small cogwheel with it. A knob is then fitted to the small cogwheel, *et voilà* slow motion. You have to rotate the little cogwheel many times before the big cogwheel moves round 180 degrees and carries the vanes of the condenser with it.

But if you now attempt to adjust the condenser by its original direct drive, i.e. by means of a plain dial fitted to the spindle of the component, some fair amount of extra force must be applied, because the large cogwheel has to drive the small cogwheel round many times for every half revolution of the dial. You see, you gear down for easy, smooth movement, and it is only fair to assume that when you gear up, you get the reverse; and actually this is what happens when you go so crudely to work.

In some cases manufacturers solved the problem satisfactorily by replacing the above-described cog-



Slow-motion dials with aperture, showing the various readings.

wheels for friction wheels, although it takes clever craftsmanship to produce happy results even with this arrangement.

You can generally tell a badly-made dial or condenser that employs this scheme by a varying drag on the direct drive. The dial twists quite easily for a time, then suddenly gets a trifle stiff. Then you encounter a very loose switch, and so on.

But we must hastily interpolate that there are

in one or other of several very ingenious manners. Here one meets with truly velvety actions, both on the direct and vernier controls.

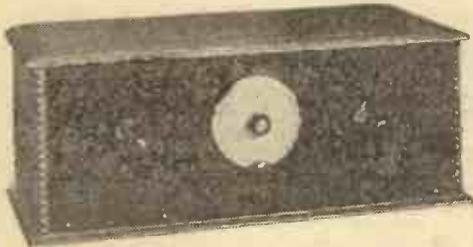
One must always be very wary that one does not choose a dial or condenser the movement of which has inherent backlash, as this fault is a very serious one, but rather difficult at times to detect when the component is not mounted on a panel.

Every tiniest movement of the knob or dial of the condenser in the one direction or the other should be accompanied by corresponding movements of the vanes, although these may be almost too small to be seen. If you have a dial which requires moving several degrees in the one direction before the control "takes up" or starts to operate the vanes, then we would advise you to scrap it for another of sounder construction.

DRUM-DRIVE CONTROLS.

A great deal of the advantage of slow-motion gearing is lost if the control is in the form of a tiny, smooth knob. A large milled dial in itself contributes "slow-motion" qualities and makes for easier adjustments, and where you have gearing in addition, fine tuning is very greatly facilitated.

There is a great deal to be said for "thumb controls" such as are to be encountered on "drum-drive" condensers and dials, and these are becoming very popular these days. But you should see that your thumb-control, if you incline to this type, has plenty of surface and projects sufficiently through the panel so that you do not have to use your finger-nails to get at it.



A slow-motion dial revealing a full-scale which has a "hair-line" indicator.

several very excellent dials using friction gearing, as there are that incorporate ordinary cogwheels. Gear-cutting is almost an art, and can be really successfully tackled only by first-class concerns having first-class machinery.

Among the smoothest working of all slow-motion devices are those embodying epicyclic forms of gearing and gearing making use of ball-bearings

THE "P.W." STANDARD LOADING COIL

This component figures as an integral part of the "P.W." "Titan" Coil which is described on another page.

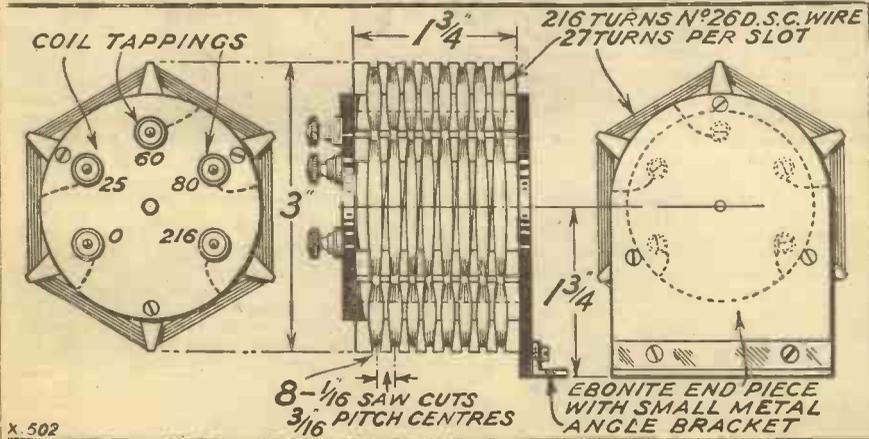
The main points in construction can be gathered from the accompanying illustration, which shows (left) the arrangement of the terminals, the method of arranging the turns (centre) and (right) the other end piece and method of supporting the coil.

Those who desire to do so can obtain one of the standard formers (Burne-Jones, Paroussi, Ready Radio, Wright and Weaire, etc.) which has a series of saw-cuts in the ribs. These form slots for the

winding, and in each of these must be wound 27 turns of 26 D.S.C., making 216 turns in all.

Tappings can be brought out in any convenient fashion, at 25, 60, and 80 turns, counting from the beginning, which should be labelled 0. The end of the winding should be marked 216.

If a ready-made former is not to be employed a piece of ribbed "Becol" tube may be used, 1 1/4 in. long, and 3 in. diameter over the ribs. In this case



eight saw cuts should be made, right down to the full depth of the ribs, and each about 1/8 in. wide. A space of 1/4 in. should be left between these cuts. Any desired method of mounting may be employed, but of course no metal must be placed in the field of the coil. Small brackets as shown can be used.

COMPONENTS FOR YOUR SET

Some practical advice on the selection of parts for home-constructor receivers.

When there is general standardisation the lot of the home constructor will be much easier. Until then, however, he must be careful in his choice of components, for with different makes they are liable to vary to a considerable degree, and these variations are not always confined to mere dimensions and shapes.

Take the so-called R.C.C. unit, for instance. In its essentials this consists of but three items, an anode resistance, a grid condenser and a grid resistance. Yet some R.C.C. units incorporate other things as well, and it may easily happen that these other things might not agree with the circuit in which you desire to use the unit.

At least one well-known make of R.C.C. unit incorporates an additional resistance, this being included for the purpose of preventing high-frequency energy passing through the article into the L.F. valve. In many cases this would prove a beneficial addition but in other R.C.C. units one is liable to find a fixed condenser connected across one of the resistances for the

purpose of by-passing high-frequency currents so that the device can be successfully employed in certain circuits. In other hook-ups such a condenser might prevent the receiver from operating. Again, should you be requiring to purchase an R.C.C. unit for a particular set, make certain that the condenser and resistances are of the correct values, for in this respect there is wide variation.

L.F. transformers appear to be settling down into a more or less stable condition of uniformity. Practically all L.F. transformers of good make are interchangeable. The leading transformer makers such as, for instance, the Ferranti people, issue N.P.L. curves for their products and these are guarantees of good performance.

COILS AND CHOKES.

Many amateurs are now replacing aerial plug-in coils for the tapped varieties in order to introduce greater selectivity in the more-old-fashioned types of sets. Such coils are not quite uniform and it should be

remembered that the position of the tappings may influence the tuning range of a set.

But, generally speaking, the tapping that is used is taken from the centre of the coil or a point somewhat lower. Although it should be remembered that much depends upon the individual aerial and earth conditions, a 60-turn tapped coil will provide practically the same tuning range as one of 40 turns used in plain parallel condenser tuning aerial position.

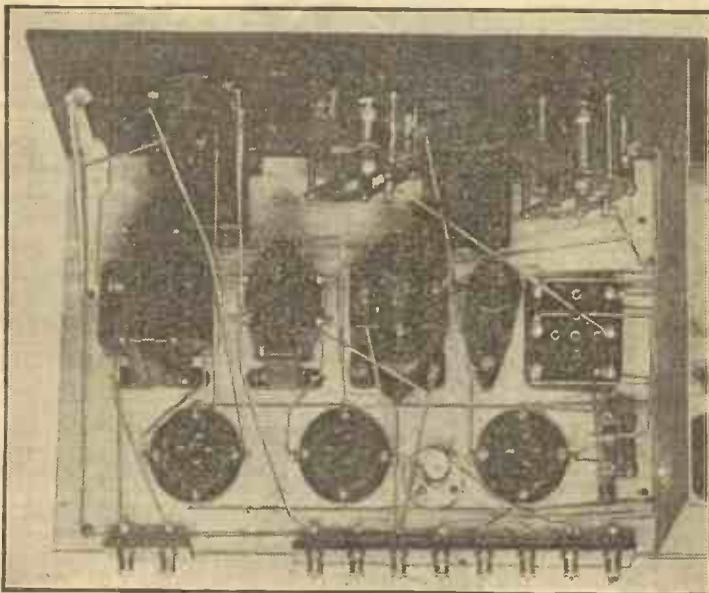
The main requirements for an L.F. choke when it is used for the output circuit of a loud-speaker receiver is that it should have ample inductance and should be able to handle a fair degree of current without saturation. Further, it should have a low ohmic resistance—something in the hundreds, and certainly not in the thousands, of ohms.

CONDENSERS FOR MAINS UNITS.

Regarding fixed condensers, the constructor should not get into the habit of considering that the only

factor of these that matters is capacity. Certainly this is the main feature in the majority of cases, but where a condenser is subjected to any big degree of voltage it must be of a more robust electrical nature than one used, for instance, in series with the aerial in order to sharpen tuning.

This is why "high-voltage" fixed condensers are specified in a high-class L.F.

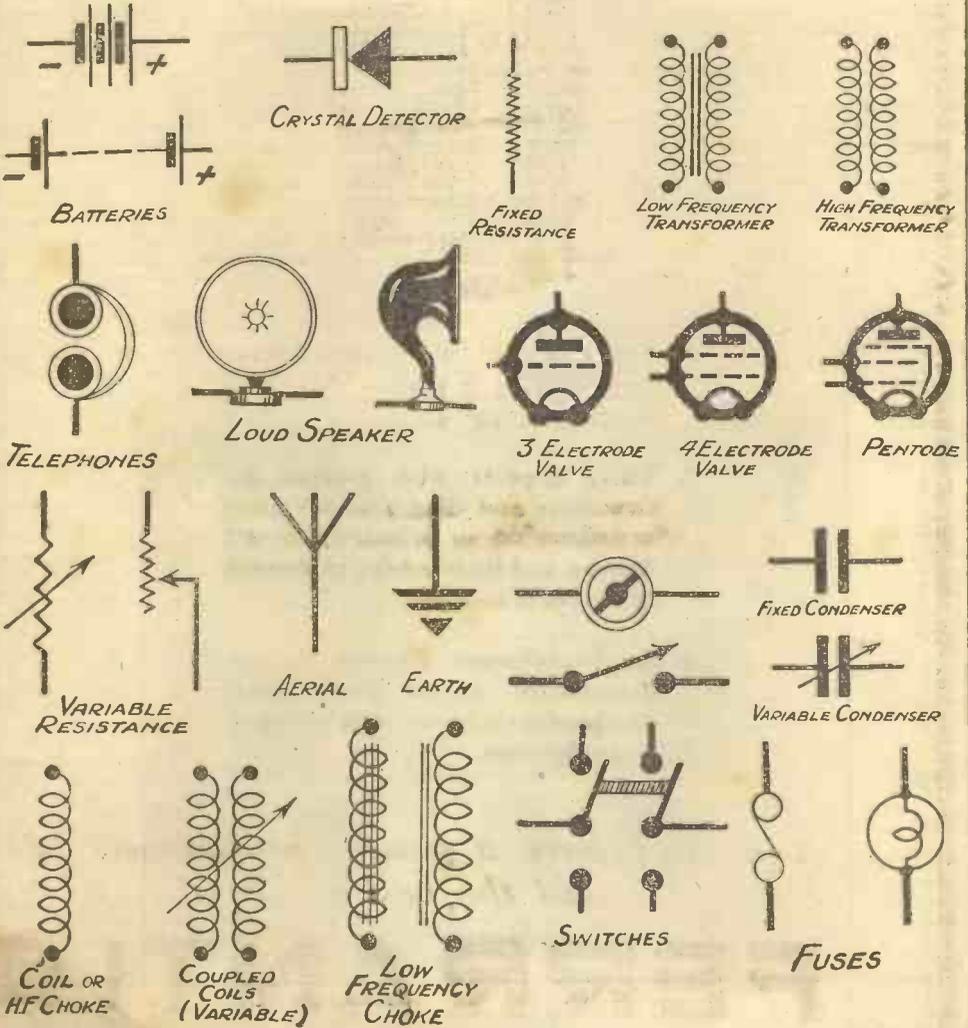


A back-of-panel photo of a straightforward three-valve set.

amplifier for grid-coupling purposes. Such a condenser has to withstand a high voltage, therefore its dielectric must be of mica or some such reliable material. And this question of strength and reliability in the fixed condenser is extremely important in the case of mains units. In such devices, condensers guaranteed to have been tested at a voltage twice that of the mains with which the unit is to be employed should be chosen. These will be more expensive, but the outlay will be distinctly worth while.

In the description of POPULAR WIRELESS receiver designs ample details of all the necessary components are always given.

RADIO DIAGRAM SYMBOLS



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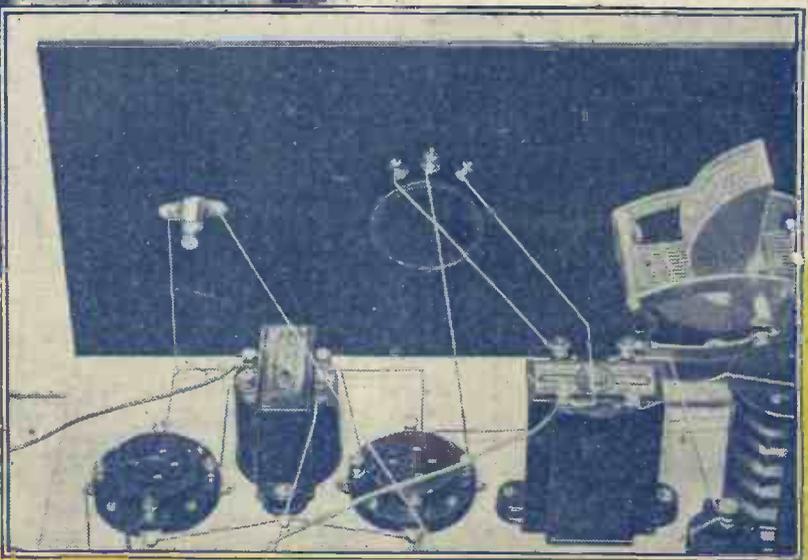
INCORPORATING "WIRELESS"

October 26th, 1929.



REFINEMENTS FOR THE "MAGIC" THREE

*See
Inside!*



SPECIAL FEATURES THIS WEEK

- Capt. ECKERSLEY'S QUERY CORNER
- THE MANCHESTER EXHIBITION
- HOW ANTI-MOBOS WORK
- A SURVEY OF THE B.B.C.
- etc., etc.

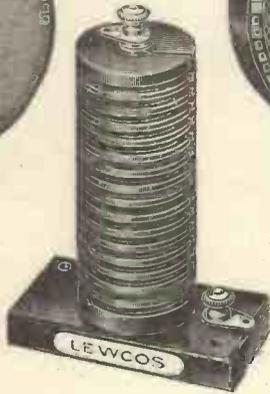
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THE REST OF THE ORCHESTRA



HERE, at last, is a loud speaker that does not cheat you of half the broadcast! It finds the missing artistes! It reveals instruments hitherto silent. It gives you notes you've never heard before. It is the new Brown Duplex Loud Speaker.

Because it incorporates the latest Brown improvements in design—the wonderful "Vee" movement and the new Duplex cone—this latest Brown triumph gives far more realistic reproduction than any heard before. Every instrument and every note—high and low—is reproduced *true-to-life*. Its tone is sweeter and more mellow. Its volume is richer and more magnificent. In short, if you buy a Brown Duplex Loud Speaker you hear the broadcast in your home as it is played in the studio. Ask your Wireless Dealer.

IN THREE MODELS:

Design as illustrated. Mahogany or Oak.

V10 £5 10s. Od. V12 £7 10s. Od. V15 £12 10s. Od.

Also obtainable by easy payments, ask your Dealer for particulars.

BY THE
WONDERFUL

Brown

DUPLEX LOUD SPEAKER

They must be good - 3,000,000 Valveholders already sold!

CLEARER-TONE VALVEHOLDER



The original Clearer-Tone Valveholder, in face of considerable low price competition, has more than held its own and will be continued at

2'-

VIBROOLDER



The Benjamin Vibroolder was last season's most successful accessory, the self-aligning feature ensuring positive contact with all types of English 4-pin valves.

1'6

5-PIN VALVEHOLDER



Designed for use with the new 5-pin valve with centre leg. The Benjamin anti-microphonic feature is incorporated, and also patented contact, which ensures perfect contact when using either solid or split pin valves.

1'9



Seen the new Switch ?

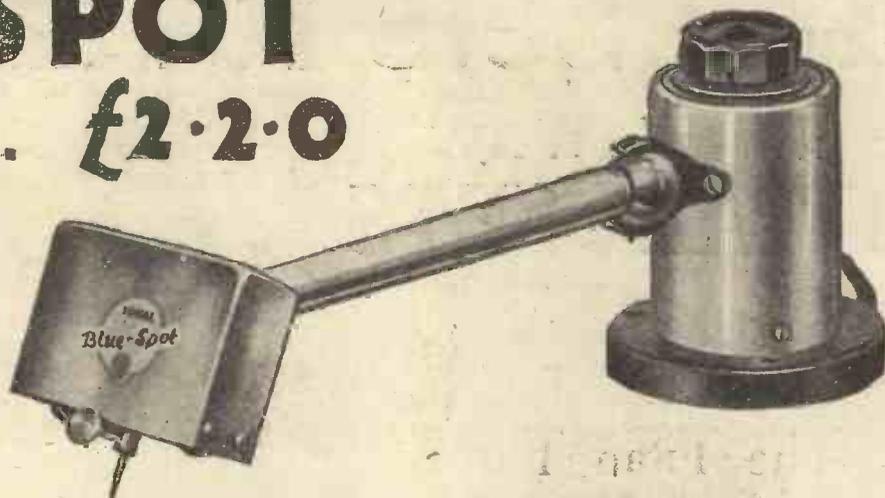
Some people say "Turn off the wireless"—and that's just what you do with this rotary switch. It's an attractive alternative to the usual pull and push type. All insulated, with indicating "On" or "Off" dial, pointer knob, terminals, and double contact. Suitable for use with panels up to $\frac{3}{8}$ -inch thickness. Quick make and break action **1'9**

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BLUE SPOT PICK-UP .. £2.2.0



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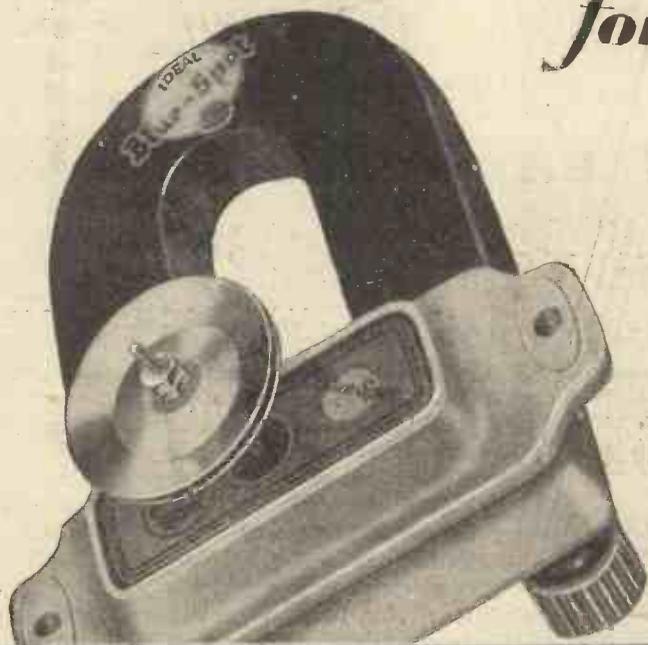
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The Sets for RESULTS

“Best Way” TITAN SETS

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are profusely illustrated with full diagrams and instructions for building in the “BEST WAY” BOOK NO. 350.

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Explains how to use your radio set as an Electric Gramophone. Here, for the first time, are given full details for the electrical reproduction of your favourite records.

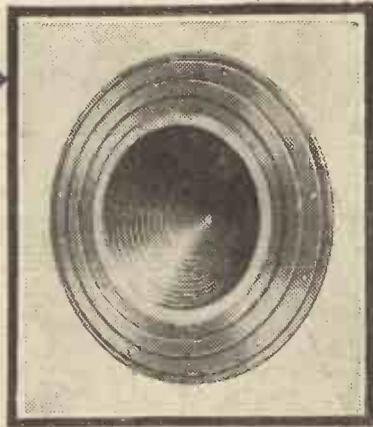
Gramophone Pick-ups and how to use them; Valves for your Radiogram Receiver; and Operating your Electric Gramophone are explained in detail, and in addition there are complete instructions for making the “Best Way” RADIOGRAM FOUR—a splendid set designed for use with a pick-up as well as for Radio Reception.

You can easily build them

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for the amateur
to build his own
**Super
Loudspeaker**

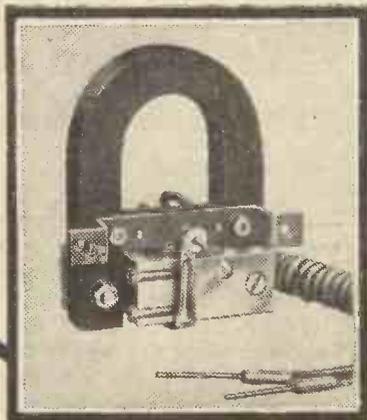
This cone unit and assembly now permits the amateur designer to construct a super-sensitive loudspeaker which is cheaper than a factory built model whilst at the same time allowing him to use his own ideas as to the type of cabinet or baffle to be used.



Assembly—Price 12/6

For the small sum of 15/- for the cone unit and 12/6 for the assembly he can build a loudspeaker unequalled in its class for volume, tone and sensitivity.

Like all Ediswan products this unit and assembly combine typically British quality with life-long dependability.



Cone Unit—Price 15/-

with this **EDISWAN** **CONE UNIT & ASSEMBLY**

THE EDISON SWAN ELECTRIC COMPANY, LIMITED.

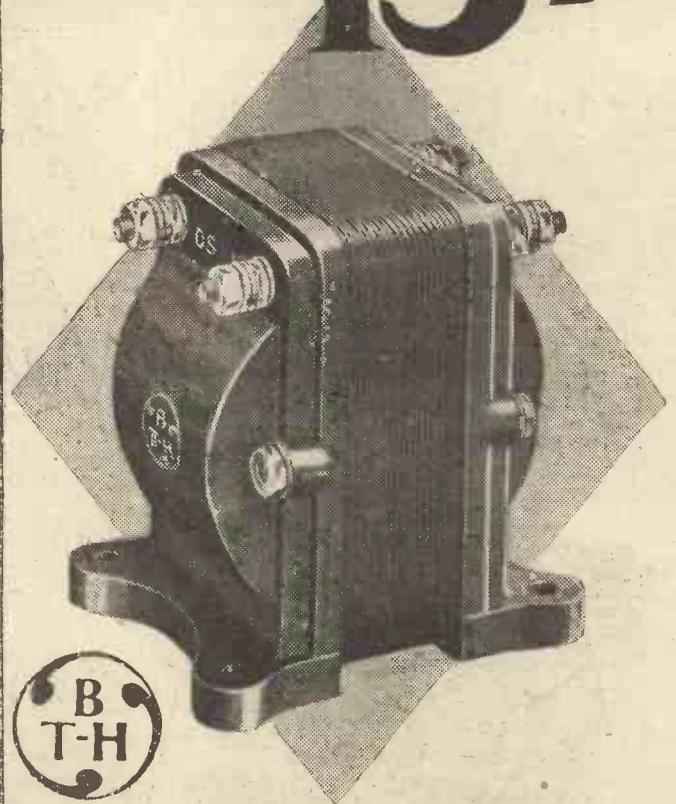
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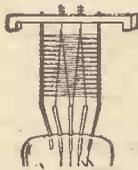
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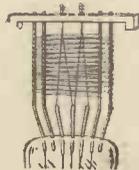
SHOWROOMS IN ALL THE PRINCIPAL TOWNS.

W 35b

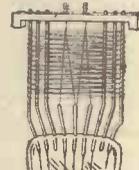
THAT'S ↓ THAT!



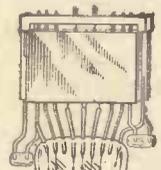
1. This is the first Grid and the double length Cossor filament. Note the seonite bridge piece.



2. Now comes the second grid locked securely in position. Every joint in this wonderful Valve is electrically welded.



3. And this shows the third grid automatically spaced at its correct distance by the seonite insulator.



4. Finally, the Anode completes the assembly and interlocks the whole unit immovable and rigid.



In two types :

Cossor 230 P.T. (2 volts, -3 amp.) and 415 P.T. (4 volts, -15 amp.) Amplification Factor 40. Impedance 20,000 Anode Volts 100 - 180.

Price - - - **25/-**
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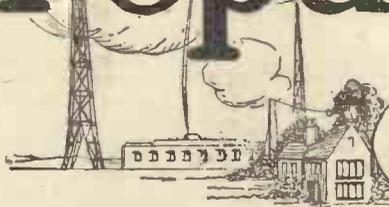
INTERLOCKED for safety—for rigidity and for long life!

The wonderful *NEW* Cossor Pentode is the most powerful L.F. Valve you can use—it gives enormous volume—equal to the output of two ordinary valves. And because it uses the exclusive Cossor system of Interlocked Construction it has exceptional strength. Its elements are rigidly braced together—proof against shocks, noises and breakage. No other Pentode Valve has this unique system of Interlocked Construction.

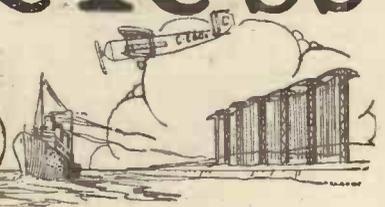
The NEW COSSOR PENTODE

The only Pentode Valve with Interlocked Construction.

Popular Wireless



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IN A BROWN STUDY-O
 —BROADCASTING
 EXTRAORDINARY
 —MORE HOWLERS—
 —THE WOMAN'S WAY

RADIO NOTES & NEWS

100% CRYSTAL SET—
 BACK TO EARTH—
 NEWS FROM SIAM—
 BUILT IN AERIALS

Pop Goes the Parson.

IT is related of the German village of Kleinow that it is about to dismiss its pastor, as a measure of economy, and to replace him by a radio receiver which will deliver sermons broadcast from Berlin. This seems to me one of the most cold-blooded and mischievous things ever conceived in the sacred name of saving money. How psychologically wrong it is time must teach that frowny flock.

In a Brown Study-O.

IT is being borne in on me that a broadcasting company is the concentration point of every kind of crank on the market, and every rummy notion evolved by Peculiar People. Just think! Some Continental stations are said to be experimenting in the use of colour for the creation of "radio-finesse"! The theory is that a certain colour produces a certain emotional response. Even the B.B.C. has been infected with the mania. Oh, dear! Can't a man get up and sing a song without all this flap-doodlery?

Broadcasting Extraordinary.

PROF. A. M. LOW is still trying to impress the untutored with the wonderful possibilities and probabilities of broadcasting, but either his proofs are corrected by an unscientific "sub" or else he has been dictating too hurriedly. In the "Sunday Graphic" he says in effect that if the action of the brain is electrical taste can be broadcast. He then says, "Thought is considered to be a mechanical process." But if thought is mechanical the action of the brain cannot be electrical, and therefore the taste-broadcasting idea goes up the spout.

Wave-trap for the Unwary.

I. C. (Upton Park) reveals his little secret for cutting out Brookman's Park locally, without the aid of special gadgets. His method is to disconnect the H.T. negative, and he offers to pay £100 to a local hospital if any reader fails to make this trick work. I am of opinion that my method is superior. Here it is: Take a cubic inch of well-dried air and connect it in series with the lead from the L.T. positive terminal on the set to the accumulator, preferably near the set, but not less than 2 in. from it. This gives a perfectly clear background.

More "Howlers."

WRITING of wireless a schoolboy gave the following definitions: "Atoms are what Sir Lodge talks about on crystal set, and are smaller than molly-coddles." "Induction is what they do to curates." "Resistance is three kinds—passive, negative and leased. Leased resistance is a line leading to a thing the easiest weigh." "Oscillation is something going to and throw. If it goes too fast it whistles and thus jabs the B.B.C." Nearer the truth than he imagines!

The Aussies Are For It!

AS a result of Mme. Sonya Michell's shot at Beethoven and Chopin, mentioned in these columns, a Mr. R. Agnew is bounding on the Australian broadcasting people to drop the good old stuff and give a lot of Bela Bartok, Ravel, Scriabine, and other composers who revel in "futuristic" effects. Pity he didn't include Ole Man Honegger and make the galaxy complete. Let Australia be warned by the agonies we have suffered—and stop this awful thing before it starts, so to speak.

Woman's Way Is Best!

A STUDENT of the radio trade has recently pointed out that only a small percentage of its customers are women, and he makes the suggestion that a special line of goods with a feminine appeal should be marketed. Precisely what constitutes feminine appeal in a radio set is hard to conceive; ornamentation, mostly, I presume. But the root of the matter is probably the fact that men, being more adventurous than women, have in most families got ahead of the girls and made or bought a set long ago—and one set per house is sufficient.

The "100 Per Cent" Crystal Set.

C. E. V. (Oxford) has good words to say for this "P.W." receiver, of which he has made three models. He also uses a one-valve "P.W." Plus-Former Amplifier, which when connected (in London) to a one-valve "Titan" gives him thirty-six stations. A cheap and useful team! The crystal set dies hard, indeed, but I do not think that in the matter of purity of results it now enjoys that measure of superiority over the valve which once it did.

SINGING IN SING-SING.



One of the most interesting wireless installations in America is that in Sing-Sing Prison. It consists of a set constructed by a convict, and operates a pair of 'phones in every cell besides 21 loud speakers.

Praise for the B.B.C.

WHEN I find anything praiseworthy about the B.B.C.'s activities I generally give the Corporation full measure, as an offset to the other kind of medicine. Now, I do think that they attend to their correspondence well—and they must get some ghastly queries, for I have written to them on a number of occasions. Last week I set them a poser. Something to do with times and one movement of sonata. In three days they replied, quite correctly, and without wasting a word. Good lads! Take a bun!

A Big British Enterprise.

AS is usual with us fool Britishers, the great communications enterprise, Imperial and International Communications, Ltd., took over the Beam

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

Services of the Post Office at the end of September and carried on without a hitch, but without any particular fuss beyond a few formal Press notices. One of the biggest firms of its kind in the world, if not the biggest, I. and L.C. controls, under the Government, the vital communications, both cable and wireless, of the Empire, and is going ahead to develop them. The Americans have set up a scream loud enough to be heard by Com. Byrd in the Antarctic, but it cannot abolish the fact that once more the old lion has made good use of the one eye it keeps open whilst "asleep."

Something Attempted, Something Done.

I PICKED this one up at the Radio Show. A man went away for some months, leaving his set in the care of a friend. On his return the friend gave an account of his stewardship, thus: "Well, old man, I'm sorry to say I've broken the valves and jammed three switches, besides cracking the panel. Still, I've one bit of good news. You know that your accumulator used to bubble when it was charged? Well, I've stopped that!"

Brand New Suggestion.

NOW let's be serious! T. J. (Norwich), who apparently reads nothing but "P.W." and the parish magazine, weighs in with one of those suggestions which astonish by their daring and originality. He says: "Would it not be excellent if we had a multitude of stations run as advertisements as in America? No licence to pay and crystal users could get any amount of stations." Yes, any amount—and all at once. Well, this revolutionary idea will be submitted to the B.B.C. with the request that they give it their sympathetic consideration. It ought to paralyse their power of pronunciation for six weeks at least.

"Back to Earth."

A READER from the London, S.E.4 district says that he does not believe that Mr. F. E. Stock (Brockley) picked up the "Bremen" at full loud-speaker strength, as reported on page 108 of "P.W.," September 21st. Both readers, I note, live in the S.E.4 district, so I hope that somehow they will arrange to meet and "have it out," though F. E. S. will have a difficult job to produce satisfactory evidence. I myself believe that with the "Sydney" Two the feat is quite within the bounds of possibility, under certain conditions.

"Do Accumulators Accumulate?"

I REGRET that by a mischance I missed "Detector's" letter on this subject in "P.W.," page 106, September 21st. Please turn to it. You see, he abolishes me in slashing style, but I stick to my point, and I repeat that accumulators do accumulate. But nobody said that they accumulate *electricity*, and if people think that they do, it is not my fault. When, however, I say that they accumulate chemical energy, and "Detector" replies "Nothing could be further from the truth," I can only ask him by what authority he says that,

"Ariel" Meets the Challenge.

"DETECTOR" challenges me to prove that an accumulator does any accumulating at all. Done! When the cell is discharged you can get no "work" out of it. When it is charged, it can be made to furnish "work." Obviously that "work" must have been delivered to it by the charging dynamo. Does "Detector" still say in the face of this that no energy is stored in the cell by charging it? Students of physics are taught that when "work" is done energy is transformed from one kind to another. So, when the cell gives "work" energy is being transformed. Where does the energy come from, "Detector"?

Sir A. Fleming Settles It.

SINCE "Detector" quotes books at me, I will give him a quotation which may, or should, command his respect. Sir Ambrose Fleming, F.R.S., the Grand Old Man of electrical engineering in this

SHORT WAVES.

Radio for Schools—Wirelessness.—"Daily Mirror."

Why is it that "Popular Wireless" doesn't need wheels to run on?
Because it is sure of its circulation.

"The new broadcasting station in Norway is to be re-equipped for long wave transmission," we read in a daily paper.
Out-of-work hairdressers, please note.

"Wireless for infirmity. Brightening the lives of sufferers," run headlines in the "Warrington Guardian."
But perhaps that's what they're suffering from.

UNUSUAL MODESTY OF A MICROPHONE ARTISTE.

Voice of Announcer (from loud speaker):
"This is Station W.L.L.L. broadcasting."
Small Boy (who is quick at spelling):
"Hey, pa, why doesn't that fellow give his full name?"—"Radio News."

"At present there is only one place where I can secure absolute privacy. That is in my bath. I view with some trepidation the coming of the day when, by television, my morning ablutions at St. Albans will be reflected on a screen in New York for the entertainment of the American cinema public." Dr. Furse, Bishop of St. Albans.—"Daily Mail."

"Chinese find wireless dull," we read in a contemporary. That's probably why they've started those matrimonial broadcasts we read so much about.

country, says in his "Wireless Telegraphist's Pocket Book," (p. 260): "In charging the cell we have to put into it a certain quantity of electricity and a certain energy. . . ." And also (p. 260): "This process is called charging the cell. It results in giving back energy to the cell, which can then be recovered in part as discharge current." If "Detector" now wishes to challenge Sir Ambrose he can confidently expect a much-needed lesson in physics.

Broadcast Broadcasting.

C. L. S. (Lewes) obliges with an interesting account of his reception of a concert in which each player was in a different country, namely, first violin in Milan, second violin in Paris, oboe in London, harpsichord in Berlin, and 'cello in Zurich. After a time there was a sort of "family coach" business and the first violin played from Zurich and so on. The time was kept

splendidly, each player being called in turn; then, a tap with the baton and the piece began. Quite a merry little stunt, but I see little future for that kind of performance.

News From Siam.

ANOTHER letter from Mr. P. Aram, radio engineer of the Siamese Posts and Telegraphs, contains a few alterations to the data given in these Notes for October 5th, H S 1 P J, 16.9 metres, transmits on Sundays from 12.00 to 14.30 and from 18.00 to 20.00. H S 4 P J sends on 37 metres; Tuesdays, 13.00 to 15.00 and 18.00 to 20.00; Fridays, 13.00 to 15.00. All G.M.T. Announcements in English, French, German and Siamese. Reports welcomed. Address: Radio Chief, Bangkok, Siam.

I Buy a Gramophone.

AFTER holding out for years, I have succumbed to pressure—exerted at every mealtime by "the family"—and have bought a wax-scratcher. "The family" argued that I could buy also all the pieces I have admired whilst listening-in, and thus enjoy any of them whilst the B.B.C. is handing out talks on the history of Cambodia, etc. I compute my favourite pieces at about 967, so I shall have to start saving pennies. Meantime I'll keep 'em busy with "Ol' Man River." What a blessing it is that one does not have to crank up a radio set!

Built-in Aerials.

I SEE that on a Long Island (N.Y.) estate houses are being built round aerials to avoid the erection of poles. Insulated wire, covered by moulding, is extended round the cornice of the roof and led-in down one corner of the house. The outlets are plugs one foot from the floor, these plugs also giving connection to mains current. In America, where nothing under five valves is tolerated, this type of aerial may be suitable, but I do not think that it would please the majority of set-owners here.

Wireless the Scapegoat.

AGES ago, when things went wrong, our ancestors generally put the blame either on one of their numerous deities or the family priest. Nowadays, their posterity in a direct line blame wireless waves. The latest crime attributed to radio is that it has caused many racing pigeons to lose their way. Professor Low is reported to have said that pigeons lose their sense of direction when flying near broadcasting stations. There are no more broadcasting stations in Britain now than last year, broadly speaking; yet the unusual losses have occurred this year. I say no more.

A Plea for Birmingham.

DO we not all agree that the Birmingham Studio Orchestra is one of the hardest-working and most welcome "turns" with which the B.B.C. favours us? Then are we not dismayed, for ourselves and for those artistes, that the B.B.C. is planning to reduce its numbers? The execution of this design will fall hard upon some people who have given us innumerable hours of jolly good music and won a place on our private honours list. Let not the blow fall, O Lord High Executioner!

ARIEL.

HOW "ANTI-MOBOS" WORK

A practical article about useful and interesting devices.

By H. A. R. BAXTER.

IN the usual way an anti-mobo arrangement is introduced into an L.F. stage on the lines of Fig. 1. A small non-inductive resistance is connected in series with the anode circuit of the valve being dealt with, and a moderately high-capacity condenser is taken to earth as shown. The direct purpose of the added devices is to prevent the circuit in which these are included from becoming coupled with any other anode circuit in the set through the common resistance of the H.T. supply.

The resistance of a brand new H.T. battery of the ordinary dry type, having a voltage round about 100, will be at least 50 ohms, and were it 300 ohms you could not call the battery a "dud." And after the battery has been in use some time its resistance will increase, as indeed it goes on increasing the whole time it is in service.

These hundreds of ohms of common resistance are capable of forming quite an appreciable coupling. There are two circuits included in the Fig. 1A Diagram, and these are coupled by the common resistance R. It matters little what constitutes these circuits; for instance, the one comprises an inductance L_1 and a capacity C_1 , and, of course, the resistance R. The other circuit includes a resistance R_1 , an inductance L_2 , and that same resistance R.

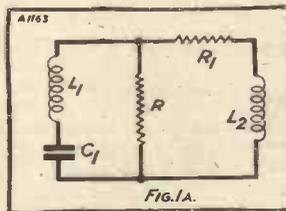
Not Strictly True

If an alternating current flows through either circuit, it will set up an alternating current in the other, and the amount of energy which is passed on in this way will depend upon, amongst other things, the resistance of that factor R.

In describing an anti-mobo device, it is frequently said that the "decoupling resistance" offers a barrier to the energy, while an easy path is afforded through the fixed condenser. This is not strictly true.

But you can, if you like, regard the large fixed condenser as a low resistance bypass path. This path falls across the anti-mobo or "decoupling" resistance as it is sometimes called, and the resistance of the H.T. battery. The resistance of the decoupling component is purely ohmic and, from an A.C. point of

view, it can stand at its specified value for our purposes. The same thing applies to the internal resistance of the H.T. battery, although the self-capacity of this tends to render it a less potent coupling factor than its same figure of ohms would sometimes seem to indicate.



The impedance, or A.C. resistance, of the 2-mfd. condenser to high frequencies of the one million order, such as are present in the set when it is tuned in to 2 L O or another such station, would be about one-tenth of an ohm, and its impedance or resistance to L.F. impulses between 1,000 and 2,000 cycles will be somewhere around 100 ohms. In this particular instance, I think we are rather more concerned with L.F.

The mere paralleling of 100 ohms across that common resistance in the form of the H.T. battery, does not constitute a completely satisfactory bypass. And regarded in that light, the anti-mobo resistance itself does nothing but lift the effective resistance a trifle. Actually the work of the anti-mobo goes much deeper for it sets up an intermediate circuit, a buffer circuit if you like, between the anode circuit in which it is incorporated, and any other anode circuit.

An Unsatisfactory Bypass

The 2-mfd. fixed condenser completes an A.C. circuit in conjunction with the valve and the primary winding of the L.F. transformer as at A in Fig. 3. Then comes an intermediate circuit, B, embodying the anti-mobo resistance, the fixed condenser, and the H.T. battery which is shown in the form of a resistance. Coupled to this is circuit C, which can be any other anode circuit.

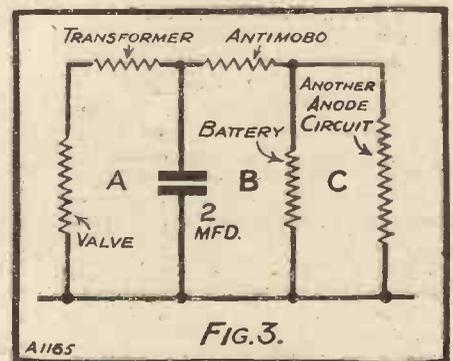
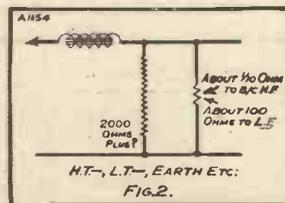
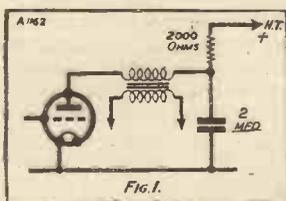
In order for any of the energy that may

be generated in circuit C, to be passed back to circuit A, the following process has to be gone through. The energy is passed on from circuit B to circuit C through the common-resistance coupling that the battery forms. The amount of energy that gets through will depend upon, firstly, the initial energy in circuit B, and then the relation of the resistance of the common resistance (battery) to that of the resistance of the anti-mobo plus that of the fixed condenser.

The greater the value of the anti-mobo resistance in relation to the resistance of the battery the less the energy passed on. You can look at it from the potentiometer point of view. The coupling is a weak one, because the resistance of the battery will be only of the order of a few hundred ohms while that of the anti-mobo resistance will range into thousands of ohms. The next step is the passing of energy from B to A, although there will not now be very much energy to pass on.

Very Weak Couplings

The coupling between the circuits B and A is the fixed condenser, 2 mfd. in value, and again the effectiveness of this coupling will depend upon the relation of the A.C. resistance of the fixed condenser to the resistance of the rest of the circuit, and this embodies the valve and the transformer winding. As you can see, this coupling will be a remarkably weak one, for the resistance to ordinary L.F. impulses of the fixed condenser will be only at the most a hundred or so ohms, while the valve and transformer together will have a resistance of many thousands of ohms.



LATEST BROADCASTING NEWS.

ARMISTICE APPEALS.

FORTHCOMING TALKS—NEW TALKS SERIES—"ONE UP" FOR SCOTLAND—THE PICK OF THE PROGRAMMES.

LADY HAIG will be heard by listeners on Sunday evening, November 3rd, when she broadcasts an appeal on behalf of the three ex-Servicemen's factories in Scotland, in one of which, at Edinburgh, the famous Flanders' Poppies are made. An appeal will also be made on behalf of the Lord Roberts' Memorial Workshops in Edinburgh, where ex-Servicemen are engaged in the manufacture of brushes, a cabinet factory at Dundee, and other workshops at Inverness, where disabled soldiers make wooden household goods and farm fittings.

The object of the appeal is to call attention to the productions of these factories as well as for financial assistance to enable their work to be extended. Another notable personality who is to appear before the microphone is Viscount Allenby. He will be heard on Sunday, November 17th, when he speaks to London and 5 X X listeners on behalf of the Crippled Boys' Home.

Admiral Jellicoe will broadcast a general appeal for the British Legion from a London studio on Saturday, November 7th. This is understood to be arranged specially to meet the wishes of the Prince of Wales, who did not desire to have his speech broadcast from the Royal Albert Hall on November 11th.

Forthcoming Talks.

The series of talks entitled "Points of View," to which many well-known people have contributed, will be summed up by Mr. Lowes Dickinson at 9.15 p.m., on Monday, November 4th. Earlier the same day, Mrs. Winifred Spielman Raphael will give the last of her series of talks on "Commonsense in Household Work," in which she will reply to some of the questions put by listeners as a result of previous talks in the same series.

Tuesday, November 5th, brings one of the first intimations of the rapid approach of the festive season, "Early Preparations for Christmas" being the title of a few hints which Mrs. Edith Martenek is to give to housewives, mainly in the direction of food. Another talk worthy of mention is the fourth in the series of talks of special interest for motorists, when Mr. H. C. Lafone, who is associated with the "Autocar," will speak on "Some Automobile Reminiscences—Grave and Gay." Mr. Lafone is due to speak in the London studio at 7 p.m., on Tuesday, November 5th.

New Talks Series.

Mrs. Mary Agnes Hamilton, M.P. for Blackburn, is inaugurating a new series of talks in the London studio on Wednesday morning, November 6th, when she will speak under the general head of "The Week in Parliament." This series, to which various M.P.'s will contribute, will go on

weekly during the Parliamentary Session, the second talk being by Her Grace the Duchess of Atholl.

"One Up" For Scotland.

Once again have the officials in charge of Scottish broadcasting beaten their English colleagues in arranging several running commentaries on both Rugby and Association football matches during the present season. The blame for this may not rest entirely with the people at Savoy Hill, but listeners on the south of the Tweed will certainly be envious to know that among the games to be described to Scottish listeners is that between Motherwell and Celtic, which is to be played on Saturday, November 9th.

The Pick of the Programmes.

There are many things in forthcoming programmes from London. Daventry (5 X X) and 5 G B, that are far too good to omit from these notes.

There is, for instance, the Hallé Concert, on Thursday, October 31st, which Sir Hamilton Harty is to conduct. The programme includes Liszt's symphonic poem "Mazzeppa," and the Sibelius "Concerto for Violin, opus 47," the solo part of which

will be played by Arthur Catterall. Julian Rose, the Hebrew comedian, pays another visit to the London studio, on Saturday, November 2nd, to take part in a revue called "Ikey Gets His." It should be a good show. So should the entertainment by Clapham and Dwyer's 1929 Concert Party, which is to broadcast from 5 G B, on Wednesday, November 6th. This party had a wonderful season at various seaside resorts during the

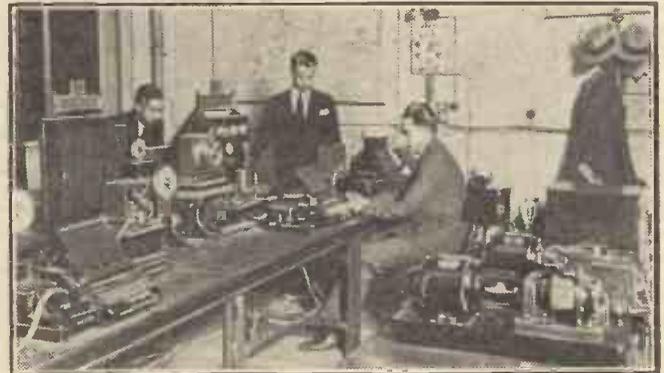
summer. On the same evening, Compton Mackenzie's "Carnival," adapted for the microphone by Holt Marvell, will be repeated for London and 5 X X listeners.

Birmingham offers a new musical comedy called "Mayneshah, a Salty Tale of the East," on Thursday, November 7th. The characters include tons of Oriental big bugs—a Sultan, a princess, a duke, a prince—and plenty of sparkling music. On the same evening London listeners will hear music, singing, and dancing relayed from a real Russian cabaret.

Tommy Handley, Helen Alston, Jack Richards, and Winifred Durk, with the D'Alton Quartet (members of a Northampton family who frequently appear with Mario de Pietro's mandoline and guitar orchestra), are in a vaudeville show from 5 G B on Friday, November 8th, and the week finishes with a production of Harold Chapin's London drama, "The Dumb and the Blind," described as the author's best play.

Looking even further ahead, there is a very interesting broadcast from the Odd-fellows' Concert at the Queen's Hall on Saturday, November 16th, when Mr. B. Walton O'Donnell will conduct the Wireless Military Band.

SIGNALLING AT THE SENATE.



This is the radio installation in the Madrid Senate House, used in connection with the Society of Nations.

TECHNICAL NOTES.

By Dr. J. H. T. ROBERTS, F.Inst.P.

ABSORPTION OF RADIO WAVES

DETAILS OF SOME INTERESTING EXPERIMENTS IN THE UNDERGROUND RECEPTION OF BROADCASTING.

SOME very interesting experiments have been made by Professor A. S. Eve, of McGill University, Montreal, on the question of passing radio waves through earth matter such as rock, limestone, sandstone, and so on. These experiments have shown that radio waves of the ordinary broadcast wave-length can pass through at least 300 ft. of rock.

In some tunnel experiments he found that the broadcast waves could be heard through the entire length of the tunnel, which was three and a half miles, but short waves of about 40 metres could not be detected more than a few hundred feet from either end of the tunnel.

The problem was to find out how the waves entered the tunnel. One idea was that they penetrated the rock, another was

that they came in through the entrance, whilst a third was that they were conducted along the rails and electric wires. Professor Eve believes, as a matter of fact, that all these three methods play a part.

By carrying out experiments in caves, where there were no metallic conductors and where tortuous passages effectually sealed off the entrance, it was found that the broadcasting was received through 75 ft. of rock on a loop aerial, whilst with an extended aerial signals were received through 300 ft. of rock.

Extremely Interesting Results.

Then a coil of wire, 100 ft. in diameter, was laid on the ground above and excited by an oscillating current. These waves

(Continued on page 411.)



L.S. Extension Wires.

J. M. (Barnstaple).—"I am going to run some loud-speaker extension wires from my set to a room upstairs, and have been told that it is advisable to isolate them from the H.T. Would you advise the use of an output filter or an output transformer, and what are the advantages of each?"

Personally, I should use an output transformer if the self-capacity of the leads is likely to be high. Then one uses a second transformer at the loud speaker and the solution is complete, because by stepping down to the cable and up again to the loud speaker, one can disregard the cable self-capacity in a simple way.

If the self-capacity of the cable is not likely to be serious, I suggest that comparative cost is the only factor—a good transformer versus a good filter. In any case, don't have H.T. running about the house.

A Constant Howl.

L. M. N. (Hull).—"Every time I switch on my receiver a howl occurs which gradually builds up in strength. The howl is of one constant frequency and is unaffected by variation of the tuning controls.

"I notice, however, that the trouble is not so bad when I move the loud speaker away from the set. Can you explain this trouble, and suggest how best it can be cured?"

If you strike one of your valves with your finger nail, the set being switched on, your loud speaker will go "pong." But if your loud speaker makes a big "pong," this will shake the valve like it was shaken by your finger nail, and make the valve go "pong"—which makes the loud speaker go pong, which makes the valve go *poong!*

The cure is obvious. Better lid to the set; stand loud speaker on soft material; turn the speaker away from the set; cover the set up, etc., etc.

Valves For Push-Pull.

G. L. D. (North Foreland).—"Is it necessary to employ similar valves in the

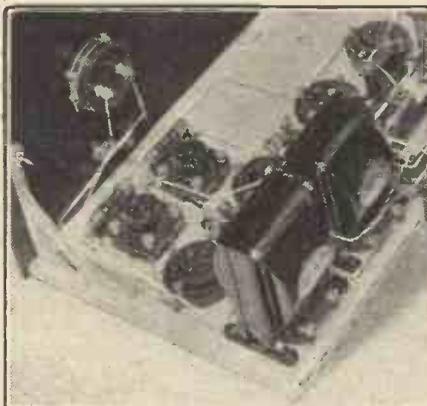
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Under the above title, week by week, Captain P. P. Eckersley, M.I.E.E., late Chief Engineer of the B.B.C., and now our Chief Radio Consultant, will comment upon radio queries submitted by "P.W." readers. But don't address your queries to Captain Eckersley—a selection of those coming to the Query Department in the ordinary way will be dealt with by him.

* * * * *

output stage of a push-pull amplifier? If this is so, would it not be better to employ matched valves?"

Certainly the valves must be similar, but any two of the same type of valves manufactured by a reputable manufacturer will match near enough.



The push-pull stage of a typical amplifier, such as is discussed above.

Curing Distortion.

J. S. K. (London, S.E.).—"I have a Det. and 2 L.F. receiver, the L.F. side being transformer coupled, and I find that there is a tendency for distortion to occur unless a '25-meg. resistance is connected across the secondary of the second transformer.

Is this method of producing stability a satisfactory one?"

The connecting of a resistance across a transformer is such a universal palliative for reproduction troubles that I should hesitate to condemn it out of hand.

It is not very scientific, and if the set was properly designed from end to end it could either be necessary or not depending on the design. My advice is to leave well alone, and if you are satisfied to leave the transformer shunted it may be doing just the right thing.

Why Signals Are Stronger At Night.

E. A. (Sittingbourne).—"I am getting very good results from my four-valve set, which seems to be very sensitive and satisfactory for bringing in Continental stations.

"I notice, however, that all my best results are obtained at night. In daylight it is practically impossible to tune in any distant broadcasts. Why is this?"

Distant reception owes its efficiency to the action of a layer of ionised gas said to hang like a cloud some sixty miles above the Earth's surface.

The direct or ground waves from a station friter themselves away in contact with the earth, but waves radiated upwards from the transmitter hit the inner side of the ionised layer (called after the name of the man who originally postulated its existence the Heavyside layer) and are reflected down on to the earth again, where they can be picked up at surprising distances, even though they fade due to the inconstant nature of the upper layer.

This layer is only effective in reflecting waves of the length used in broadcasting at night, hence distant reception of broadcasting stations is in general only possible at night. Very short waves are reflected during the day as well, if their length is adjusted to suit the world path and the state of darkness and light, etc. Hence the beam system, by choosing proper waves, can work over 24 hours.

B.B.C. EXPENSES.

The likelihood of the B.B.C. requesting more of the licence money to defray the cost of the new stations and Broadcasting House is discussed

By THE EDITOR.

AS we reported exclusively in a recent issue of POPULAR WIRELESS, it is likely that, in view of the considerable expense which the B.B.C. has entailed in connection with the building of the Regional Scheme stations, and the new headquarters in Portland Place, representations will be made to the Postmaster-General for a larger share in the broadcasting licence revenue.

Balance Deficit.

Our readers will remember that when Sir William Mitchell Thomson was Postmaster-General he referred to 1929 as the possible date on which the B.B.C. might be allowed to have a larger proportion of the licence revenue if the financial situation warranted it. It is interesting to note that in the financial year of 1928 the share of licence revenue of the B.B.C. fell short of revenue expenditure by £7,560, although in the previous year there had been a credit balance of £27,669.

The income for 1928 was derived as follows:

Licences	£871,763
Publications	£120,635
Interest on sundry receipts	£10,107

Making a Total of £1,002,505

The principal items of expenditure were:

Programmes	£538,990
Plant, Power, etc.	£160,455
Rent, Rates and Taxes	£77,999
Administration and salaries	£56,211

the total expenditure amounting to: £879,324

If the B.B.C. decides that it wants more money, the claim would be a just one. However, whether the Post Office will be induced to part with its "rake off" from wireless licences remains to be seen. If the B.B.C. experience any difficulty in receiving further sums of money which they are entitled to, there is no doubt that the Post Office's refusal to acquiesce to the B.B.C.'s demand will result in a first-class public controversy.

Too Much Deducted.

There has always been a good deal of resentment because of the Post Office's deduction from the income from wireless licences, and we should welcome an opportunity which would enable the situation to be cleared up once and for all. As far as we know, there is no law in existence which empowers the Post Office to deduct such a large percentage as 12½ from the gross wireless licence income.

Certain it is that expenses are more than covered by this 12½ per cent reduction, and there must be a very large sum of money retained by the Exchequer which should by rights be in the coffers of the B.B.C. for expenditure on programmes and other branches of the broadcasting administration.

Our readers will remember that some months ago the B.B.C. decided not to broadcast the titles of dance tunes. The B.B.C. gave it as a reason that the announcing of dance titles caused friction which nearly developed into a scandal because of song plugging.

Titles To Be Given.

In other words, the B.B.C. found out that its arrangement for the broadcasting of dance tunes was being made use of in the extensive way of song plugging, that is dinning in the titles of songs and tunes so that listeners were more or less at the mercy of an unpleasant system of advertising; at the same time some of the best song and dance tunes were ignored because of this system.

In 1927 it was found that certain music publishers were getting unfair publicity

THE "MAGIC" THREE.

The Editor, "Popular Wireless."

Dear Sirs,—This is the first time I have ever written an appreciation of any set, but I must say that the "Magic" Three is all you claim for it. I got "P.W." on the Thursday, and was favourably struck with the circuit so decided to pull my set down and build the "M.T."

I finished it on Saturday, having to wait until pay-day to get a couple of odds and ends, but had it going O.K. by 8 p.m., stations rolling in on the medium range. The volume is quite surprising on Continentals, quite as loud as 2 L.O. and so easy to tune in; in fact, you cannot help but get them. I am not used to potentiometer control yet, but guess I have found it all right and also found the set all right.

It is wonderful for just a Det. and 2 L.F. It seems unbeatable, and I cannot see it even being improved much. Thanks for a real set for a person with a limited purse. There is no need to pay fancy prices.

Yours faithfully,
F. J. RADFORD.

West Ham, E.15.

for their particular numbers because of secret arrangements with orchestra leaders, while other music publishers who did not negotiate on these lines were found to be justified in complaining that even when they brought out first-class popular numbers, for which there was a large public demand, orchestras refused to play them, and consequently B.B.C. listeners never heard them.

The B.B.C. have since tried to solve this problem of plugging by having an arrangement with one particular music publisher, but it appears that this attempted solution has not proved satisfactory. Certain it is that when the B.B.C. stopped announcing dance tunes, listeners wrote in in their thousands demanding to know the reason why. Publishers were also worried, and fresh negotiations were started between them and the B.B.C. which have resulted in the B.B.C. announcing that, as from November 1st, titles of dance tunes will again be broadcast.

It is to be hoped that this pernicious system of plugging will not be continued. If it is, the only remedy for the B.B.C. is to cut out all outside dance bands and rely on its own very excellent dance band under the able leadership of Jack Payne.

The Dramatic Criticisms.

The following letter was sent out with tickets for the first performance at the St. James's Theatre of Mr. Roland Pertwee's new play, "Heat Wave":

"The management of the St. James's Theatre will be obliged if you will kindly co-operate with them in safeguarding this invitation from being used for the purpose of broadcasting a notice of the play from any station of the British Broadcasting Corporation. The invitation is intended to meet the convenience of legitimate journalism, exclusive of broadcasting."

As a result of a recent broadcast dramatic criticism theatre-managers are—with the exception of Mr. Cochran and one or two others—dead against the B.B.C.'s policy of "reviewing" plays by radio, and the above letter is a good indication of how the theatre managers feel about the matter.

Mr. Horace Collins, secretary of the Society of West End Managers, stated the other day:

"All our members have been consulted in the matter, and I think the objection to criticisms of new plays being broadcast will be solid.

"So far, 75 per cent. of members have replied, and all of them are against the practice."

B.B.C.'s Reply.

A B.B.C. official said:

"We have stated our attitude in the matter several times. We employ a competent critic, in whom we have full confidence, to criticise plays for the benefit of listeners.

"We have never sought permission to attend a public performance and we do not intend to do so."

We understand the B.B.C. will, in future, purchase first-night tickets for its dramatic critic, and that broadcast criticisms of plays will be continued. So that's that!

INTERESTING ITEMS

Whistling and howling noises may be due to bad spacing between your components or to badly-spaced wiring, particularly if the spacing between grid and plate circuit is inadequate.

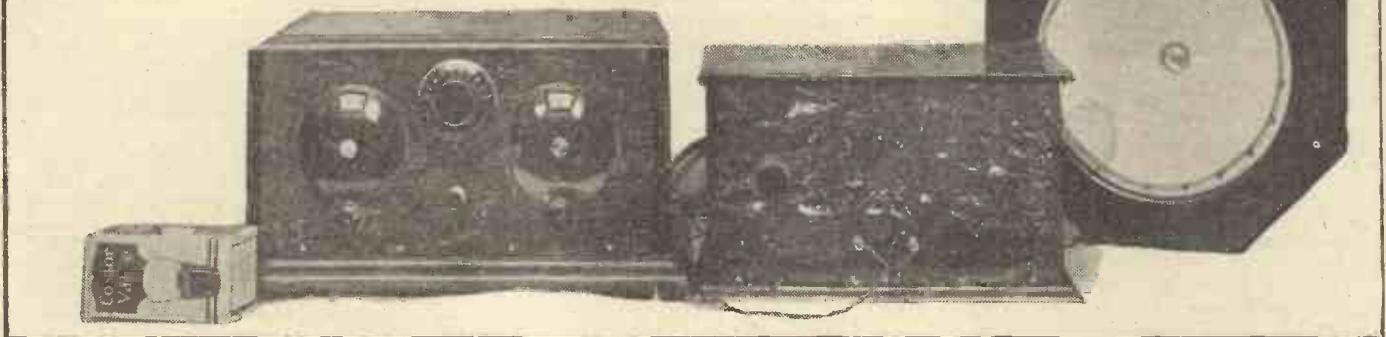
Flat tuning is sometimes due to a leak across a panel, condenser end plate, or similar insulating surface.

In general an L.F. valve should be given as much high tension as its makers specify, with the correct grid bias for that anode voltage, as this is a great aid to pure reception.

Do not forget that an earthing switch or lighting arrester should be protected from the weather, if possible, and in any case should receive an occasional overhaul.

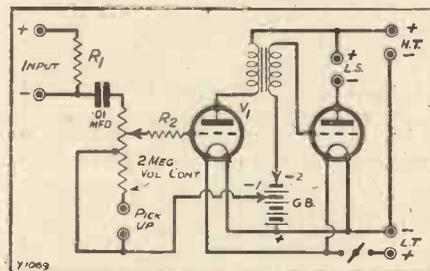
Disconnecting the aerial wire from the set to see whether this has any effect upon interfering noises is a very good rough-and-ready test, when it is uncertain whether the interference is atmospheric or due to trouble in the set itself.

THE "VANGUARD" AMPLIFIER



IN describing the "Vanguard" Two recently, we explained a pet theory of ours to the effect that one of the best ways for anyone to progress from a small set to a comparatively large one was to do it in two stages.

We suggested that anyone thinking of taking this step should build first of all a two-valve unit consisting of one high-frequency stage and a detector, and thus quickly get some sort of outfit working again, after which he could at leisure build a low-frequency amplifier and so obtain the desired complete powerful loud-speaking outfit. We have already given you a carefully worked-out design for the H.F. and detector portion of such an outfit, in the form of the "Vanguard" Two and now follows the amplifier.



We have tried to make this design a particularly useful and universal one. Not merely does it suit particularly well the "Vanguard" Two, with which it matches up very nicely in appearance and panel layout, but you will find it can be regarded as a good standard design for all sorts of purposes. We have spent a good deal of time on this aspect of the design, and as a result you will find that it can be used with practically any set which requires L.F. amplification to bring the signals up to loud-speaker strength.

Ideal For General Purposes.

For example, this is an ideal amplifier for anyone who possesses a single-valve or crystal set, and wants to change over to loud-speaker reception, and it is also a very useful outfit for gramophone reproduction, for which purpose it possesses certain rather useful special features.

We should like to stress this point a little because we do not want the reader to imagine that because this amplifier was originally intended to form part of the "Vanguard" outfit, it is not equally suitable for all sorts of odd purposes. It can be added, as a matter of fact, to

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Here is the companion unit to the "Vanguard" Two, in the form of a neatly-designed and efficient two-stage amplifier with several special features.

By THE "P.W." RESEARCH DEPARTMENT.

* * * * *

practically any small set, and it does not even matter whether H.T.— is connected to L.T.— or +, in the set, so long as you follow out carefully the instructions we shall be giving you later in regard to battery connections to the amplifier.

How Much Magnification?

If you take a look at the diagrams and photographs you will see that the main portion of the amplifier is quite straightforward, consisting of that well-tried arrangement, one resistance and one transformer-coupled stage. This combination gives good amplification, and is a very desirable one for use in any universal type of amplifier such as this. Higher magnification could be obtained, of course, by using two transformers in the modern fashion with anti-battery coupling devices, but such an amplifier cannot be expected to suit any and every set in the way that the present one does.

For example, if a two-transformer type of amplifier with its very high power were added to the "Vanguard" Two, we should find that we were getting decidedly too much amplification, because we already have a good H.F. stage at work, and so all the signals fed into the L.F. amplifier are moderately strong ones. As a result, the last valve would be tending to overload all the time, and hence our choice of a more moderate degree of amplification for the "Vanguard" Amplifier.

The regular reader may wonder how we can reconcile this statement with our recent use of two transformer-

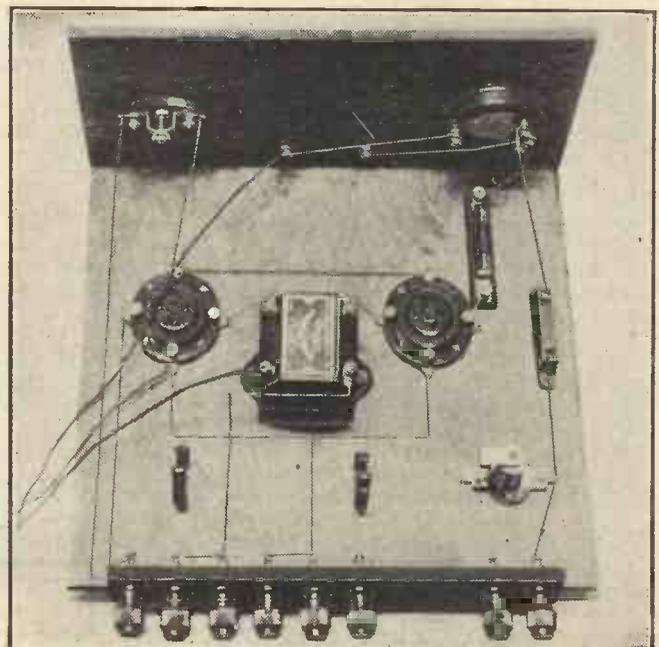
coupled L.F. stages in the "P.W." Four, which also contained a stage of screened-grid H.F. amplification, and perhaps we had better explain this point. The fact is that the "P.W." Four is a rather unusual type of receiver, in that, although we have a screened-grid H.F. stage, that stage is arranged to give very high selectivity rather than the maximum possible magnification. As a result, the output from the detector valve is not so strong as to cause these overloading troubles.

Simplicity and Economy.

Actually, we provided this powerful L.F. circuit in the case of the "P.W." Four in order to take the medium-strength signals from the detector and build them up to the full-strength output required in a modern four-valver. It was a case of getting high selectivity and moderate magnification from the H.F. stage, and then relying upon a very powerful L.F. side to bring up the overall performance of the set to the desired level.

An incidental advantage of the use of the more moderate magnification arrangement of one transformer and one resistance stage is to be found in the simplicity (and hence economy) of the practical layout of the

(Continued on next page.)



The layout permits very neat and direct wiring to be achieved quite easily.

THE "VANGUARD" AMPLIFIER.

(Continued from previous page.)

amplifier. Such an arrangement does not, as a rule, require anti-battery-coupling devices to make it stable and you will note that there is no anti-motor-boating filter on the amplifier, and not even an output filter for the loud-speaker connections.

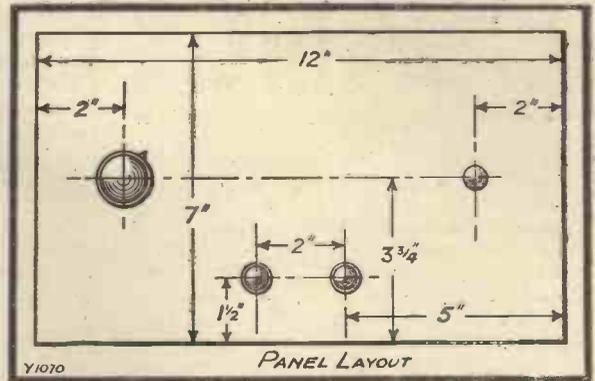
When to Add a Filter.

This last, of course, is something of an optional point, because, although it may not be needed to prevent battery coupling in the great majority of cases, yet if you use a super-power valve in the last stage it is then rather a desirable fitting, in order to prevent the loud speaker being connected directly in the anode circuit of the valve.

If you desire to use a super-power valve,

therefore, we would certainly advise you to incorporate an output filter actually in the design, unless you possess one which can be joined up as a separate unit, and this is how you can do it. You will require two additional parts, namely a 2-mfd. condenser and an output-filter choke of something like 20 henries inductance, and a D.C. resistance of not more than 500 ohms and preferably rather less.

Here are the necessary modifications. You will find that you can mount the parts in the rear corner of the set, at the left-hand end (looking at the amplifier from the back). In order to get enough room, you may find it necessary to move the grid-bias battery clips over towards the right a little bit, or even, if your L.F. choke is a very large one, to transfer the battery



to a position on the inside of the cabinet at the back.

These are the alterations in connections required. First of all note that there is a lead from H.T. + to L.S. + on the terminal strip. Remove this and instead connect H.T. + to one side of your output choke. Note also the wire from the plate of the last valve to the L.S. - terminal. Remove this and instead wire the plate of the valve to the remaining side of the output-filter choke and to one side of the 2-mfd. condenser. Wire the remaining side of the condenser to the L.S. - terminal. Wire the L.S. + terminal to H.T. - and the job is complete. When this is done, by the way, the loud-speaker terminals no longer have any polarity, since there is no direct current passing through them, and so it does not matter which way up you connect your loud speaker.

Stopping H.F. Currents.

There are just two special features of the amplifier which we ought to explain before we go any further, and these are first of all the H.F. stopping resistance R_2 in series with the grid leak of the first valve. This is intended to prevent ill-effects arising from H.F. currents making their way into the amplifying circuits, and the resistance can be of any value from about 100,000 ohms up to a quarter megohm. Something of the anode resistance or grid-leak type will suit here.

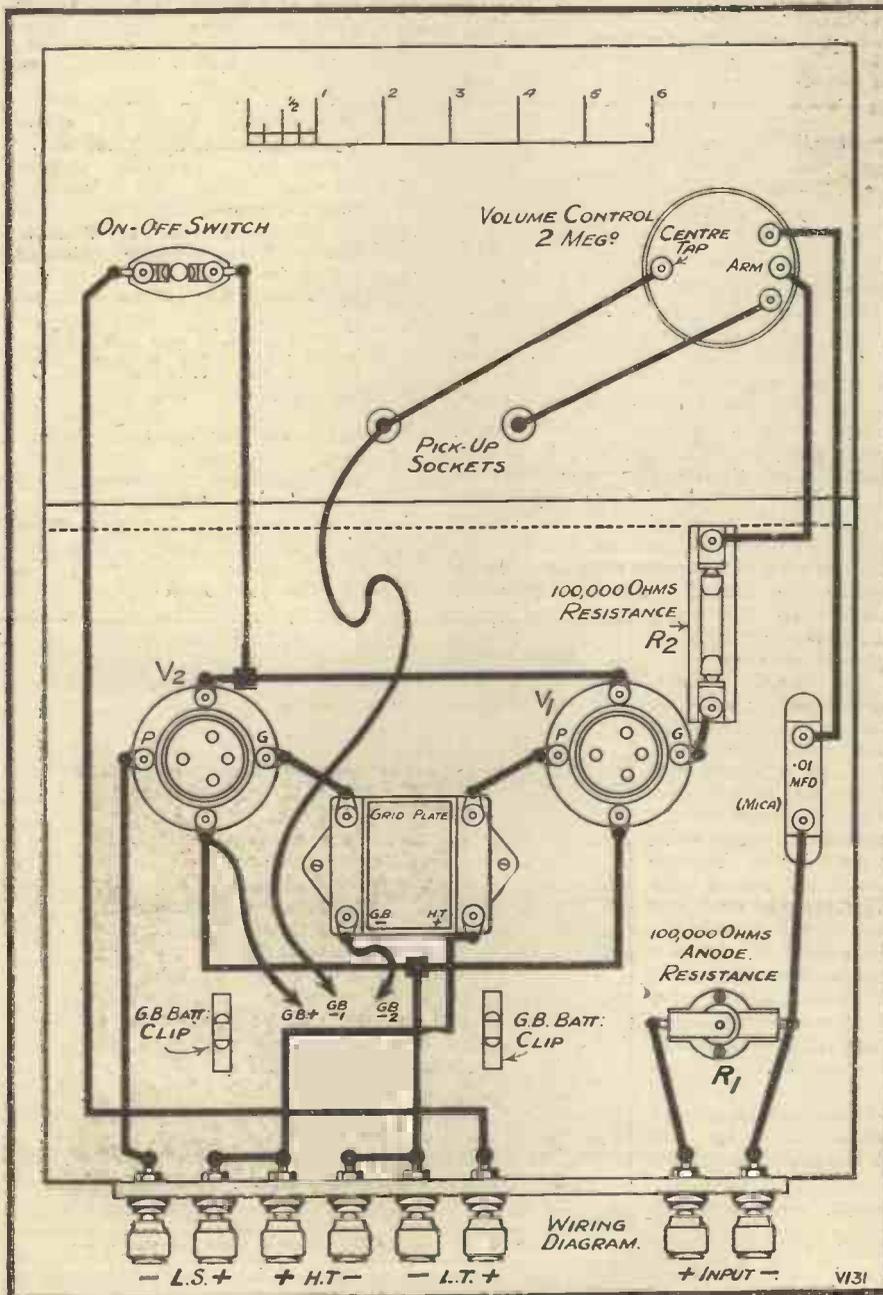
The other feature is the use of a special "fader" volume control, which combines the function of a volume control and a change-over switch for going over from radio reception to a gramophone pick-up. This is a rather attractive little device, because it enables you to fade down the radio reception, pass through a silent point, and then fade up on the other side into gramophone reproduction quite smoothly and progressively and without any click at the moment of changing over. Quite useful for impressing non-technical listeners!

The Special Volume Control.

The required control is simply an ordinary type of volume control with an extra tapping point on the resistance element, which is shown as a centre tap on the wiring diagram. Besides its "stunt" value, this arrangement is a genuine convenience in operation, and, of course, simplifies matters somewhat by replacing two separate components, namely, the usual volume control and a change-over switch.

Two small sockets are provided on the panel for the connections from the pick-up, and the idea is that the pick-up leads shall

(Continued on next page.)



THE "VANGUARD" AMPLIFIER.

(Continued from previous page.)

be furnished with two small plugs at their ends so that they can be inserted in the sockets. This, you will find, is rather a convenience in use, since it means that you can disconnect the pick-up leads in a moment and so are not obliged to have a permanent long trailing lead from the gramophone.

Now, just a word about the value of the coupling resistance in the R.C. stage. This is actually of only 100,000 ohms, and you may wonder why so low a value should be chosen, since it will presumably follow a



The dimensions and panel layout of the amplifier have been arranged to make it match up nicely with the companion unit.

detector valve. Well, the point is that we have found that with the more modern types of detector valves, with their somewhat lower impedance, the 100,000-ohm resistance gives ample magnification and permits somewhat better reaction control to be obtained on the preceding detector stage than the more conventional value of 250,000 ohms. This value of 100,000 ohms is therefore becoming a standard in POPULAR WIRELESS sets.

Constructional Hints.

Now, there are two points about the construction of the amplifier which we should like to give you. It is a pretty straightforward job, and there are no special dodges about the assembly and wiring-up, but there are just a few minor details requiring explanation. First of all, about the grid-bias battery. You will see in the photographs how it was mounted in the original amplifier, and you will note that certain leads run underneath it on the baseboard. These leads should obviously be insulated ones, and you can make your choice of bare wire covered with Systoflex sleeving or one of the special covered materials like Glazite.

It certainly is not advisable to leave these leads bare, because you may get partial short-circuits developing if the grid-bias battery becomes a trifle damp. If you like to make doubly sure on this point, you could quite well avoid taking the two wires in question under the grid-bias battery, and run them by slightly longer routes round its two ends. They are not critical wires, and it will not matter in the least if you make them a little longer than you see them on the original design.

The practice of providing an earthing

point on the frame or core of L.F. transformers appears to be coming into favour again among manufacturers, and if the specimen you use is so provided by all means make use of it. Connect up this point to any convenient spot on the filament circuit. This generally provides a slight extra degree of stability, and although there is not much need to worry about stability in an amplifier of this type, it is just as well to be on the safe side.

Now for connecting up the finished amplifier. First of all, join up the positive and negative input terminals to the telephone terminals on the receiving set, and be careful to see that you get them the right way round. The one marked + should be joined to that telephone terminal which is wired inside the receiving set proper to H.T.+, and the negative input terminal should go to the telephone terminal which is wired to the plate or H.F. choke of the detector valve.

Easily Checked.

If you cannot quite make out which is which of your telephone terminals, it is quite a simple matter to find out by test. Connect up the input terminals either way round, and note whether the amplifier works. If it does not, reverse the leads.

Your loud speaker is, of course, to be joined up to the L.S. terminals on the amplifier, and an accumulator of suitable voltage to the low-tension positive and negative terminals.

Now comes the important point. If you are using the same batteries for the set and for the amplifier, do not on any account make any connection to the H.T. - terminal on the amplifier. Leave this terminal entirely blank and merely connect the H.T. + terminal on the amplifier to a suitable positive point on the H.T. battery. Normally, of course, this should be the highest positive point available.

The pick-up connections we have already dealt with, and we can go on now to the choice of suitable valves and to battery voltages. Voltages are simple. The L.T. battery will normally be the same one which runs your set, and you will choose valves of a suitable filament rating to work thereon.

The H.T. voltage should not really be less than 120 volts for best results, but, at a pinch, you can use only 100 providing you remember that you will not now be able to handle quite such powerful signals without distortion. Preferably, however, use a full 120 volts, or even 140 or so if your valves are rated to stand this higher figure.

The valve types should be these. For V1 you want a valve of the H.F. type with an impedance of round about 20,000 ohms, any figure from, per-

haps, 18,000 to 30,000 being quite suitable. In the second stage (V2) you want either a power or super-power valve, and the reader will no doubt understand how the choice is made here.

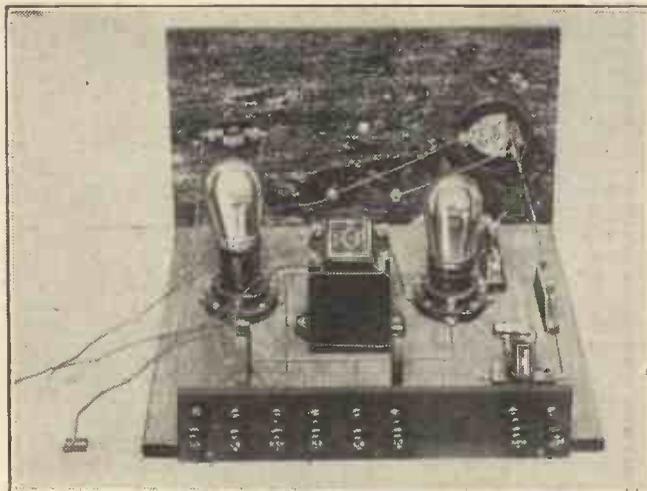
Grid Bias Adjustments.

Grid-bias voltages will be somewhat as follows: G.B.—1 is for the first valve, and the usual figure of 1½ to 3 volts should be applied to this plug. (Insert the G.B. positive plug in the positive socket of your grid-bias battery and place G.B.—1 in the

COMPONENTS REQUIRED.

- 1 Panel, 12 in. x 7 in. (Radion, Becol, Kay Ray, Goltone, Ripault, Paxolin, Trelleborg, etc.).
- 1 Cabinet and baseboard, 10 in. deep (Raymond, Pickett, Osborn, Camco, Ready Radio, etc.).
- 1 2-meg. "Fader" volume control (Magnum, Centralab).
- 1 L.T. switch (Lotus, Lissen, Igranic, Benjamin, Bulgin, Keystone, Raymond, Ormond, Wearite, etc.).
- 2 Small sockets and plugs for pick-up leads (Clix, Eelex, etc.).
- 2 Sprung valve holders (Lotus, Benjamin, W.B., Igranic, Wearite, Formo, Bowyer-Lowe, Dario, etc.).
- 1 Low-ratio L.F. transformer (Varley, Ferranti, Brown, Lissen, R.I., Philips, Telsen, Cossor, Igranic, Lotus, etc.).
- 2 100,000-ohm resistances (Igranic, Ediswan, Lissen, R.I., Dubilier, Varley, Precision, etc.).
- 1 .01-mfd. fixed condenser (Magnum, Lissen, T.C.C., Dubilier, Goltone, Clarke, etc.).
- 2 Grid battery clips (Bulgin or similar type).
- 1 Terminal strip, 10 in. x 7 in. x ½ in.
- 8 Terminals (Belling & Lee, Eelex, Clix, Igranic, Burton, etc.).
- Wire, screws, G.B. plugs, etc.

1½ or 3-volts negative socket.) The plug G.B.—2 is the one for the second valve, and the voltage required here will obviously depend upon the particular valve you are using. With the ordinary power type about 6 or 7½ volts will usually be correct with a moderate amount of H.T., but you should really be guided by the maker's data slip which you will receive with the valve. With a super-power valve considerably more grid bias is necessary.



Finished and ready for the insertion of the grid-bias battery.

FROM THE TECHNICAL EDITOR'S NOTE BOOK

Tested and Found-?



A USEFUL INSTRUMENT.

THE Waters Panel-mounting Test-Meter will, we predict, prove very popular with constructors. With it you can measure L.T. volts up to 6, H.T. up to 150, and H.T. current, in milliamps, up to 30. It is said to be the first instrument for



The Waters Panel-mounting Test-Meter fixed on a piece of ebonite to illustrate its layout when in use.

panel mounting that measures these values on one dial.

There is a bakelite plate fitted with eight coloured, circular discs, and three two-point plugs for inserting in the centre holes in these discs. The connections necessary for giving the various indications are clearly shown on a neat ivory tablet which is placed on the panel just below the meter.

The meter connections are, of course, permanently wired up when you build the set, and you do any particular job of measurement by simply shifting the plugs. Thus you can see any time at a glance whether your L.T. and H.T. battery is in condition, or test for distortion. The use of this meter makes all the difference between the haphazard operation of a set, which is all too common, and an easy although scientific maintenance that ensures consistently good results.

The test-meter is a neat, very well made affair, and it undoubtedly adds to the panel

appearance of a set. And its price is not a matter of guineas, for it is available absolutely complete with instruction book at the remarkable price of 13s. 9d. On all three ranges it is reasonably accurate and, judging by the sample we have tested, readers need have no hesitation at all in accepting the verdicts of its readings.

EXACT TUNERS.

Two small panel holes are all that are required to fix the Exact Aerial Tuner, a product of the Exact Mfg. Co., of Croft Works, Priory Street, Coventry. The Exact tuner covers a range of from 250 to 2,000 metres and eliminates the necessity for plug-in coils or wave-change switching. It is a nice little piece of work.

There is a panel plate over which ranges a knob and pointer. In the main the device consists of two coils, one of which is tapped. The back portion is the reaction coil and swings away, the smooth control being given by the second small knob. The movement is completely even and there is no backlash whatever. Extremely close adjustments are possible. The whole occupies a very small space and is easy fitted to any panel. The price is 14s., and a very attractive figure it is, too, considering that it needs but a .0005-mfd. variable condenser in parallel to complete the reaction and tuning portion of a set, over the wave range mentioned above.

I have tested the tuner and find it functions well, the reaction being particularly smooth over the whole of the band covered. There is also the Exact Aerial and Anode Tuner outfit, which comprises all the inductances needed for an H.F. tuned-anode set. The aerial tuner portion comprises a tapped coil device, which is really the Exact Aerial Tuner above-mentioned, without the reaction adjustment. The reaction arrangement is embodied in the Exact Anode Tuner. The price of the outfit complete is 30s., and, again remembering that this covers from 250 to 2,000 metres and is the equivalent of no end of coils, it makes an attractive proposition. I fixed this Exact Anode Tuner in an H.F., Det., L.F. set, and must say the results were very good indeed. I would certainly advise "P.W." readers who are desirous of constructing a simple, compact and efficient set to acquire the details of these Exact components.

THE EASY WAY.

The Peto Scott people have issued a sumptuous catalogue giving details of all the radio gear they have available on the hire-purchase system. Sets due to all the leading makers, mains units, meters, and all sorts of things are included. Kits of the "Titan Two," "Titan Three" and

"Titan Four" are to be obtained for monthly payments from 14s. 11d. upwards.

A NEW R.I. CATALOGUE.

The general catalogue of Radio Instruments, Ltd., is printed on excellent paper, and the fine-screen half-tones well illustrate all the various R.I. productions. Full details of the R.I. All-electric Three are included.

ELLISON H.T. ELIMINATORS.

The Ellison Mfg. Co. Ltd., Dragon Works, Harrogate, have sent us one of their eliminators. It is an A.C. model (a D.C. variety is available), and it sells at £6. A

Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

valve rectifier is employed, and this goes right inside the stout metal case. There are two fixed outputs, the one giving 1½ milliamps at 65 volts for a detector, and the other, for serving amplifier valves, giving up to 40 milliamps at 120 volts.

It is by far the smallest unit giving this respectable output that we have yet seen. It is exactly the same size as the ordinary



This is the Ellison H.T. Unit.

100-volt dry battery, and it can fit snugly into the H.T. compartment of a portable set. The advantage of this is that it can be employed to drive the portable during the long winter evenings, while an inexpensive battery can take its place for the comparatively short time the portable is needed for out-of-doors work.

We carefully tested the Ellison eliminator and found its smoothing adequate. Its outputs are up to specification and, altogether, it can be considered an efficient device. Undoubtedly its compactness is an advantage which will considerably add to its popularity.

LISSEN *for* THE MAGIC 3

Make your version of the Magic 3 better than even the original designers dreamed of. Build it with Lissen, the parts that are made to pull together!

Get Lissen—the fixed condensers that deliver ALL their stored-up energy. Get Lissen—the grid leaks of precise value that never vary. Get Lissen—the Mansbridge type condenser that stands up to high pressure, the ideal condenser for H.T. filter circuits. Get Lissen—the wire-wound resistances in their most convenient form.

GET LISSEN—AND GET BEST VALUE FOR YOUR MONEY!

LISSEN FIXED GRID LEAKS

These resistances are absolutely unvarying, no matter what the conditions or the current load. All values, each **1/-**
(With terminals, 1/3 each.)

LISSEN WIRE-WOUND RESISTANCES

Suitable for use in power amplifiers—unaffected by current density or atmospheric changes.

Made in the following values:—

Ohms.	Price	Ohms.	Price
10,000	3/6	100,000	4/6
20,000	3/6	150,000	5/6
25,000	3/6	200,000	6/6
50,000	3/6	250,000	6/6
80,000	4/-		

LISSEN
RESISTANCE BASES
Price 1/-

LISSEN FIXED CONDENSERS

have become the standard fixed condensers in almost every published circuit. Accuracy to within 5 per cent. of the stated capacity. .0001 to .001 mfd. each **1/-**
.002 to .006 mfd., each 1/6. .01 mfd., 2/-

LISSEN MANSBRIDGE TYPE CONDENSERS

Hermetically sealed in a non-conducting case, cannot be short-circuited on the case. Deliver all their stored-up energy and have the biggest margin of safety of any condenser made.

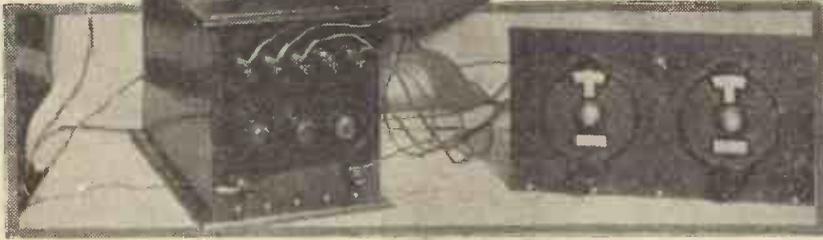
.01 to .05	1/9
.1	1/9
.25	2/-
.5	2/3
1	2/6
2	3/6
3	4/6
4	6/-



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(Managing Director: Thos. N. Cole.)

INCREASING MAINS UNIT OUTPUTS



How to improve your H.T. battery eliminator, and thereby get better results from your set.

By A. S. CLARK.

THE title of this article may appear a little strange at first. How, you will ask, can the output of a unit be increased above what it is designed to give? The answer is that this article applies to home-constructed H.T. eliminators, and explains simple alterations which can be made to increase the output, and also indicates likely faults when the output is not up to what it should be.

We will consider A.C. eliminators first. To increase the voltage and current is rather an expensive business in this case, as the transformer, which is one of the most costly items, will have to be changed. Let us suppose, first of all, that it is desired merely to increase the voltage.

Increasing the Voltage.

First of all, make sure that you have a tap which has no variable resistances or fixed ones in series with it, as these would naturally reduce the voltage. If the voltage cannot be increased in this way, a new transformer with a higher H.T. voltage output must be purchased, and when ordering do not forget that a voltage drop occurs in the rectifier and smoothing chokes. The new voltage must not be too high for the rectifier, whether it be dry, electrolytic, or valve, and in the latter case the filament output from the transformer must be the same as before.

In cases where it is desired to take more milliamperes, or, in other words, to increase the current output, there are more points to consider. A new transformer is required to give the increased current, and if the rectifier is not capable of handling it, a fresh one will also be necessary. The chokes must also be considered. These, it will be found, are rated to carry a certain current. If the current taken is not within this rating, proper smoothing will not be obtained, and also an undesirable voltage drop will occur, due to the resistance of the winding. Do not forget that if a larger rectifying valve is to be used, a different filament output from the transformer may be required.

D.C. Mains Units

With D.C. eliminators, since no transformer is employed, it is absolutely impossible to increase the voltage beyond that of the mains, and actually, in practice, the maximum available will be slightly less, due to the resistance of the smoothing

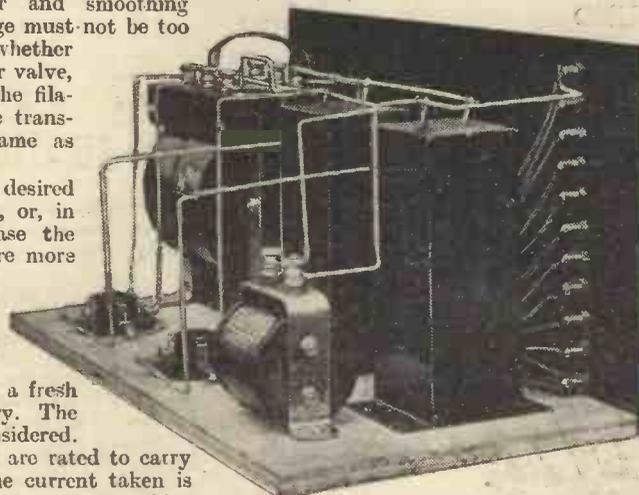
chokes. Therefore, the only thing to do if more voltage is required, is to make sure that a tap is available which is free from all series resistances.

There is no limit to the current which can be taken from a D.C. eliminator, apart from the carrying capacity of the chokes. Therefore, if you desire to use more current than the eliminator is intended to give, all you will have to do is to use larger chokes.

Now let us consider the question of eliminators which fail to give the voltage or current for which they are designed. It may be mentioned here that all H.T. voltages should be measured while the eliminator is in use, and a very high resistance voltmeter is necessary if true readings are to be obtained. One with a resistance of 1,000 ohms per volt is desirable. That is to say that if the whole scale reading is 200 volts, the resistance should be $200 \times 1,000$, which is 200,000 ohms.

Check the Components.

First of all, in the case of a home-made unit the components employed



A modern A.C. mains unit with H.T. tapping points for varying the anode voltages.

should be checked against those mentioned in the article describing the eliminator. If makes other than those specified are employed, make sure that the chokes are capable of carrying the desired current, and in the case of an A.C. eliminator make sure that the transformer gives the correct output voltages. Also ascertain that it has the correct input rating, not forgetting the question of the number of cycles of the mains. If the transformer is of the universal type, namely, suitable for all voltages of

mains, check over the connections to see that the right ones are in use.

The next thing to suspect is the rectifier in the case of an A.C. eliminator, and it is as well to return this to the makers for test. Assuming the rectifier is all right, we have only the resistances and fixed condensers left to suspect. In the case of variable resistances try shorting them out of circuit, and check over the values of the fixed resistances.

Testing Condensers.

The fixed condensers may be tested by being removed from the set and being charged up by an H.T. battery of not less than about 60 volts. They should then be left to stand for four or five minutes, and then shorted with a piece of wire. If a good, snappy spark is obtained, they are not faulty, but if the spark is very weak or the condenser has completely lost its charge, it is leaky and must be replaced.

If all the above tests fail to show any fault, there must be a break in the circuit somewhere, and every connection must be tested. The transformer and choke windings should be tested for continuity by means of a pair of 'phones and a battery, and the transformer should be returned to the makers for test as a last resource.

PERTINENT PARAGRAPHS.

An easy method of finding which side of the mains is earthed is to connect a lamp in series with one lead and attach this to a water-pipe or other earth conductor. If the lamp lights it indicates that this lead is NOT earthed.

One of the best methods of determining whether a soldering iron is hot enough for the work is to hold it near the face, the correct temperature being readily recognised after a little practice in this way.

It is no good complaining that a wave-trap is insufficient to cut out the local station if its condenser has not been adjusted with patience and accuracy when the wave-trap was installed.

Soldering a pigtail connection between the spindle and the appropriate terminal of a variable condenser which depends upon pressure contact to the moving vanes, will often improve efficiency greatly.

Dust is a great enemy to good reception, so keep the "works" of your set covered in.

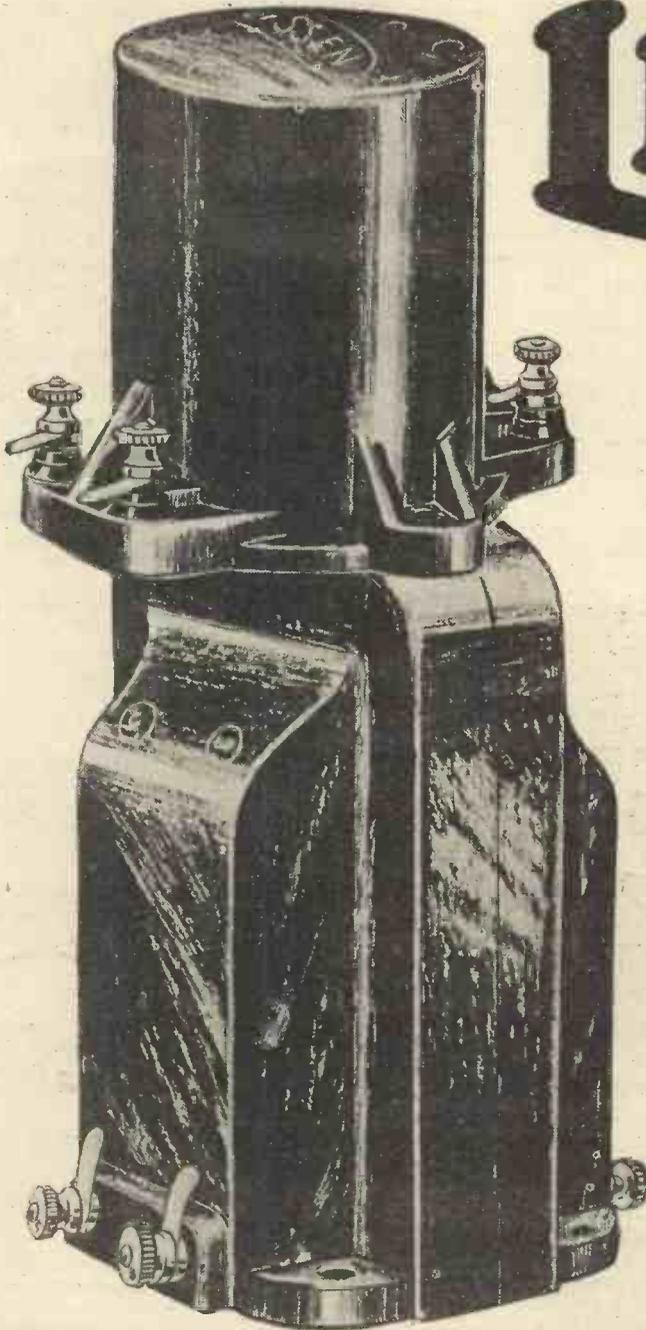
Do not use old or doubtful fixed condensers for coupling, as the slightest fault in a component used in this position will result in distortion.

TRANSFORMERS

for the
MAGIC 3

GET

LISSEN



The designers say "Two transformers of different types and different ratios." Now reason it out for yourself!

Here are two Lissen Transformers, definitely designed by Lissen to work together in just such a circuit, and absolutely "made for the job."

The Lissen 8/6 Transformer, with its 3 to 1 ratio followed by the Lissen Super Transformer, ratio $2\frac{1}{2}$ to 1—where can you find two more dissimilar transformers in type, or two transformers of any kind at all to build up so successfully this most powerful two-stage amplifier at such moderate cost?

FOR THE MAGIC 3 USE THESE TWO LISSEN TRANSFORMERS

LISSEN 8/6 TRANSFORMER—used in every circuit for years past, and universally known as the "transformer that never breaks down." Price **8/6**

Turns Ratio 3—1
Resistance Ratio 4 to 1

LISSEN SUPER TRANSFORMER—the curve of this transformer, taken with just such valves as you will use for the Magic 3, shows almost perfect amplification over the whole band of audible frequencies. A transformer whose performance has never been challenged. Price **19/-**

Ratios $3\frac{1}{2}$ —1 or $2\frac{1}{2}$ —1

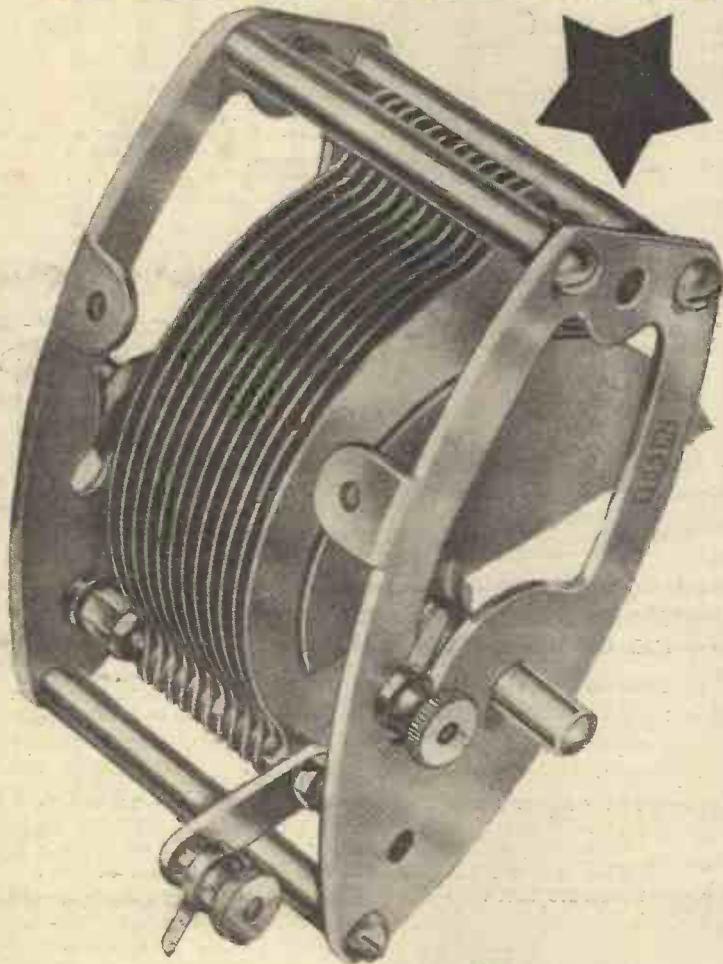
Lissen Transformers amplify a whisper to a great degree of loudness in a background of absolute silence.

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(Managing Director: Thos. N. Cole.)

CONDENSERS



★ FOR THE MAGIC 3

The designers specify Lissen Variable Condenser for the extremely sensitive tuning circuit of the Magic 3—it conserves incoming signal strength, it gives you easy separation of stations close together, and real freedom from losses in the tuning circuit. These are of first importance in this circuit, and the Lissen Variable Condenser is therefore a key component.

Use also the Lissen Neutralising Condenser as the aerial series condenser for short-wave work in this circuit, because of negligible losses, because of delicate adjustment, because of absolute accuracy.

★ GET LISSEN

LISSEN VARIABLE CONDENSER

PRICES :

0001	Mfd. capacity	5/9
0002	" "	6/-
0003	" "	6/-
00035	" "	6/3
0005	" "	6/6

LISSEN SLOW MOTION DIAL **3/6**

LISSEN NEUTRALISING CONDENSER - - **4/6**
Baseboard Mounting Type EACH

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A VISIT TO THE MANCHESTER EXHIBITION

An Impartial Review of the Northern Radio Show.
FROM OUR SPECIAL CORRESPONDENT.



THE Manchester Show is very different from Olympia and, even although one has seen the London show, a visit to the North is very well worth while.

For one thing there seems to be much greater freedom of expression at the Manchester City Hall. There is a great deal to be said for organised and standardised stand decoration and such, as Olympia has proved, can be very impressive and very beautiful.

But the stand individuality at Manchester is most pleasing. It makes up in great measure for the smaller dimensions of this Exhibition. Indeed, it is no doubt due to this that the show gives one the idea that it is little, if any, smaller than Olympia.

I must say that I was greatly surprised by the whole show. This happens to have been my first visit to Britain's Northern National Radio Exhibition, and I had not expected it to be constructed on such magnificent lines.

As I have already indicated, it is most colourful. Whereas Olympia retained, throughout, dominating notes of blue and gold, here one is greeted by much more of a rainbow effect.

Nevertheless, blue is by far the strongest colour in the variegated scheme and, indeed, it would seem that everywhere blue has been adopted as a radio hue. Let us hope this is not a subtle dig at the programmes our broadcasters provide!

A Fine Concert Hall.

At the City Hall the layout is on more or less conventional lines, although there are breakaways to be noted here and there. There is first the main hall with its large stands spread around the central flooring, and with various sized booths laid around the walls.

Here and there are smaller halls, annexes and bays into which one can wander. The concert-hall is a most distinctive feature. This is domed and walled with dark and light blue draperies, and at the one end, strikingly inset, is the stage on which famous radio artistes are daily performing.

As readers will know, many of these items are being broadcast so that visitors to the exhibition have the chance to see a microphone end of the ether.

All around the main hall runs the gallery containing a varied selection of exhibitors, large and small. At the far end from the main entrance, up in the gallery, are four moving-coil loud speakers, and behind them comes the "bench of the elect."

Upstairs are also the demonstration-rooms in which radio-gram receivers are being operated. Each of the silence rooms contains a number of curtained recesses, and in each of these is a product of one or other of the firms. I suppose lack of space prohibited the assignment of a complete silence-room to each demonstrating exhibitor. However, the idea is an excellent compromise and enables visitors to hear a large number of instruments working—not all together, of course, but one at a time.

Excellent Lighting Effects.

The City Hall is a sprawling, dingy sort of a building in a very drab part of the city, but once you pass through the entrance to the Radio Exhibition you enter a new world. Here is light, colour and music that drives the Manchester fog and drizzle right away.

And, I must mention, the lighting effects are excellent. The main illuminations of the hall seem to catch up the diverse and



The City Hall, Deansgate, where the Manchester Show is being held.

striking lighting effects of the individual stands and sweep them into one brilliant and kaleidoscopic ensemble.

Mains units and receivers and radio-gram outfits seem to be the leading exhibits and the greatest attractions of the Manchester Radio Exhibition, just as they were at Olympia. But there appears to be a greater wealth of constructor's items, and here the City Hall distinctly scores over Olympia.

Probably the reason for this is to be found in the fact that the show is primarily due to the Manchester "Evening Chronicle," which always has devoted a great deal of

interest to the home constructor of radio sets. Indeed, I believe it is the only great daily in the country that runs articles in every issue intended to appeal to this class of enthusiast.

It has had its reward in this exhibition, for it is being most enthusiastically supported by both the trade and the public. At the time of writing, and as far as I personally can judge, it would seem very probable that all previous attendance figures will be beaten hollow.

Another point where the Manchester Show differs from its London predecessor is that the former does not lay down the rigid nationality bar. Undoubtedly, it gains by this and the exhibits are made much more representative.

I notice that a few of the exhibitors are duplicating their London stand layouts. Thus, the Ediswan people have their model of a home-constructor's home on view.

There are a number of local firms exhibiting which did not show up at Olympia, and some excellent gear they have displayed.

Lissen, Ltd. (whose stand numbers are 13 and 13a—they evidently are not superstitious folk) are well placed, and again they have, by cunning devices, so arranged their stands that they seem to be much larger than their floor space would indicate.

Ward and Goldstone are Mancunians, and appear to have done their utmost to "do well by their own home-town."

The Common Amplifier.

All the other well-known Manchester concerns are showing; for instance, the Chloride Electrical Storage Co., Ltd., are to be found on the ground floor displaying their famous Exides.

Our old friends Ferranti have their enthusiastic teeth well and truly into this show for, besides having a stand, it is they who designed and built the common amplifier which relays the music to all the individual exhibitors' loud speakers. Thus speakers blare away in unison and fill the hall quite completely. The distribution of sound is fine and seems to drown any peculiar acoustic effects the hall might be expected to have.

And, on the whole, the quality is of good standard. Here and there one might notice a loud speaker that was not, by any means, equal to a moving-coil type that may happen to be not far away, but the price difference completely softens the blow!

One of the most striking displays is that arranged by the Marconiphone people,
(Continued on next page.)

A VISIT TO THE MANCHESTER EXHIBITION.

(Continued from previous page.)

whose stand is distinctly colourful. They are showing a fine range of products, and their latest receivers are attracting considerable attention.

The "Safe, Silent and Sound" concern have come all the way from Leigh-on-Sea to display their "Ecko" mains units and sets to the canny northerners, and seem to be getting away with it in great style. (And this is real proof that they deliver the goods!)

The new Cossor Melody Maker is occasioning no little interest, and the crowds around the Cossor stands provide good evidence of the continuing enthusiasm of the home-builder in general and the Melody Maker fan in particular.

"High General Standard."

Now that these radio exhibitions give firms the chance to let visitors hear various instruments in action (and in this the Manchester Show led the way), concerns such as Celestions come into their own. Radio folk would always look at such

on view, including the pick-up. I found it interesting to gauge the vast superiority in numbers of loud-speaker enthusiasts by the proportion of visitors that stopped at the Blue Spot stand—a tribute too to the popularity of the accessories displayed.

I trust that by now I have conveyed the impression that the Manchester show really is a big one. It fills the three halls almost to overflowing and if, next year, the same rate of increase in exhibitors is registered, a new home will have to be found for it.

A Veteran Set.

Over forty more exhibitors had to be provided with places this year, and great credit is due to the organisers for the way the whole affair has been handled.

It is very curious for a Southerner, such as I, to hear radio interpreted all around one in the dialect of the North. As a matter of fact, I was so fascinated by this that I stopped one or two visitors and engaged them in quite lengthy conversations. You can do this sort of thing at radio exhibitions, for it is at such places that we radio folk meet on completely common ground.

One visitor I spoke to was a Preston man who had never been farther south than Birmingham. He told me that he had a "P.W." Combination set working at home. This is a design due to "P.W." that achieved enormous popularity some six or so years

ago. London except, perhaps, here the visitors are rather more searching in questions about the various sets' actual capabilities and their running costs. Whereas in London appearance and practical performance seemed to be the main requirements—that is judging by the questions asked—up here knowledge of the most intimate details is required by visitors.

"Do you find that the average visitor up here knows more about radio?" I asked him.

"On the whole, I think so," said the stand attendant, "although it is rather hard to judge, because it seems to me that some of these folk assume more than they know." And with this libel on the good people of Manchester, which I do not endorse, he turned to deal with the large group of inquirers waiting at his elbow.

Meeting a fellow scribe from London I endeavoured to add his views to my growing symposium, but he protested that he had not yet formed his opinions. "But I will tell you this," he said. "I think this is a most homely and friendly show."

An Air of Cheeriness.

And so do I. There is an air of cheeriness about it all the time and, in my opinion, no one who visits it, however far they travel to do so, will consider it anything but time very well spent. It has yet to run a few days, and I advise all who can do so to train, fly or walk to Manchester to see Britain's Northern National Radio Show.

Among the many other leading manufacturers who are represented at Manchester are the following: Belling and Lee, Ltd., Watmel Wireless Co., Ltd., Burndep Wireless (1928), Ltd., Ever Ready Co.



The Baird Television transmitter that was demonstrated during the Olympia Show. The turntable that can be seen on the left is used for supplying gramophone music to fill in intervals.

notable gear as is made by this firm, but a demonstration completes the effect.

And it means that the loud speakers at Manchester, as at Olympia, must be of a high general standard, otherwise, with such criterions at work in the same building, they might just as well pack up and go home.

Prominent radio-gram. exhibitors this year are Graham Amplion, Ltd., with their magnificent new outfits. These and the range of Amplion speakers shown have crowds around them all the time.

F. A. Hughes & Co., Ltd., have a full range of their renowned Blue Spot products

ago. The only alteration made to this veteran set since its original assembly was that the L.F. transformer had been changed. I wonder how many other "P.W." Combination sets are still in existence?

"Searching Questions."

I asked one of the stand attendants what lines were creating the greatest interest in the North, and whether he found any real difference between Olympia enthusiasts and those at the City Hall.

"On the whole," he said, "this show from my point of view is very much like

NEXT WEEK

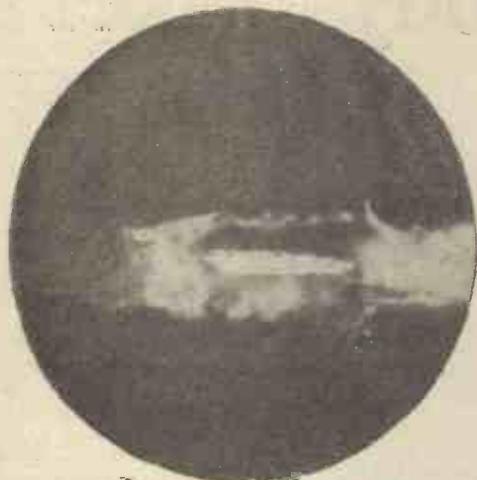
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This is, of course, by no means a complete list and gives the names merely of those exhibitors that happened to catch my eye as I wandered around the show jotting down notes in the small book I was carrying.

But it will, I trust, serve to give you some idea of the representative nature of the exhibition and, as you will also note, firms from all over the country are there to give it support.



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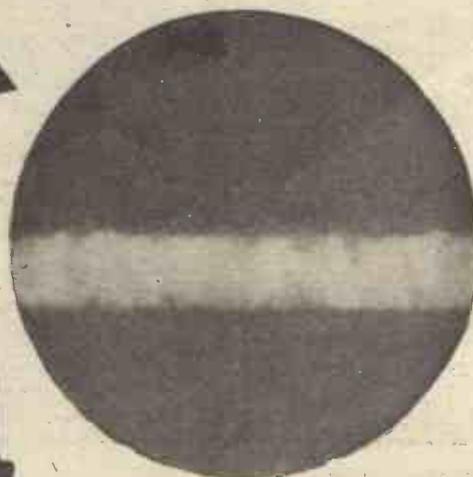
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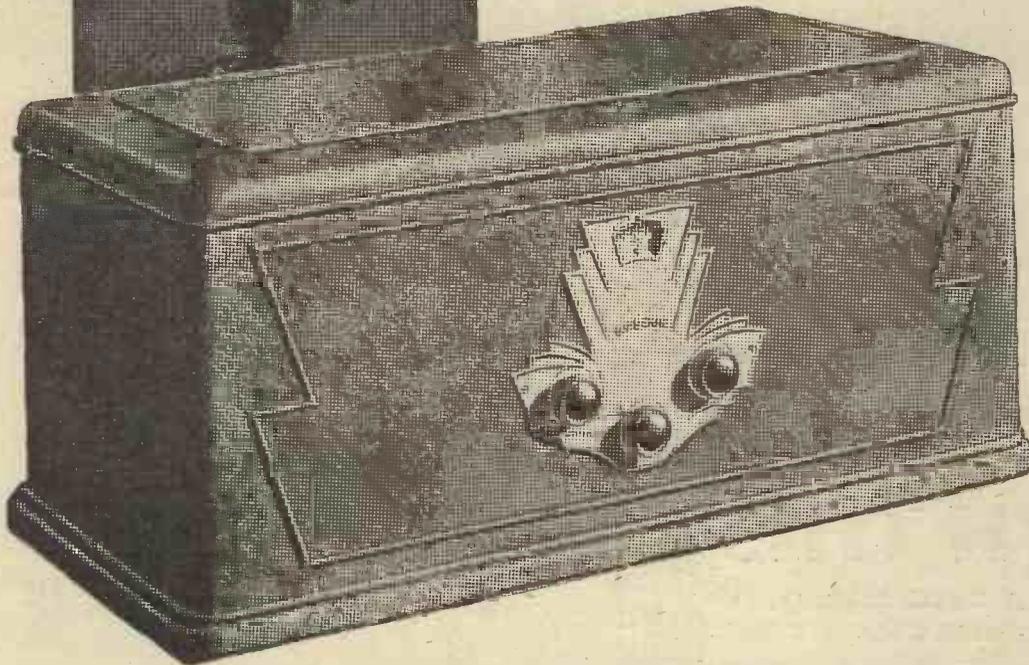
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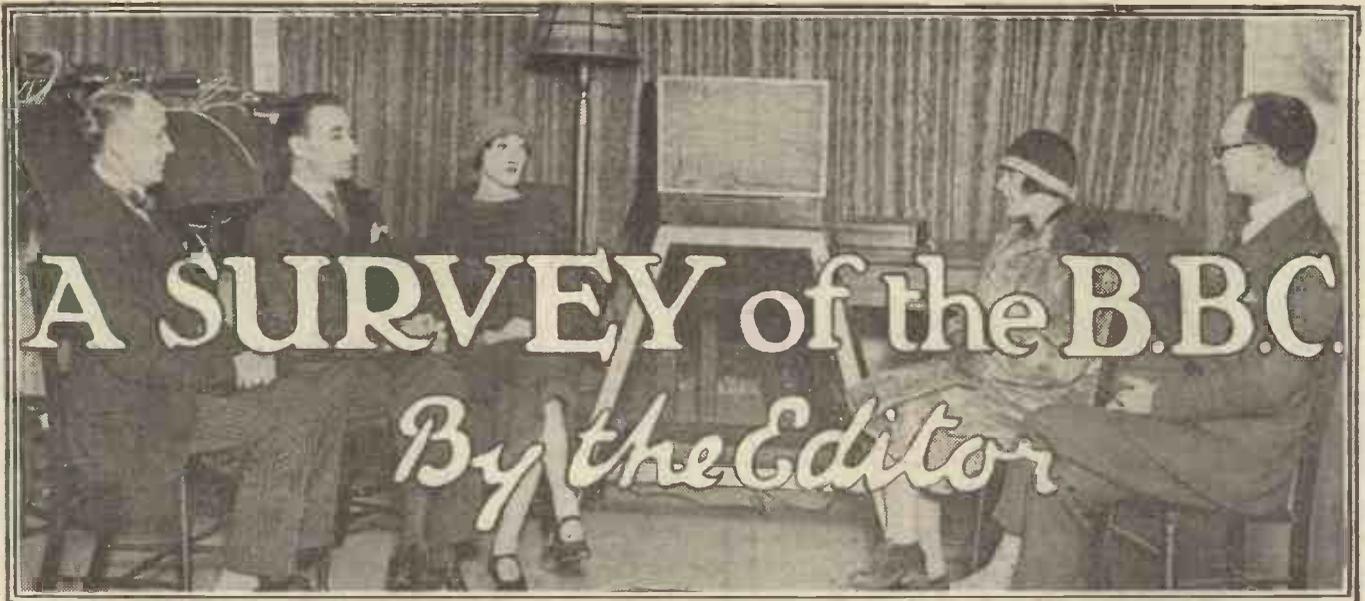
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A SURVEY of the B.B.C.

By the Editor

HAVING examined the constitutional and organisation difficulties of the B.B.C., it is now possible to inquire into the product of the work of the B.B.C. with an understanding of its background.

Radio Drama in its development during the past year is undoubtedly a bright spot in the B.B.C. programmes. The reason for this is not hard to find. Mr. Val Gielgud attacked the problems of Radio Drama with a view to their solution on distinctive and original lines. He abandoned the theory that the broadcasting of drama should be and indeed must be patterned slavishly on the model of the stage. He realised that a special technique must be evolved; that, as the ear alone was the vehicle, much of the preconceptions and a great deal of the attitude of stage drama must be abandoned.

Anonymous Actors.

As an early test of faith Mr. Gielgud insisted on the anonymity of radio actors and actresses. It was objected that this would ruin the dramatic work of the B.B.C. But the result has justified the theory. The idea was that anything that detracted from dependence upon the voice was apt to prejudice the artistic effect.

The name of an actor or actress taking part in a stage play is naturally and inevitably given in the theatre programme. But the name of a radio actor or actress may divert attention through a preconception thereby vitiating the "radio effect." This lesson has been applied with excellent results. The wireless play as now evolved by the B.B.C. needs to be shorter than the average stage play and to be broken up rather more frequently.

Many Short Scenes.

The best length is between an hour-and-a-half and two hours. Unlimited by sight and the necessity for changes of scenery, it can be divided into as many scenes as the story requires, and for the sake of variety the scenes should be quite short; perhaps as many as thirty in a two hours' play. But the changes of scene must be made obvious through such devices as fading-in, music, and appropriate sound effects. Incidental music may be regarded as an essential accompaniment.

In the course of the development of the

This is the third article of a short series in which the machinery is candidly criticised. It is the best-informed series of articles that has been published and discloses behind-the-scenes details that are seldom, if ever, made known to the public.

3. PROGRAMME DEVELOPMENT —DRAMA AND MUSIC.

Broadcast Play, the B.B.C. has devised two main methods of presentation. Firstly, the method in which the play is introduced by a narrator who links the various acts or divisions by explanations and description. This is proved to be the best means of adapting novels.

Secondly, the play may proceed from scene to scene fading in and out either with dialogue or with music, but without any positive breaks.

So far so good. Mr. Gielgud can be congratulated on laying excellent foundations for a real Radio Drama tradition. But I

have this criticism to make, namely, that there has been unjustifiable delay in the creation of a Radio Repertory Company. There were rumours a year ago that the policy of a Repertory Company for Radio Drama had been approved at Savoy Hill,

Much too Slow.

It was indeed a necessary corollary to the application of the new principle. Previously methods had been too haphazard, there had been the unworthy use of the publicity argument in order to attract stage artistes at less than their real value. Now that anonymity was to be applied the establishment of a permanent corps of radio actors and actresses was urgently needed. But this has not yet come to pass.

There has been much too much delay, and while I mention the subject of delay in this connection, I would emphasise that in administrative matters of this kind, the machinery of the B.B.C. works so slowly that by comparison a winged snail could win the Schneider Cup!

When I last surveyed the work of the B.B.C. in Music, I did not fail to remark upon the fact that the old Company had begun a virtual revolution in the popular attitude towards and appreciation of all kinds of music. Those who have kept an eye on the trend of public taste observed a steady improvement, the lion's share of the credit for which must be given to the B.B.C.

B.B.C.'s Musical Shortcomings.

Having said this much, it may seem ungracious to begin to qualify. But the very importance of the good work which the B.B.C. has done for Music sets out in convincingly bold relief the mistakes and shortcomings attendant upon the effort. Operas are given in plenty, symphonies are numerous and well performed; the Promenade season is a great boom; Jack Payne is a public benefactor. Chamber Music attracts the ecstasy of the few at the cost of general irritation; Sir Walford Davies remains at the old stand; of eighty-eight thousand hours of programmes in the past twelve months, no less than sixty-two thousand were of music. Truly an amazing achievement!

(Continued on page 387.)



Mr. Aylesworth, of the National Broadcasting Co. of New York, paid a special visit to England to study British Broadcasting methods.

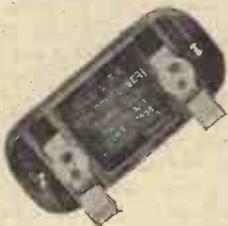
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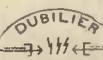
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M.B.

A SURVEY OF THE B.B.C.

(Continued from page 385.)

And yet, all is not well. Percy Scholes has gone, and this means more than the passing of an individual; it symbolises a changing attitude, a dangerous tendency to ignore human sympathetic contact with the mass of listeners. True the bands play better; the orchestra is better rehearsed; the repertoire is steadily widened. But an important ingredient of the old spirit is lacking.

Mr. Percy Scholes.

And this was best personified in Percy Scholes. It was through his influence and guidance that millions of listeners in this country were introduced to the joy and mystery of good music. He had in superb measure the quality of instructing pleasantly without being didactic or tiresome. For five years he was an important part of the B.B.C. About eighteen months ago he went away to Switzerland in a sort of premature retirement.

No attempt was made at Savoy Hill to induce him to stay. This is a very great pity. In Mr. Scholes the B.B.C. had the world's leading interpreter of music to the millions. They should have clung to him. The first thing that is wrong with B.B.C. music is its lack of just those qualities that Mr. Scholes personifies. I believe he might even now be prevailed upon to return. Anyway, I do know that broadcasting is the only thing that would bring him back to active work in this country.

The second main trouble with B.B.C. music is lack of coordinated, firm, and statesman-like direction, conscious of objectives. A scheme such as the National Orchestra is adumbrated. There is much optimistic talk about it, but it takes so long to materialise that its value is greatly depreciated.

Having decided on a definite step such as a National Orchestra, the authorities should move courageously and rapidly. Instead of this, they appear to spend months, even years, in endless quibbles, and in resolving doubts which never should have existed if the scheme was right. B.B.C. music will not go ahead without more understanding, direction and coordination.

A Great Opportunity.

Here is a great opportunity for Dr. Adrian Boult, who takes over B.B.C. music on January 1st. I am not suggesting any censure on his predecessor, Mr. Percy Pitt, whose pioneer work for broadcast music has won him richly-deserved renown and honourable retirement. But by the nature of the case, Mr. Pitt was never accorded the freedom that his successor is able to stipulate as a condition of his appointment. Without a large measure of freedom and autonomy for the chief, the

music department of the B.B.C. will not make the progress it should.

Dr. Boult is believed to be fully alive to the actualities of the position, and determined to get on with the job in the right way. It has already been suggested that one of the first acts of the new régime should be an attempt to get Percy Scholes back from Geneva, if only for a year or two. Dr. Boult and Mr. Scholes would make an ideal team not only to formulate and define a new music charter for the B.B.C., but also to carry it out with efficiency and economy.

Orchestras and the B.B.C.

There is another point about B.B.C. music policy. For some years Savoy Hill appeared to be moving in the direction of entirely separate and self-contained orchestras all over the country. This inevitably involved competition sooner or later with existing orchestras both for instrumentalists and for public support.

The B.B.C. has definitely abandoned this policy during the past year. The attitude now is to help existing musical organisations, and generally to provide nothing which can be done equally well by established local orchestras. But this attitude needs crystallising into a firm policy.



FROM THE BED OF THE THAMES.

One of the early "outside" broadcasts was a description by a diver of the bed of the River Thames.

The B.B.C. has no mandate to become a Ministry of the Fine Arts as long as the Treasury raids its funds, but it can do a great deal for good outside orchestras by prudent cooperation on a value for value basis. It is even conceivable that Dr. Boult will discover that there may be no real need for the contemplated National Orchestra, at least on the lavish scale envisaged by Sir Thomas Beecham.

The Presiding Genius.

As a footnote to this article, I would put in a plea for the continued cooperation of the B.B.C. with Sir Henry Wood in the Promenade Concerts. It was stated last year that the B.B.C. would probably withdraw from the arrangement with Sir Henry after the 1929 season. I hear now that Savoy Hill is still of the same mind, despite the overwhelming success of the 1929 season.

The attitude of the B.B.C. is that if

they do the Proms. again, they will use their own orchestra and a number of conductors, including Sir Henry, if he is willing.

Three Essentials.

This would be a mistake. The Proms. are essentially a "one-man show"; they are inconceivable without Sir Henry Wood as the sole presiding genius.

Let the B.B.C. think very seriously before they destroy a partnership which has meant so much to them, as well as to the public, in the past few years. If Savoy Hill is misguided enough to drop out of Sir Henry Wood's Promenade scheme, it will find that he will develop it under other auspices, with the result that any competitive Proms. run by the B.B.C. would be a hopeless failure.

For the present three things are essential to the ideal Proms. The first is Sir Henry Wood, the second is the B.B.C., and the third is the Queen's Hall. They are a natural alliance; let no hand be raised to disturb it.

FOR YOUR NOTEBOOK.

A good high value of grid leak is often an advantage where long-distance short-wave stations are being received, and a resistance of 5 megohms or so will generally be found satisfactory.

Never attempt to listen-in during a thunderstorm, but keep the aerial earthed until the storm has passed.

Carelessly allowing wander plugs or flex wires simultaneously to touch positive and negative tappings on a grid-bias battery is certain to damage it.

ELECTRIC LIGHT WIRING.

Always remember that great care is necessary in the handling of electric light or power wiring. It should not be undertaken by inexperienced persons.

An easy method of removing the layer of scale on a neglected soldering iron is to heat the iron until it is almost red hot and plunge it swiftly into cold water, when the deposit will flake off.

When a soldering iron has to be heated in a fire it is a good plan to place an empty tin on the fire, inserting the end of the iron into this so that it is heated without coming into actual contact with the dirty ash.

For quick soldering do not use an iron with a long and thick handle, or most of the heat will be radiated away from the copper bit by this.

TUNING YOUR SET.

If you are not quite sure of the way to tune your valve set, write to the B.B.C., 2, Savoy Hill, London, E.C.2, and ask for their free booklet on "Oscillation," which will give you many valuable hints.

Holes accidentally made in a panel need not spoil its appearance, for these can be filled up with black sealing wax, or heelball as used by shoemakers.

The small holes in accumulator vent plugs should on no account be stopped up, as by allowing the gas to escape when the accumulator is being charged they play an important part in its operation.

IN the last two issues of "P.W." we have endeavoured to give you a detailed account of the construction and use of the standard version of the "Magic" Three, and now we propose to go on to consider some of those little detailed refinements and modifications which some constructors may like to add to suit their own particular ideas.

In hopes of pleasing as many people as possible we have adopted the scheme of giving, first of all, a perfectly plain standard version, and then going on to describe all sorts of little special refinements and frills which you can add or not, just as you like.

We have tried to arrange matters as carefully as possible so that you can pick out just the particular refinements which appeal to you and add those alone, or if you

Here are some interesting suggestions for the wonderful "Magic" Three which will appeal to the constructor who likes to have every possible "gadjet" in his set.

like to make a very thorough job of it you can follow out all our suggestions and add the whole lot. Whatever you may decide to do, you may be sure that there will be no scrapping of existing parts, and any modifications which have to be made will be of a very simple and easy nature.

Controlling the Volume.

First of all, there is the question of a volume control, and this is a rather important point. The "Magic" Three is a set capable of giving very big volume indeed on the louder stations, such as your local, 5 G B, and so on, and some means of keeping the volume down to manageable limits is very desirable.

A rough-and-ready method which can be used by those who employ just the simple standard version of the "Magic" Three is to be found in the reduction of reaction to minimum and a little detuning. This method is quite effective in general, but it is

not quite ideal where one has to deal with the excessively powerful signals of a very nearby local station.

In such cases one has to detune pretty considerably, and then there is always the risk of some powerful distant station tending to come through as an annoying background to the transmission you are listening to. Some more effective volume-control scheme is, therefore, very desirable, and forms a most useful adjunct to the set. In our experience, such a volume control is decidedly worth while and makes the receiver even pleasanter to operate.

We are reproducing a diagram on these pages which shows exactly how to incorporate a volume control of the standard potentiometer type, and you will find this a very easy little modification to make. You want a volume control of the three-terminal type, sometimes described as a high-resistance potentiometer, and the resistance of this should be either half or one megohm. On no account make the mistake which we have sometimes heard of and use the ordinary type of potentiometer here. It must be of the very high-resistance type mentioned.

Improved Appearance.

This extra component can be mounted on the centre line of the panel in a position you will be able to scale off quite easily with the aid of the diagrams. This extra part just fills in the panel layout nicely and rather improves the appearance of the set than otherwise. (We had left a blank space near the middle of the set specially for it.)

The connections of the volume control are shown very clearly on the diagram referred to, but it may perhaps be helpful to give them in words as well. First of all, you remove the wire in the set between the grid of the second valve and the G. terminal on the first L.F. transformer. Instead,

Refinement for THE "MAGIC"

wire the grid of the valve to the middle terminal of the volume control. Wire the G. terminal on the L.F. transformer to one of the outside terminals on the volume control, and connect the other terminal of the control to the G.B. terminal on the transformer.

You will understand, of course, that a volume control only reduces the volume given by the set and cannot in any circumstance increase it. We mention this point because once a reader wrote to us and complained that he had fitted a volume control in his set, and it did not make signals a scrap louder!

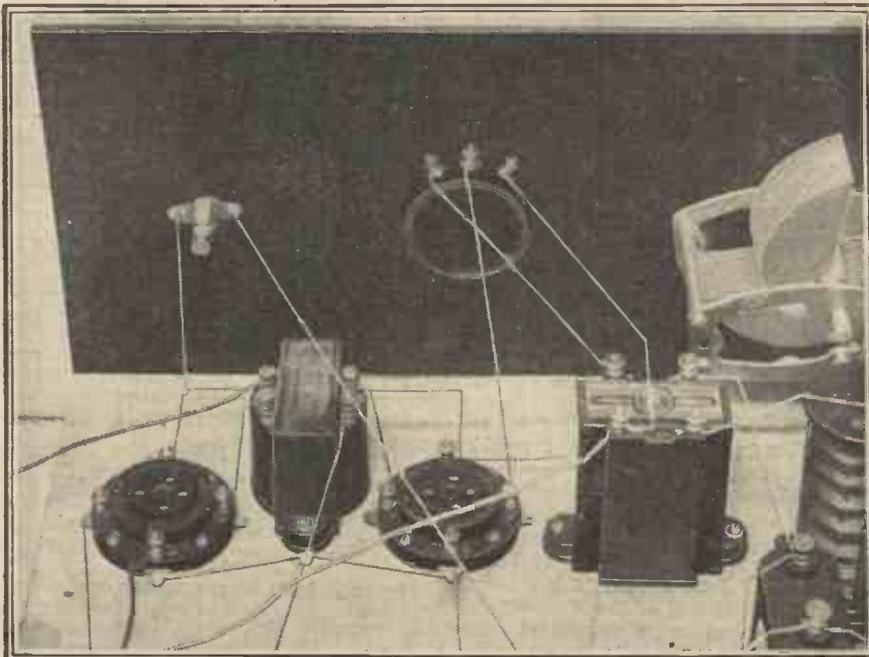
Seriously, however, we only brought in this point because we wished to explain that you can arrange the volume control in two ways, in the first of which it reduces volume when the knob is turned in one direction, and in the other direction when a different system of connections is used. With the connections shown on our diagram, the volume is reduced when the control knob is turned in a clockwise or right-handed direction.

Which Way Round?

We adopted these connections because the wiring is made a trifle neater in this way, but you can quite well adopt the opposite scheme if you like. Some people prefer to have their volume control so arranged that volume increases when the knob is turned to the right and diminishes when turned to the left, and if you wish to have this arrangement you can do it as follows. Looking at our diagram, this is what you have to do. Instead of connecting the G. terminal of the transformer to the left-hand terminal on the volume control, connect it to the right-hand one. Instead of connecting the G.B. terminal on the transformer to the right-hand terminal on the volume control, connect it to the left-hand one. That is all.

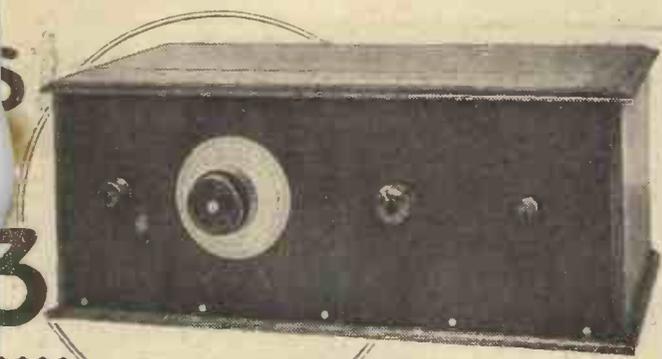
Now about that promised little device for use on short waves. We explained in our last article that the .0005-mfd. tuning condenser in the "Magic" Three standard version is not quite ideal for work on the very short wave-lengths, because it makes tuning rather sharp and critical. It is quite possible to handle it with a little care with the aid of a slow-motion dial so that one obtains good results, but the set becomes very much easier and pleasanter to handle if a little device is incorporated to open out the tuning scale a little bit on these short waves.

The original design of the "Magic" Three gave form, and now follows of some very essential modifications of the "d" By The "P.W." PARTM



Adding a volume control only involves the simplest of alterations to the wiring in the first L.F. stage.

VERY EASY SHOW



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All that you require to do this is a fixed condenser of .0005 mfd. with grid-leak clips, and this is simply inserted in series in the lead which goes to the fixed plates of the tuning condenser. Then, when you have this condenser in circuit,

the effect is to reduce the total tuning capacity to a maximum value of .00025 mfd., so that short-wave tuning becomes very much easier.

You can still cover quite a wide wave-range on each set of coils, and this modification is one which we strongly recommend to those who take a keen interest in short-wave work. Of course, if your main interest is in the broadcast wave-lengths, it is hardly worth troubling about.

Since we only require this condenser on the short waves, and not on the ordinary broadcast wave-lengths, some provision has to be made for cutting it out when it is not wanted. This is where the grid-leak clips come in. In these clips you can insert a short piece of brass or copper rod or tube of about the same size as a grid leak, and the condenser is then shorted out. If you find you have not got a suitable piece of metal rod or tube, take a short piece of wood such as a piece of pencil and wrap tin foil or copper foil round it. This also makes quite a good shorting bar.

Short-Wave Hints.

To help you to check up your connections after you have made them in accordance with the diagram reproduced this week, we give the actual connections in words as follows. Looking at the original blue print or the set, you will find that a lead comes off one side of the coil L_1 , joins on to one side of the grid condenser C_1 , and then goes off to the fixed plates of the variable condenser. This lead should be cut where it leaves the fixed condenser C_1 , leaving merely the connection from C_1 to one side of L_1 . Then join this same side of C_1 to one side of the new fixed condenser. Join the remaining side of the new fixed condenser to the fixed plates of the tuning condenser, and the job is done.

Now we should like to give you one or two extra hints about operating the set on short waves for which we could not find space last week. First of all, if this is your first attempt at short-wave work, we should like to advise you to make your first trial with headphones rather than the

loud speaker. Connect up a pair of 'phones to the L.S. terminals, and set the volume control so that strength is cut down to about one half, to avoid being deafened when you accidentally tune in the very powerful Morse stations which abound on the short waves.

The best wave-band on which to make your first trial is the 20- to 40-metre one, coil sizes for which we gave you last week. Start off with the tuning condenser at the upper end of its range

and set the reaction condenser so that the set is just oscillating, and then gradually turn the tuning condenser down towards the lower readings. You will find plenty of Morse stations as you go, and probably before long you will strike a carrier-wave. As soon as you do so stop the set from oscillating, remembering that other people may be already tuned in to that station.

Avoid Oscillation.

Now proceed to work the reaction very carefully up again towards oscillation very slowly and gently, slowly turning the tuning condenser meanwhile round about the spot where you heard the carrier-wave. As you bring the set up to its most sensitive condition you will probably find the signals again, and if you think they are not going to be very loud you can turn the volume control round towards the loudest setting again.

Do not do this, however, if the carrier-wave you heard was a powerful one, for you may be suddenly deafened if the set breaks into oscillation and you find that you are actually on top of the wave again. If you are careful, of course, this will not happen, and you will bring up your signals quite easily without actually oscillating

again. Once they are properly tuned in you can turn the volume up to the desired strength and change over to the loud speaker.

If you adopt this method of searching you will be able to cover the whole-wave-band quite easily and never actually oscillate on a carrier-wave once you have found it. This is rather an important point if you wish to be considerate to your neighbours, since an oscillating set can cause interference in an extraordinarily wide area on the short waves.

Reaction Dead Spots.

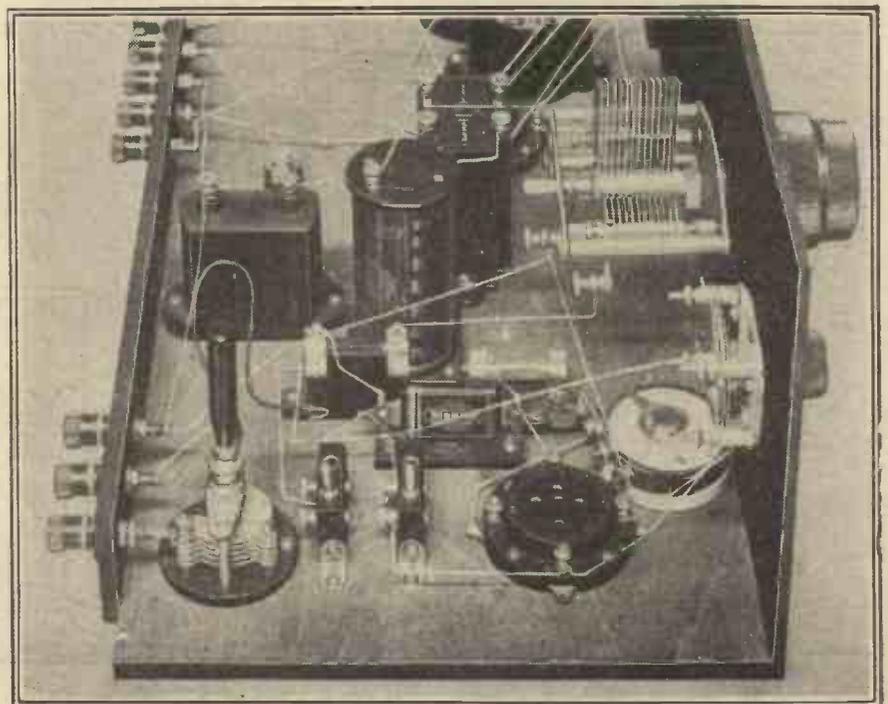
Now just a word about what is called "flat spots." These are points on the tuning range on short waves where it is found difficult to get reaction, and there is nothing abnormal about them. If you

The "Magic" Three gives wonderful results in its simplest form, and there is no need to alter a single wire unless you wish to make it a very "de luxe" outfit indeed.

strike any bad ones, simply put the aerial lead on terminal A_1 so that the series condenser C_3 is brought into circuit, and you will find that they have been removed. Very bad ones may require the series condenser to be set to some smaller reading than the usual maximum value, but this is decidedly unusual.

There are one or two points about the reaction condenser which we have not previously found space to mention, and we will take this opportunity of explaining them. First of all about its capacity. You will have noticed that it is marked .00013 mfd. on the blue print, a figure which looks so unusual that one or two readers have queried it with us.

(Continued on next page.)



Between the coil holders and the H.F. choke you will see the extra fixed condenser which makes timing easier on short waves.

T-WAVE TUNING

REFINEMENTS FOR THE "MAGIC" THREE.

(Continued from previous page.)

The one actually in use in the set was of this rated capacity according to its makers, hence the reason for the figure quoted. Actually a differential condenser with a capacity anywhere from .0001 to .00015 will suit the set perfectly well, and so any of the standard makes can be used.

Another point about the reaction condenser concerns the use or omission of the usual fixed safety condenser in series therewith. In the original set we did not use such a condenser, the reason being that the differential reaction condenser we employed had thin sheets of insulating material interleaved between the plates, so that a short-circuit due to the vanes touching was practically impossible. Consequently this

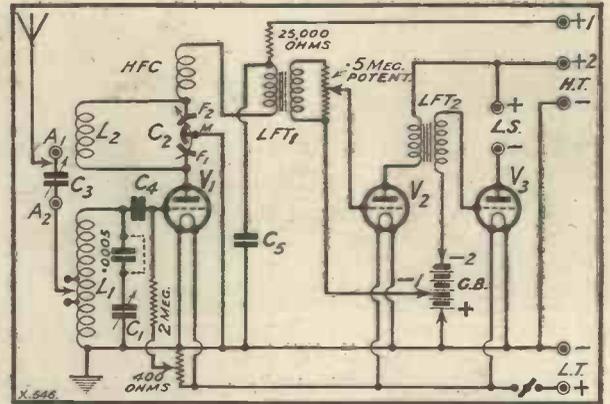
safety device was not really necessary and we omitted it.

Preventing Short Circuits.

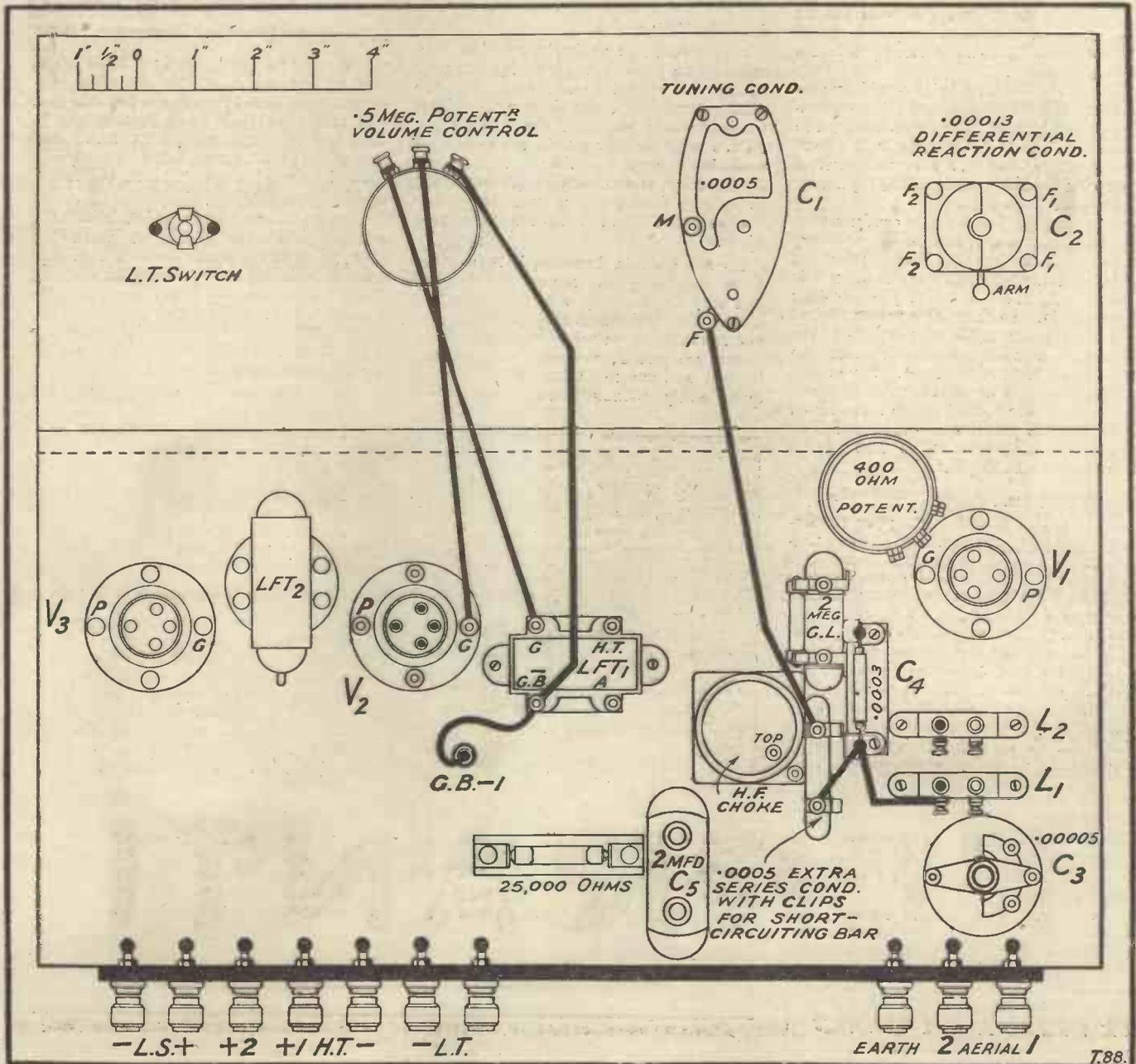
One or two makes of differential condensers, however, have the ordinary air-spacing scheme so that it is possible for the plates to become bent and touch, and if you use one of these we would suggest that you incorporate the usual stopping condenser in series with it. The risk is rather a remote one with a well-made condenser, but it is just worth taking into account.

To insert this safety condenser proceed as follows. Obtain a fixed condenser of any capacity from .001 mfd. upwards and screw it down upon the baseboard between the detector

valve and the panel or between the detector valve and the end of the baseboard. Then
(Continued on page 410.)



Here is the circuit re-drawn to show the inclusion of the volume control and the special short-wave device.



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Recent developments in Radio have created a demand for a new transformer of the same quality and reliability as the AF5, but capable of greater L.F. amplification. In their class of medium ratio, the Ferranti AF3, AF4 and AF5 are still supreme: but changed conditions— notably the advent of the Screened Grid Valve—have rendered this a necessary addition to the standard range.

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SHORT-WAVE NOTES.

A chat about reception and receivers on the higher frequencies.

By W. L. S.

MY recent remarks on the 75-cm. wave-length band have brought forth quite a crop of enquiries from readers as to how they can "get down to it" on their ordinary receivers! The first requirement is, of course, an unquenchable optimism. The second is a considerable amount of imagination. And even then I don't think they will do it.

A very special receiver of a most uncommon design is used for work of this kind, the basic principles of most of the circuits used for this work being that the valve capacities are always arranged so as to be in series with the tuning capacities and not in parallel.

I predict, though, that before very long we shall hear of practical work being done on this wave-length, and, furthermore, I should not be surprised if H.F. amplification is possible even on this wave!

On 25 Centimetres.

Incidentally, the 75-cm. band will soon be regarded as long waves! A Russian experimenter is, according to a reliable source of information, establishing regular communication over quite long distances on a wave-length of 25 cms. or less! Are these radio waves at all?

The exact wave-length of W 2 X A F at the moment, "A.J.," is 31.48 metres. He could not be at the figure you suggest, since it is outside the band allocated for use by broadcasting stations altogether. Thanks very much for your note on the "Titan" Four as a short-waver.

G 2 C J is in trouble because he wrote to "Ariel" when he obtained his transmitting licence. "Ariel" published a note to the effect that he would like reports, and he now finds that he needs a secretary to answer them all! I expect you will find they slacken off after the first rush, G 2 C J. He says that people with crystal sets send him a card saying they have heard him, and expect by return full details of his transmitter and receiver, preferably with photographs. I am afraid I have lost trace of the other experimenter in Gloucester who is working on 10-metre reception, but if he sees this I hope he will come forward again and get into touch with G 2 C J.

H.F. in L.F. Side.

Mr. David A. Carey asks whether he qualifies for the H.A.C. Club. I am afraid it is a little doubtful, however, since his only Asiatic is a "Persian amateur, R V 9 D." I should not be surprised if this is a leg-pull, because I have only known of one Persian amateur before, using the call-sign R V I G, and he eventually proved to be in Austria! He was a gentleman with an engaged sense of humour who wanted to collect QSL cards in large numbers.

And now to get down to technicalities. The more work I do on short-waves the more I am convinced that all the troubles experienced by novices (and others) are due to the presence of H.F. in the note-

magnifiers. Therefore, I make it a matter of principle to choke, filter and bypass wherever possible, and I experience very little trouble in the way of capacity effects, instability, and threshold howling, etc. A .25-megohm "H.F. stopper" between the transformer and the grid of the L.F. valve is a material help, and if one employs a de-coupling resistance for the detector, an H.F. choke between the reaction coil and the transformer primary, even when series feed is used, large bypass condensers where-

seem to happen, and I think the priming-grid wants its own little power supply, all completely screened and filtered. In any case, I regret to report that I am losing faith in pentodes for short-wave work. I think I shall go back to resistance-coupling for a while, and try to regain that silent background that I used to treasure so much!

I think I have had a new short-waver on the bench each time I have sat down to write these notes for the last six months! They all come to pieces within a week in favour of something better, although after the first moments of enthusiasm have died away I feel that I would sooner have the old one back again.

Most Popular Set.

Thus you will understand that I am not always on the listen for new stations or changes in the old ones, and must appear

A NOTABLE SHORT-WAVER.



Here are the two 20-kw. short-wave transmitters at the Nauen station in Germany. Nauen's call-sign is A G C, and it operates on 17.20 metres.

ever they might seem to be necessary, and a .0005 condenser across the 'phones, I don't think there is much left to go wrong.

A useful tip, incidentally, is the use of two H.F. chokes of different sizes in series. These may be wound with quite fine wire on ordinary glass boiling-tubes or test-tubes, and one of 80 turns and another of 30 seems a good combination. Naturally, if your set is of the "all-wave" variety a choke of this nature will be of little use for the broadcast wave-length.

Noisy Pentodes.

I should be interested to hear whether any reader is using a pentode in a short-wave receiver working from an eliminator. Mine is satisfactory enough, but I have never yet succeeded in getting a really perfectly silent background. With an ordinary power valve it is easy enough provided that one uses plenty of smoothing and an H.F. choke in each H.T. lead from the eliminator.

With a pentode all sorts of funny things

sometimes as if I am not keeping pace with the times. One day, however, I shall probably find one that pleases me for a whole fortnight, and I shall have a proper feast on all the good things that are now available for short-wave listeners. Incidentally, my broadcast receiver is nearly covered with cobwebs, which is a sign of the times!

I think it would be an excellent idea to have a kind of ballot among readers to decide the most popular type of circuit with the average short-wave listener at the present moment.

Here are the types I propose to "standardise":

- No. 1. Detector and L.F.
- No. 2. Detector and 2 L.F.
- No. 3. Detector and pentode.
- No. 4. S.G., detector and L.F.
- No. 5. Detector only.
- No. 6. Super-het.

Please send in your choice to W.L.S., c/o POPULAR WIRELESS, and I will publish the result as soon as there are enough entries to form a good opinion of it.

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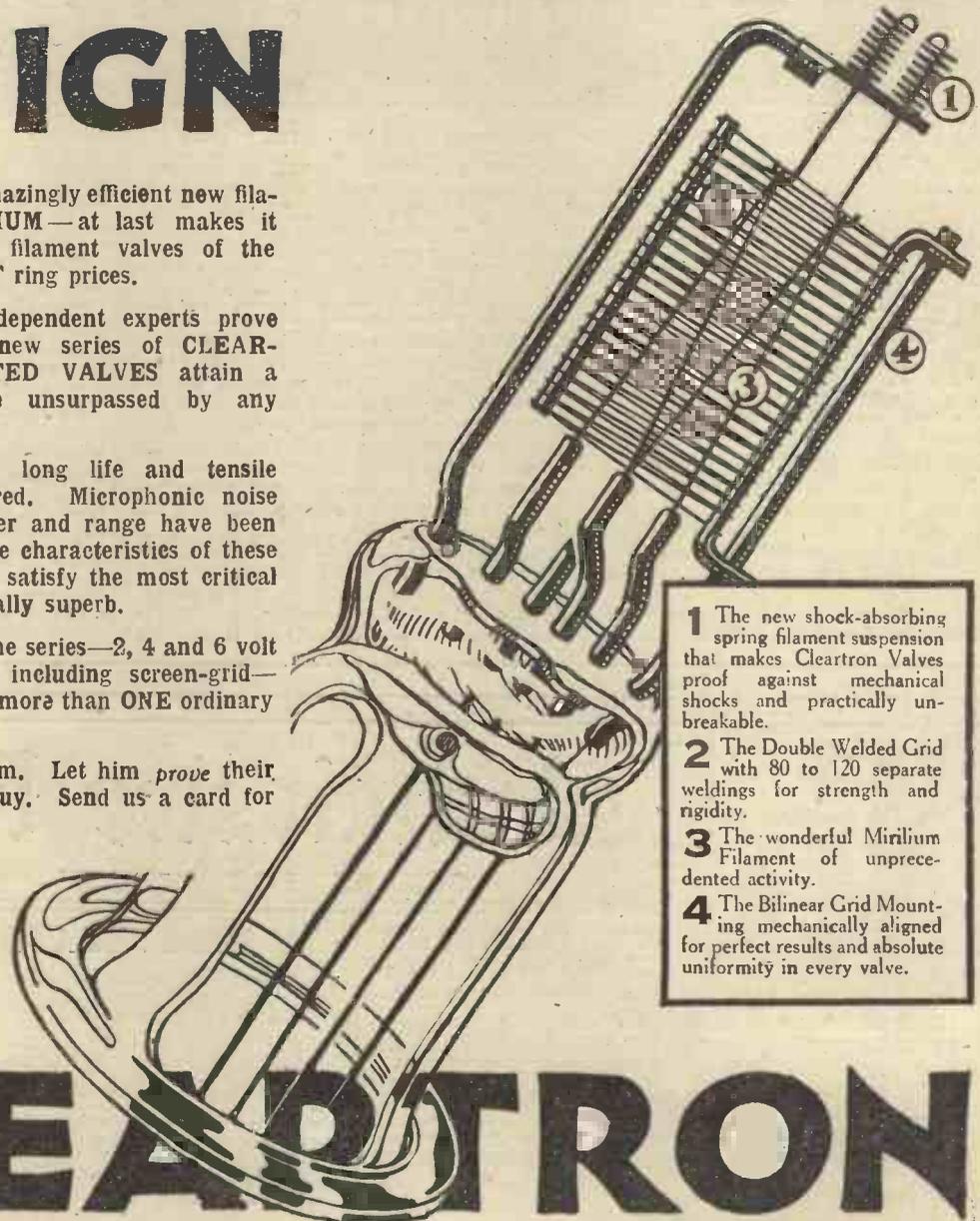
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The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

LOCATING AND CURING A HUM.

A. L. G. (Deptford)—“Being of an ambitious turn of mind, I made up my mind that I would go straight from a two-valver to a four-valve set, and have succeeded in making an excellent job of it, except for one thing. It does hum!”

“Looking through all the back numbers I could find I tackled this on Saturday, and al-

though I have not cured it I think I have made a good deal of progress. I found, for instance, that with a crystal-detector and a pair of 'phones in series there is no trace of hum in the H.F. stage, which seemed to point to the detector or the L.F. wiring. Taking out the primary of the low-frequency transformer, I discovered with the 'phones that the hum was strong at that point, thereby exonerating the last valve.

“Going a step further I joined the 'phones across H.T. positive and P. on the R.C. unit, and here again the hum was going strong. Apparently this points conclusively to the detector being the cause of the trouble (as

suggested in 'P.W.' as being likely), and I should like to know the best way of eliminating it. Do you think that the H.T. eliminator itself needs overhauling or can I put extra bypassing or smoothing into the set itself?”

“If so, what type? (The insertion of the fixed condenser marked reduced the hum until it is quite bearable, but having got so far I should like to eliminate it altogether.)”

From your description we should imagine that little extra smoothing is required, and this should be inserted in the detector-valve's H.T. supply. Probably almost any L.F. choke would do the trick, and if you have an old L.F. transformer on hand we should try using this, as the current it will be carrying is quite small.

Perhaps the primary alone will be sufficient, or failing this the secondary alone, or possibly you may be able to use both these in series. It is sometimes an advantage to connect a fairly large capacity fixed condenser to L.T. neg. on one side, and on the other side either to the centre tap on the choke (the junction between primary and secondary) or to the end of it, when used in this way; and the probability is that the combination of choke and bypass inserted between the detector and the rest of the circuit will be sufficient to overcome the trouble.

CHANGING FROM REINARTZ TO SCHNELL.

W. K. R. (Sleaford).—“The set is a two-valve Reinartz, employing plug-in coils, one for aerial, one for grid and one for reaction. The only trouble with it is that there is a little hand-capacity on the reaction, which reversing the condenser leads does not seem to remove.

“I am told that I could easily alter the set to the Schnell arrangement in which hand-capacity is not troublesome, and I should be glad of details as to this if it is not a very big undertaking.”

You can very easily change over from your present system to the Schnell system of reaction control. Fundamentally the only difference is that whereas in both circuits reaction consists of a reaction condenser and coil in series between filament and plate of the detector valve, in the simplified Reinartz which you are using the reaction condenser is connected towards the plate, whilst in the Schnell circuit

(Continued on page 396.)

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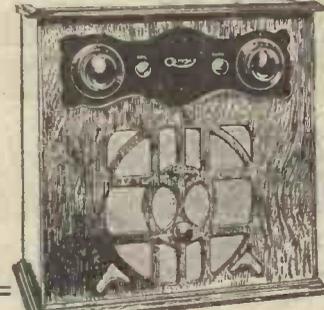
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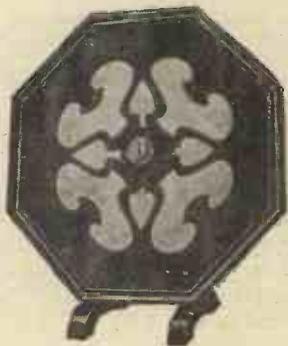
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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 394.)

the coil is towards the plate, and the condenser towards filament. So all you have to do is to rewire the reaction circuit as follows:

Instead of filament to reaction coil, other side of reaction coil to reaction condenser, and other side of the condenser to the plate, join the filament to the moving vanes of the reaction condenser. The fixed vanes of this will then go to that side of the reaction coil which formerly went to filament.

The remaining side of the reaction coil will now be joined to plate (and to H.F. choke), and the alteration should remove your trouble.

INSERTING AN ANTI-MOTOR-BOATING UNIT.

D.D. (Reading).—"You sent me the anti-motor-boating details, and a diagram, but unfortunately I lost the diagram and now do not know how to connect it up. The set is a three-valver, detector and two low-frequency amplifiers (transformers).

"The unit has a fixed resistance joined to a 4-mfd. fixed condenser, so there are three terminals, No. 1 to one end of the resistance, another to the junction between the resistance and the condenser (No. 2), and one to the remaining side of the fixed condenser (No. 3). Where should these points be connected to?"

All you have to do is to break the lead which goes from the first low-frequency transformer primary to the H.T. positive terminal (possibly via other points). Terminal 1 on the unit should go towards H.T. positive terminal, and terminal 2 towards the L.F. transformer primary, thus restoring the circuit by inserting the resistance. The final connection is to join the third terminal to the L.T.—wiring, which completes the necessary alterations.

ADJUSTING A WAVE-TRAP.

S. G. N. (Croydon).—"I bought the wave-trap at the Wireless Exhibition, and although I can get it connected up O.K., I do not seem

to be able to get full results because I am not sure whether I have it adjusted properly. Sometimes I can hardly find 2 L O and at other times I have to fiddle with the wave-trap before I can shut it out. What is the proper way to adjust?"

The first thing to do is to tune down the variable condenser on the wavetraps to its minimum capacity position, and then tune in 2 L O as usual on the set itself. Then turn the aerial tuning dial upwards until you have reduced the volume by about 50 per cent. Now screw down the wave-trap condenser carefully and very slowly and note the effect.

You will soon find that the strength of 2 L O begins to diminish, and if you proceed carefully and slowly you will shortly discover a setting of the wave-trap condenser at which 2 L O signals go down to almost nothing, or vanish altogether, whilst beyond this point they come up again.

Ascertain as accurately as you can where this point of minimum strength lies, and if you lose 2 L O altogether over several degrees, strengthen him up again, slightly by turning the tuning dial a little nearer down towards the normal loudest point. This will bring in the transmission stronger, and after this you can return to the wave-trap again and readjust until you get a sharp and definite cut-out adjustment.

When once this is found the wave-trap is left alone and the set is handled in just the ordinary way, the difference being that instead of the local station trespassing half-way over the dial it will be confined to only a few degrees.

QUALIFICATIONS FOR A WIRELESS OPERATOR.

"WOULD-BE WIRELESS" (Chatham).—"I am very keen on getting abroad as a wireless operator in the Mercantile Marine. I understand I shall have to obtain a Board of Trade certificate, and undergo an examination in telegraphy etc. What kind of an examination would this be? (Having been employed on the railway I am a good telegraphist, so I do not expect that the telegraph part of it would cause me much trouble)."

Wireless telegraph operators must hold either a first-class or a second-class certificate of proficiency from the Postmaster-General, of whom full particulars can be obtained. Candidates must be able to send

on an ordinary Morse key for five consecutive minutes at a speed of not less than twenty words a minute for the first-class certificate, and correct formation of the Morse letters, correct spacing, etc., is very important.

In addition to the telegraphic tests, the candidate must be able to understand simple electric diagrams, and to explain the elementary principles of wireless telegraphy, as applied to the system in which he will be examined. The practical examination consists of connecting up the apparatus, sending on an ordinary Morse key, and receiving from double-headgear telephone as used ordinarily. Also regulating and adjusting the apparatus, altering the wave-length, reducing or increasing the power, and tracing and clearing faults in the transmitter and receiver.

In addition to this practical examination candidates must satisfy the P.M.G. in a written examination consisting of two papers of two hours each.

The scope of the examination covers elementary mathematics, elementary electricity and magnetism, and technical wireless telegraphy, and a full syllabus of the class of knowledge required is obtainable from the P.M.G. on application.

GOING OVER TO THE MAINS.

M.S. (Saltdean, Sussex).—"I am converting the set to use it from the mains for H.T. supply, and I should like to have an idea of what the approximate cost of running this will be, and what steps are necessary with regard to the electric-light company, when taking current from the mains in this way."

Unless you have a very large set indeed, or the rates of electricity supply are exceptionally high, you will find that the running cost of deriving H.T. from the mains is quite low, for the current supplied is very small, and even the pot of a moving-coil loud speaker and a really powerful receiver would not take much more current than the household lamps.

Usually an electric-light company requires that the installation of extra apparatus—wireless sets, vacuum cleaners, and of the like—should be notified, in order that a representative may call and make sure that the installation conforms to safety regulations, etc.

A GOOD AERIAL.

E. C. C. (Long Melford).—"What are the chief points to watch in putting up an aerial?"

(Continued on page 398.)

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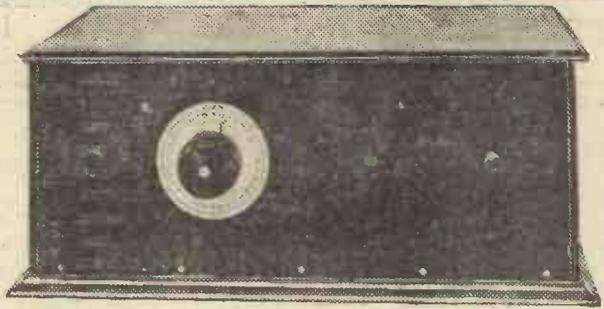
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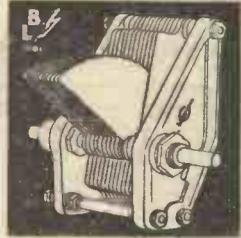
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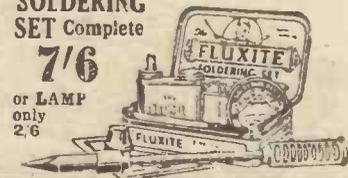
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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 396.)

A good aerial will make an enormous difference to the quality of your reception, so we advise you to pay particular attention to making it as nearly perfect as possible, and maintain it in good condition. The ideal way is to have a good high mast, 30ft. or more, erected in such a position that not only is a long aerial available, but this in no place passes close to the sides of a roof, building, tree or similar obstruction which would "screen" the aerial and impair the results.

The total length from lead-in to the far end must not exceed 100ft., but generally a very much shorter aerial is perfectly satisfactory, and if you can raise it, say, 25 ft. or 30 ft. at the house end and run it to a mast which is about 40 ft. away, you should get excellent and satisfactory reception. We should use a single and not double wire, of stranded copper, or similar high conductive material, avoiding any breaks or joins, so that the aerial runs from the furthest insulator, right down to the lead-in without a break, if possible.

Take care not to kink the aerial when putting it up, and use an adequate number of insulators of the type that will remain dry (even under severe weather conditions) over parts of their surfaces.

If you are going to use an aerial lead-in switch (and it is advisable to do so) make sure that the contacts of this are really firm and sound, and arrange that the whole switch is covered with some protective device, such as a box, to protect it from the effects of the weather. Be particularly careful not to take the lead-in through the window close to any metal, bearing in mind that the wire itself should not be within a foot of any wall, etc., except at the point where it enters the house, and here it should be well spaced away from all conductors.

Finally, remember that in the endeavour to get a good aerial, the earth must not be neglected, as this is just as important in its effect upon reception.

CURING MOTOR-BOATING.

D. N. F. (Stafford).—"What were the parts required and the connections for the anti-motor-boating unit described in 'P.W.' some time ago?"

The unit consisted of a small wooden baseboard, a strip carrying three terminals, a 2-mfd. condenser, and an anode resistance of about 50,000 ohms. The

terminals should be marked L.T.—, H.T. 1 and H.T. 2. Only four wires are required, the connections being as follow:

H.T. 1 is joined to one side of the anode resistance holder. H.T. 2 is joined to the other side of the resistance holder, and to one side of the fixed condenser. The remaining side of the fixed condenser

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers an *unrivalled* service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: On receipt of this an Application Form will be sent to you free and post free immediately. This application will place you under no obligation whatever, but having the form you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS PLEASE NOTE: Applications should NOT be made in person at Fleetway House or Tallis House.

goes to the terminal marked L.T.—. In use the unit is joined up as follows:

The lead from the H.T. supply to the detector valve on the set is undone and the "valve" side is joined to the H.T. 2 terminal on the unit. H.T. 1 terminal on the unit is joined to the appropriate place on the H.T. battery or mains unit, and the L.T.— terminal from the anti-motor-boating unit is joined to the L.T.— terminal on the set. As the resistance in the anti-motor-boating filter drops the voltage on the detector valve, remember to allow for this fact, by adding a little extra H.T. positive in the detector-valve circuit.

Usually if you have been giving the detector about 60 volts and the last valve 100 or 120, you will find that the detector can now take up to 120 (which in practice is often more convenient).

SHORT-WAVE "TITAN."

R. C. A. (Headingley, Leeds).—"I was making enquiries of a friend and saying that the only disadvantage of the 'Titan' is that it will not go down to the short waves of 50 metres or so, when he told me that some time back he saw a description in 'P.W.' as to how it could be adapted for this purpose.

"If this is so can you tell me how the change over to short waves is effected, and whether it is efficient. Also what wave-lengths this would cover?"

The short-wave "Titan" referred to was described in detail in "P.W." No. 375 (August 10th, 1929, issue). The author—who believes he was the first amateur in England to hear a broadcasting station in South America, and therefore the first to hear all six Continents—designed his set originally as a short-waver; but when the "Titan" set was described in "P.W." it was adapted to that circuit by a plug-in system, the receiver thus covering the medium and long wave-bands, as well as the short waves from 13 to 70 metres.

The coils are mounted on a four-pin plug-in base, but the broadcast coils differ slightly from the standard "Titan," inasmuch as the wave-change coil is mounted on an ebonite disc screwed to one end of the loading coil. The whole unit is then mounted on a base similar to that of the short-wave coil with which it is interchangeable.

Although the set requires rather more care in construction than many of the simpler types of broadcast set, the trouble taken is well repaid by those who like long-distance short-wave reception. Full details from which any experienced set-builder will be able to make it up are given in the number of "P.W." referred to above.

The "Presto" Three.

F. M. (Letchworth).—"In what number of 'P.W.' was the 'Presto' Three described, and was it an absolutely straightforward Det.-2 L.F. receiver for full loud-speaker reception?"

(Continued on page 400.)

THE Mullard ORGOLA RECEIVER

FOR 10'6 DOWN



Here is the chance to get the greatest set of the year for the coming winter season. For an initial outlay of only 10/6d. you can get a complete kit of parts ready for construction, the purchase being completed in twelve monthly payments of the same amount. Now that dark, long evenings are with us there is no more fascinating hobby and entertainment than Radio through the great Mullard Orgola.

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I enclose P.O. value 10/6, this being first payment for your guaranteed Mullard "Orgola" Radio Receiver kit, and I agree to pay the balance over 12 monthly instalments of 10/6.

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The "Minstrel" loud-speaker, which created such a sensation at Olympia, is of the double diaphragm type and enables every note in the scale, high and low, to be heard with a clarity of tone never before obtained. No field current supply is required, and the Speaker will reproduce a very large volume without the slightest distortion. The movement is of the balanced armature type and is adjustable.

Floor model in Oak Cabinet - - £9.0.0
 Floor model in Mahogany Cabinet £9.9.0
 Table model in Oak or Mahogany £4.4.0

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For full particulars and catalogue write to—
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 18, Eastnor House, Blackheath, S.E.3

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 398.)

The "Presto" Three was an extremely simple but highly efficient three-valver capable of giving the greatest satisfaction with a minimum of expense and trouble. (Employing pluz-in coils and covering both high and low waves). It was fully described in "P.W." No. 379, September 7th issue. Note: Where difficulty is found locally, back numbers of "P.W." can be obtained direct from The Amalgamated Press, Ltd. (Back Number Dept.), Bear Alley, Farringdon Street, E.C.4, price 4d. per copy.

BUYING A LOUD SPEAKER.

F. M. (near Dublin).—"Before deciding, I should like to raise one point that has always interested me. Why is it that certain makes of loud speaker, when reproducing the same music as other makes, give to it a sharper or "cleaner" tone, whilst other loud speakers seem to round everything off into a pleasant mellowness? Why do they not reproduce the music exactly as it is played, instead of with these differences?"

Absolute fidelity of reproduction is extremely difficult to obtain, and the reason for this cannot easily be expressed in a few words. If, however, you remember that all sound is a matter of vibration, you can understand why certain loud speakers have a sort of characteristic tone of their own as compared with certain other loud speakers.

You will already be familiar with the fact that air-containing vessels, such as large glasses, each have a characteristic frequency at which they tend to "ring" or vibrate, when a sustained note is played near to them. Again, every mechanical vibrator, such as a springy rod, has its own particular frequency, at which it is easily set in motion most easily, and tends to remain vibrating.

Consequently, the horn of a loud speaker, by naturally favouring certain frequencies, tends to emphasise a band of frequencies, and thus gives a characteristic tone to the reproduction which might not be heard upon another loud speaker. Similarly, a vibratory mechanism such as the reed of the

ordinary cone loud speaker, has a tendency to emphasise a certain part of the frequency band and appears to neglect other equally important parts, and only by the most careful design can these effects be eliminated.

In the last year or two so much progress in this respect has been made that in a very great number of cases only a well-trained or highly-critical ear can detect any peculiarity in reproduction due to the loud speaker.

FOUR OR FIVE VALVES.

J. S. (Nr. Newcastle-on-Tyne).—"I want a blue print of a four-valver—screened grid,

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TWELVE FINE SETS

are given in the November

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of

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ON SALE NEXT WEEK.

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detector, and 2 L.F. stages, for working a moving-coil loud speaker. Or else a really first-class five-valver—the sort of set that will last for years, and not be left in the cold by some new device. Can you tell me where I

can get details of these, the parts required, panel lay out, etc., so that I can decide which will be better for my purpose?"

We know how difficult it is to choose between different designs and to weigh up the respective merits. Honestly we think the best thing you can do is to wait till next week, and get the new "Modern Wireless." It contains full details of several powerful sets of the type you name, so that you should be able to choose exactly what you want. (There are full how-to-make details.)

"COME-FROM" CALL SIGNS.

"MARINER" (Belfast).—"Can you give me the list of the various countries and the call-sign letters which indicate what part of the world the signals are coming from?"

The following are the chief nationality prefixes:

CE Chile	OK Czecho-Slovakia
CR Azores	ON Belgium
CM Cuba	OZ Denmark
CT Portugal	PA Holland
CN Morocco	PK Dutch East Indies
CV Roumania	PY Brazil
CP Bolivia	RA U.S.S.R.
CX Uruguay	RV Persia
CZ Monaco	RX Panama
D Germany	RY Lithuania
EA Spain	SM Sweden
EI Irish Free State	SP Poland
EL Liberia	SU Egypt
ES Esthonia	TF Iceland
ET Ethiopia	TS Saare
F France and Colonies	UL Luxembourg
G Great Britain	UN Jungo-Slavia
HA Hungary	VO Austria
HB Switzerland	VE Canada
HC Ecuador	VK Australia
HH Hayti	VO Newfoundland
HR Honduras	VP-VS Colonies
HS Siam	VU India
I Italy and Colonies	W U.S.A.
J Japan	YI Iraq
KI Philippines	YL Latvia
K4 Porto Rico	YM Danzig
K6 Hawaii	YN Nicaragua
K7 Alaska	YS Salvador
LA Norway	YV Venezuela
LU Argentina	ZA Albania
LZ Bulgaria	ZL New Zealand
OA Peru	ZP Paraguay
OH Finland	ZS South Africa

TWO VOLTS

Universal	.1 amp.	5/6
Resistron	.1 amp.	5/6
Super H.F.	.15 amp.	5/6
Super-Power	.18 amp.	7/6
Hyper-Power	.3 amp.	9/6
Pentodion	.3 amp.	18/6

5/6 UNIVERSAL

FOUR VOLTS

Universal	.075 amp.	5/6
Resistron	.075 amp.	5/6
Super H.F.	.075 amp.	5/6
Super-Power	.1 amp.	5/6
Hyper-Power	.15 amp.	7/6
Pentodion	.15 amp.	9/6
	.15 amp.	18/6

POWER 7/6

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Fit a P.R. Moulded Paper Cone to your speaker and you will be positively amazed at the difference. Double the volume and much greater purity in tone. All the notes come out in their correct value. No resonance—no "drumming"—just pure and real music.

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The P.R. Cone is the only one which correctly reproduces the human voice as well as instrumental music. That is why it will improve any cone speaker, no matter the make or price. 11" diameter, correctly proportioned, ready to fit, complete with washers and screws. Can be adjusted instantly. No cutting, sticking or wash leather required.

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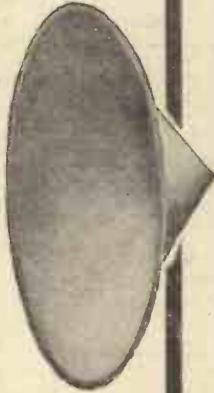
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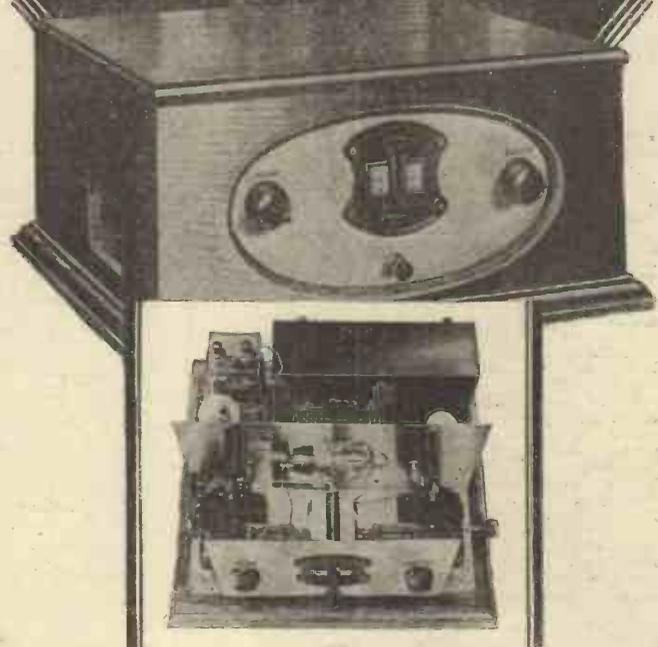
BROWN "V" UNIT and CHASSIS, fitted into our own high-grade Cabinet, equal to most expensive speaker, with the exception of moving-coil, 5/- with order and 11 payments of 5/3.

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Lotus Works Liverpool

A "P.W." SET IN THE BUSH.

The Editor, POPULAR WIRELESS.

Dear Sir,—Since I have taken up wireless for better or worse, I have been a regular reader of your paper, and I must say that it is great.

I am writing this letter in praise of the first set I ever made—a one-valve set from one of your editions. I am 122 miles from the nearest station (6 W F), and the next nearest station is 2,000 miles away, yet I can always depend on a good programme. 6 W F I can get day or night with good volume. 6 W F Eastern States (3 L O, 3 A R, 2 F C, 5 C L, etc.) are good at night-time. I have built two or three valve sets since, but I always keep the one-valve for earphone reception. With the same set I have received Manilla, Malabar, and American stations on the short waves. As 6 W F is on the 1,000-metre band, and I have got as low as 23 metres it seems all the more remarkable. There are several sets in the district that cost from £25 to £70, and yet if there is anything particular that they want to know that has been broadcasted they phone me up and ask me to get it for them. (News items are of great interest here, as we are in the bush.) I have never managed to get up in time in the morning to get England. When I do manage I will send to you and get you to verify it.

Yours faithfully, T. PEACOCK.

P.S.—I have built two sets similar to mine for other people, and they have had the same results except they have not tried the low waves.

Boganup, W. Australia.

A QUESTION OF H.T.

The Editor, POPULAR WIRELESS.

Dear Sir,—It was with some amusement that I read in your issue of September 28th a letter from a correspondent signing himself "One of the L.S. 5 Brigade."

Although I feel completely crushed by the reference to my existing battery being very handy for grid bias, I also feel I should like to point out to your worthy correspondent one or two errors which have occurred in his interpretation of my letter of August 31st issue.

(1). I have never owned a moving-coil loud speaker, consequently I could not have joined it up the wrong way round; but I have heard several demonstrations with a view to getting one, and, as my letter stated, decided to keep to my old set as giving better and purer results.

If the speakers were correctly worked, then the sets must have been bad (if your correspondent is right) or vice versa, either of which is bad for the trade, since it has no doubt deterred others from becoming M.C. enthusiasts.

I am always open to conviction, and if your correspondent will favour me with his address I may yet avail myself of his very kind offer.

CORRESPONDENCE.

A "P.W." SET IN THE BUSH.

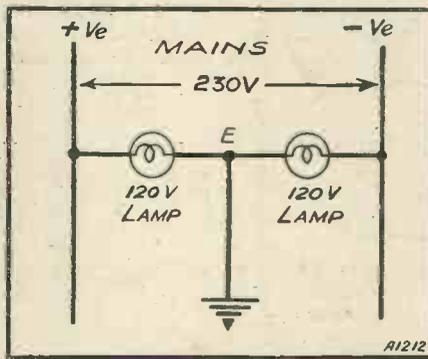
A QUESTION OF H.T.—WHICH MAIN IS EARTHED?—IS IT THE BEAM?

Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

(2). I did not say that 60 volt H.T. would drive an M.C. speaker, but simply that that voltage was sufficient for the set in question, for anyone who would be satisfied with four or five stations, etc. (See my last letter).

I can give your correspondent several years' experience in experimental work, having started seriously in 1918 when the war ended, but having dabbled and been interested in it at times since 1894 or 5, after attending lectures and demonstrations by an assistant to the now Marquis Marconi.

Though my H.T. requirement for the "Twelve-



trees" Circuit is so modest, I have quite a respectable amount at my command when required, namely a motor generator and smoothing outfit giving more than sufficient for the most extravagant M.C. speaker, and an H.T. Acc. Battery capable of supplying more modest requirements—so further comment re grid-bias batteries is necessary.

In conclusion I should like to draw your correspondent's attention to an article by G. P. Kendall, B.Sc., in the October issue of "Modern Wireless," page 325, starting at the words "It is here—"(Centre column).

Again wishing you every success,
Yours sincerely,
Invergordon. J. H. R.

WHICH MAIN IS EARTHED?

The Editor, POPULAR WIRELESS.

Dear Sir,—In a recent issue of your journal, in "Radiatorial," under the heading, "Which Main is Earthed?" you give a simple method of determining which main is earthed. This town is served with 230 v. D.C. from a private company's power station, and I tested the mains in this manner a short while ago, during some laboratory work.

To my surprise, the lamp lit, but not strongly, on both occasions, i.e. on both positive and negative. On inquiry at the power station I learned that the arrangements were as the enclosed diagram shows. Two 120-v. bulbs are connected in series, and the intermediate point earthed. Thus the supply conforms with regulations, and yet does not have to provide guard wires when crossing over P.O. lines.

I wondered if any other of your readers are served with mains of a like nature. So far, I personally have never heard of any other such mains.

Thanking you for some really fine sets and an equally fine weekly,

I remain yours faithfully,
Diss, Norfolk. W. J. HUNT.

IS IT THE BEAM?

The Editor, POPULAR WIRELESS,

Dear Sir,—With reference to the query by "Troubled" (Cardiff) in a recent issue of "P.W.," I am of opinion that he is suffering from the same trouble that is worrying a friend of mine at Clevedon, Somerset. That is, interference by the beam station at Portishead.

I was given to understand, whilst on a recent visit to Clevedon, that this station is causing a lot of trouble to local listeners, and the symptoms are exactly as "Troubled" describes.

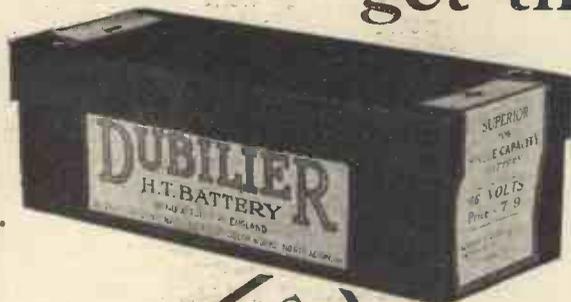
It would be interesting to learn the opinion of other listeners within a twenty-mile radius of Portishead.

Yours faithfully,
London, E.C.1. C. LONG.

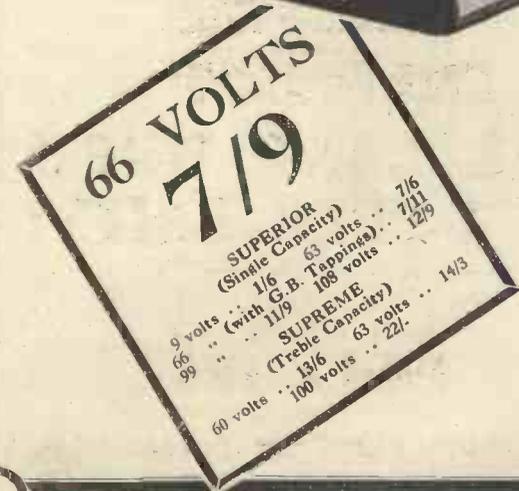
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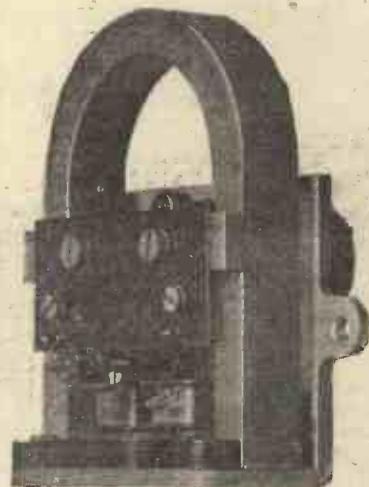
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L.S. EXTENSION LEADS.

Much trouble may be encountered if the long leads to a loud-speaker in another room are not properly laid. An interesting article

By N. A. STURGESS.

IN many cases a fair amount of the trouble experienced with regard to parasitic noises in radio reception may be directly traced to the faulty installation of loud-speaker lines. It must be remembered that good contact from an electrical point of view is not necessarily good contact from a "wireless" aspect, and a little care in laying loud-speaker extensions will always pay.

Avoid Twisted Flex.

In the first place, it is not a good plan to use twisted wire for extensions, as this has rather great self-capacity, and can quite easily give rise to an unpleasant hum, especially if light or power mains are to be found in the immediate vicinity.

The wire used should be of a well-covered, single type, and should naturally be of different colours, in order to distinguish the positive and negative of the loud speaker and output of the set itself.

As to the question of whether wires should be fixed away from the walls, it has been my experience that this is not really important, unless the wire runs through a kitchen or some similar place where there is

likely to be a considerable quantity of steam or moisture.

Practically any method of fastening the wire to the wall may be adopted, provided, of course, that the fastening is not actually driven through the wire; a very good method of fastening is to use the insulated staples employed by electricians in fixing bell or telephone wires.

Still further safety may be obtained by putting a small piece of wood between the wire and the wall, thus keeping the line clear of the wall. If, however, you don't mind going to a little extra expense in order to secure a perfectly trouble-free extension wire, there is a twin wire now made by a certain firm which is in every way admirable for this kind of extension work.

The Ideal Extension Lead.

It consists of two (or three) wires, untwisted, and held together by a material something like webbing, which can be obtained in a great variety of colours. Incidentally, special fastening pins are supplied with this wire, which do not damage the walls—a very important consideration when there is the possibility

that the extension may at some time have to be moved.

There are just two more points which should be noted. First, run the wires as near the ceiling as possible, because for one thing they are less noticeable, and for another they are out of harm's way.

Lastly, do not run them parallel to or near electric-light or power lines, for if you do you may get a very noticeable and annoying "ripple" the only cure for which is to move the extension or place a large fixed condenser across the L.S. output terminals, both of which courses mean trouble which would have been rendered unnecessary by a little more care in the first place.

NEXT WEEK

THE "MAGIC" TWO

Don't miss Your copy!

On Sale on Thursday, Oct. 31st.

Obtainable Everywhere.

One advantage of charging your accumulators at home is that you can be sure that the makers' instructions regarding charging rate are carried out properly.

The slightest imperfection in the insulation of a coupling condenser may result in distortion, so only mica condensers should be used for this purpose.

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ALWAYS GIVE SATISFACTION

If you are building the MAGIC 3 the best results will be obtained by using components as under:

	s.	d.
PAXOLIN PANEL, black or mahogany finish, drilled	7	9
PAXOLIN TERMINAL STRIP, drilled	2	0
H.F. CHOKE, range 30-2,000 metres	6	6
LOW LOSS COIL HOLDERS, each	1	6
VALVE SOCKETS, sprung, each	2	6
L.T. BATTERY SWITCH	1	0

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Use Wearite Titan Coil, 15/-, to ensure good reception.

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THE new Universal (No. 97 b) and the new Power Model (No. 98) fitted with 9" and 12" cones respectively will take every unit at present on the market including the new Amplion BA2 They will take yours. In each case the cradle is of aluminium, cone of the latest Vellume type and the beautifully polished octagonal front gives the speaker a really finished appearance. This is entirely in keeping with the magnificent reproduction afforded. See them at the Manchester Radio Exhibition, Stand 116 (Gallery), or drop us a postcard for a fully descriptive leaflet.

- 97b Aluminium Cradle, Enamelled and Polished, fitted with Vellume cone and octagonal front, back leg and bracket also included **15/-**
- 98 Similar in every respect to the above, Universal Fitting, etc., with 12" Vellume Cone and Octagonal Front, back legs and bracket included **18/6**

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FREDK. SQUIRE

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P & T



VERNIER DIAL

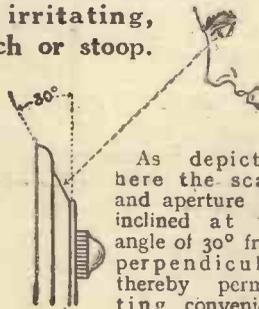
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Every wireless enthusiast should have these books. They tell you how to build mahogany cone speakers for 20/-, cabinets for 8/-, and a host of other interesting matter. Full of essential information for the home constructor. One has 20 pages and the other 12 pages—both are free on request. Just send a postcard now before you forget. Write to Dept. 69.



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"POPULAR WIRELESS" BLUE PRINTS

OF TESTED CIRCUITS 6d. EACH

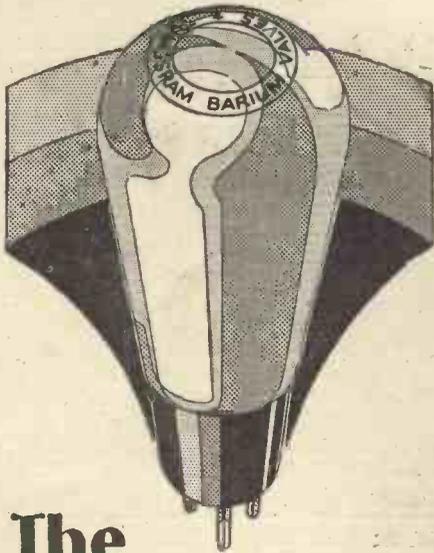
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1. DETECTOR VALVE WITH REACTION.
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6. H.F. AND CRYSTAL (Transformer Coupled, without Reaction).
7. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Tuned Anode).
8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
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21. THE 2-VALVE LODGE "N."
22. "THE GUARANTEED REFLEX."
23. THE 1-VALVE "CHITOS."
24. THE "SPANSACE THREE." Three-Valve Receiver employing 1 Neutralised H.F. Valve, Detector with Non-Radiating Reaction Control, and 1 L.F. Valve.
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37. THE "LONG SHORT" CRYSTAL SET.
38. A TWO-VALVE L.F. AMPLIFIER.
39. THE "SYDNEY" TWO.
40. THE "SUPER SCREEN" THREE.
41. THIS YEAR'S "CHITOS" ONE-VALVER.
42. THE "Q AND A" THREE. A simple set (Det. and 2 L.F.).
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The Better Valve at the lower price

It's been wanted for a long time. It was left to Tungram, a name already known all over the world for electric lamps, to produce a non-Association Radio Valve of really high quality. The strength of the Tungram valve lies in its Barium filament which will endure long after the old filament is useless. The results obtained can compare with those obtainable from any other valve. 2, 4 and 6 volt types available; the prices, 5/6 to 10/-, show a great saving over the valve - ring figures.



TUNGSRAM BARIUM VALVES

If you have any difficulty in obtaining, write direct to:—

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GETTING THE MOST FROM YOUR SET

By J. H. T.

IT is always worth while introducing a milliammeter into the H.T. supply circuit and making adjustments with the grid-bias voltage until you find out what is the minimum H.T. current which will give you satisfactory reproduction. The saving in H.T. current which can be effected in this way—not only without any adverse influence upon results but even with improvement in the same—is often quite surprising to experimenters who have never taken the trouble to determine what current is passing from their H.T. battery.

I would point out that an improvement in results may be obtained (quite over and above the economy in H.T. current), because amateurs are sometimes apt to think that, whilst economy in H.T. current is obviously desirable when an H.T. dry battery is used, it is of little or no importance where a mains-supply unit is employed having ample current capacity.

It is true that the question of economy may not arise in the latter case, but it is still desirable to give careful attention to the question of correct grid bias because of the improvement which is thereby obtained in reproduction.

Gramophone Pick-ups.

A very simple indication of the advantage of the sensitive pick-up is the fact that the light and shade effects upon a gramophone record used with a pick-up are more or less faithfully reproduced from the loud speaker; if the input to the pick-up has little effect upon the final volume, the variation of light and shade in the record would be more or less smoothed out and there would be little variation in the reproduction from the loud speaker.

The very fact that the variations are more or less appropriately reproduced shows that the output volume from the speaker varies in accordance with the input to the pick-up. It follows, therefore, that a sensitive pick-up represents a direct saving in amplification. **Standardisation.**

Talking about pick-ups, it seems to me a pity that, for some aggravating reason, some manufacturers make pick-ups which lie in a plane parallel to the gramophone track, whilst in other cases the pick-ups are designed to lie roughly at right-angles to this position. The result is that with the usual type of tone-arm or pick-up arm it is very inconvenient to try different kinds of pick-up.

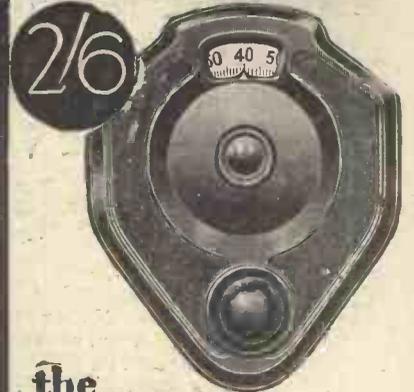
There seems to be a complete absence of standardisation in these pick-ups, as there is, incidentally, also in gramophone tone-arms. I do not know whether you have ever noticed it, but if you want to take a sound-box from one gramophone and fit it to another it is ten chances to one that it won't fit.

Comparative Tests.

I believe it has been mentioned before that the H.T. battery—especially accumulators—is unsurpassed for quality of reproduction, and, in spite of all the arguments which are raised (and will, I suppose, be

(Continued on page 408.)

Brownie



the 'DOMINION' Slow Motion Dial

A VERNIER Dial at 2/6! Bring your set up-to-date by fitting this slow-motion dial. The mechanism is of special non-backlash construction which makes very fine tuning easy. Finished in smooth black or beautifully grained mahogany bakelite, this unique dial gives high-class finish to every set in which it is included.

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Panels for ORGOLA 3/6

All-Wave Tuners 7/11, Indoor Aerials 1/-, H.F. Chokes 2/-, 3/-, S.L.F. Condensers 3/3, Reaction 2/8, S.M. Dials 2/3, Cone Chassis 8/11, Titan Coils 15/-, Screens 1/6, Coils for Master 3 3/3, P.P. Switches 8/d., V.Holders 8/d., Coils for New Corsor 8/6. Everything Wireless. Stamp for list. £1 orders post paid. No rubbish supplied.
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Bass Notes—These being the most difficult notes to record correctly, it is the aim of all Transformer Manufacturers to attain perfect tonal reproduction of these notes; having attained this perfection, the High and Low Notes will also record successfully—providing the Transformer is constructed on sound Transformer Theory—here Telsen Transformers Excel—because we specialise in Transformer construction; we make nothing else; our very lives are steeped in Transformer Manufacturing. Try one now. They are entirely British.

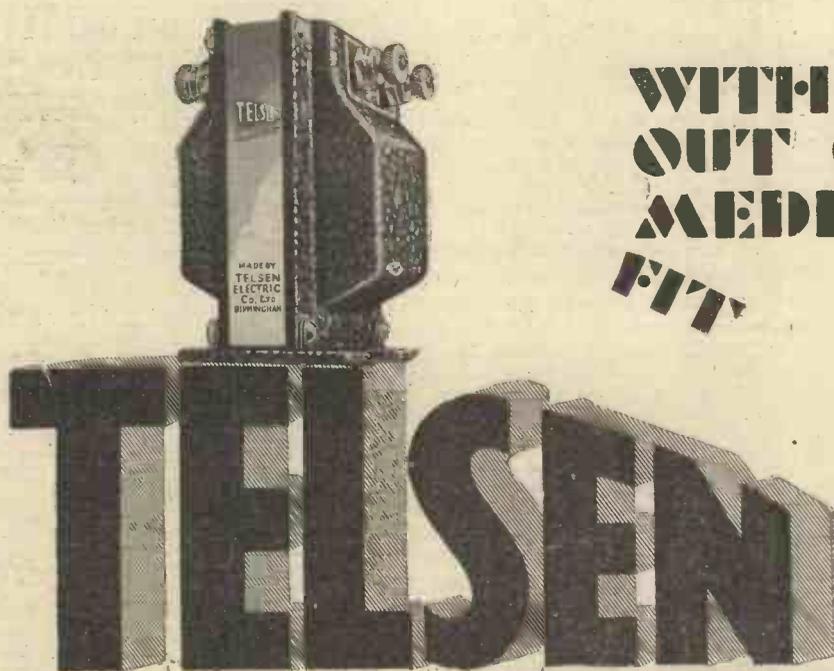
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12/6

Ratios 5-1
and 3-1

8/6

Ratios 5-1
and 3-1



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GETTING THE MOST FROM A SET.

(Continued from page 406.)



Patent No. 295,625.

The Speaker which created such amazing popular interest at the Show

... incorporates **the Double-diaphragm Principle** ... uniform frequency response from 60 to 10,000 cycles ... reproduces the high and the low notes faithfully.

IN ATTRACTIVE CABINETS.

Model U 12	Price	£3 19 6
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Model U 18 (in oak)	Price	£11 0 0
Model U 18 (in mahogany)	Price	£11 17 6
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IN CHASSIS FORM.

Type L	12" x 10" x 3 1/2"	42/-
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*Type F	18" x 23" x 5 1/2"	84/-
Type J	24" x 24" x 6 1/2"	105/-

*Type F is that used by Mr. Percy W. Harris in his "Wireless Constructor" All-Electric Gramophone.

ULTRA AIR CHROME

The only speaker with a published frequency response curve.

raised by these present remarks) in favour of eliminators, I still maintain that I have yet to test the mains unit which will give results really equal to those given by a first-class high-tension battery of accumulators in proper condition.

Any trouble attaching to the use of accumulators, whether high-tension or low-tension, has still further been reduced by the introduction during the past two or three years of several excellent forms of re-charging devices. The problem of re-charging was a great bugbear with the low-tension battery, whilst in the case of a battery of high-tension accumulators re-charging was practically out of the question on alternating-current mains. But now that so many inexpensive and thoroughly reliable chargers are available high-tension accumulator batteries are coming into their own, even in face of the competition of the much smaller and more compact H.T. mains units.

RADIO REMINDERS.

One of the commonest causes of "mysterious" faults is faulty contact due to a defective or broken flex lead.

Ivory labels which have become detached from panels can be secured by ordinary rubber solution as used for mending bicycle tyres.

Always switch the filaments off before altering your grid-bias negative adjustment, especially if you are using a power valve.

A large value condenser, say 1 or 2 mfd., connected across the contacts of a vibratory rectifier will very often cure sparking at this point.

If you have odd or dirty pieces of solder, these need not be thrown away, but can be placed in a suitable flat lid over a gas flame and heated. The scum can be scraped off, after which the solder should be poured on to a cold surface such as a tiled floor, when it will set immediately.

If the celluloid plugs which fill the holes at the top of your accumulator have become dislodged and lost, do not continue to run it in this condition as it is very easy to ruin the accumulator if small metallic particles find their way through the holes into the electrolyte.

To protect small drills, tools, etc., from rust and keep them in good condition, all that is necessary is to coat them with a thin coat of grease or oil.

The **MAGIC** of **Ready Radio**

SEE PAGE 397.

The REGENTONE POWER BOX

Our 12 months' GUARANTEE—given with all Regentone products—covers Westinghouse Metal Rectifier.

Comprises Westinghouse Metal Rectifier and Regentone Transformer to give H.T. Output when smoothed of 120 volts at 20 m/a or (Model No. 2) 180 volts at 30 m/a. Also equipped with two additional tappings to deliver L.T. for A.C. Valves 4 volts up to 4 amps.

When used with Regentone Filter Compact — 2 connections only—it forms a complete H.T. Unit.

A.C. Power Box, complete with Fuse, Flex, Lead and Adaptor	No. 1	£2 10 0
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Filter Compact	No. 1	£1 10 0
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Our ART BOOKLET contains much interesting information on "Radio from the Mains." Write for free copy to-day.



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Latest Model. To 1st Grade Brit. Eng. Standard. Mirror Double Scale. Moulded Base. The finest Precision Multi-measuring instrument is the DIX-ONEMETER, the acknowledged Radio standard beloved by Expert and Amateur. Imitations of its Bakelite case and mirror scale are inferior. They lack the 50 Multiplier Ranges, the Precision, the Duplex Scales, Knife-Edge Needle, Accurate Bearings and High Figure of Merit. Remember that the DIX-ONEMETER is as nearly electro-static in its tiny load and can be used at 2,500 ohms per volt. On 100 volts the high value of 250,000 ohms can be used. Micro-Amps., Milli-Amps., and Amps. to 20A. Milli-Volts and Volts to 2000 V. Resistances from 50 ohms to 50 million ohms. All these are measured with ease on the versatile and finely made DIX-ONEMETER.

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PLEASE be sure to mention "POPULAR WIRELESS" when communicating with Advertisers. THANKS!

SONGS OLD AND NEW.

TONI FARRELL, the popular Wireless Syncopated pianiste and composer, has a few words to say about songs, old and new. (We shall be hearing her once again tonight (Oct. 24th) from 2L.O.)

I WAS talking to a friend of mine the other day about Wireless and the amazing strides that have been made in this and other marvels that have come to pass in our time, surely the most wonderful era that has yet been known on our old planet. We agreed as to the stupendous difference that Wireless has made in lives which, up to a little while ago, had small knowledge of the great masters of music.

I refer not so much to the people of good means, to whom concerts and theatres are everyday occurrences, but to those in wayside villages, to invalids, to the many, many souls to whom, before the coming of Wireless, music was but a name for the wailing of the village choir, or the raucous efforts of the travelling circus band.

Forgotten Favourites

"But," I said, "just one thing struck me the other day. Perhaps you will think that I want too much, but do you know, often and often, lately, I have heard on the Wireless, songs of all kinds, opera, musical comedy, ballads, etc., that I had almost forgotten, songs that brought back very early memories. In several cases I have noted down their names, and made a vow that I would get them 'for keeps' in the morning, but do you know, in hardly any case was I successful! What a pity it is, and how I wish it were possible to get some of the beloved favourites of yesterday!"

"You certainly talk like a book," said my friend with a pitying glance, "but (as I have been trying to tell you, only you would not let me interrupt your brilliant flow of language), it is true that the Radio has re-opened an interest in the old favourite songs, and it is true that the younger generation is getting to know and to love the songs that their parents sang.

A Book to be Proud of!

But it's wrong to say that you can't buy those songs now. You can! This idea that has only just struck your mighty brain, has been simmering for some time in the minds of several bright people, with the result that now we are going to have a wonderful new fortnightly part work that everyone can buy, edited by Percy Pitt, a book to be proud of, within the reach of all (at the amazingly small cost of 1s. 3d. per part), and called, of course, 'Famous Songs, Old and New.'

"Well, I am very glad to hear it," quoth I, in no wise crushed by this withering rejoinder, "and I shall be only too pleased to buy a copy, though as perhaps, owing to your zeal in describing this book to me, you are not unconnected with its publication, you will be delighted to present me with a free copy. No? Oh well, never mind, I will buy one after my next broadcast!"

The Easy Way TO PERFECT RADIO

In addition to their own extensive range **PETO SCOTT** offer **YOU** every known Radio Receiver or Component. The list given below merely illustrates our terms for a few well-known lines and we ask you to fill in the coupon or send us a list of your requirements for which we shall be pleased to quote for cash or on our famous system of

EASY TERMS with SERVICE AFTER SALES

THE NEW "TITAN" SETS. Complete kits, including the very best components, drilled panels, and polished cabinets.
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"TITAN" THREE. Send only 10/4, balance in 11 monthly instalments of 10/4.
"TITAN" FOUR. Send only 13/2, balance in 11 monthly instalments of 13/2.
THE "P.W." FOUR (as described in issue of Sept. 21st). Complete kit, including polished mahogany cabinet, panel, and all specified components. Send only 17/8, balance in 11 monthly instalments of 17/8.
THE BROOKMAN'S THREE (described in "Modern Wireless," September issue). Complete kit less valves. Send only 17/5, balance in 11 monthly instalments of 17/5.
NEW OSRAM MUSIC MAGNET. Send only 16/6, balance in 11 monthly instalments of 16/6. Valves included.
McMICHAEL SCREENED GRID THREE. Complete kit of components, excluding cabinet, valves, etc. Send only 16/3, balance in 11 monthly instalments of 16/3.

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B.T.H. R.K. UNIT (for 6-volt accumulator or D.C. Mains). Send only 11/7, balance in 11 monthly instalments of 11/7.
REGENTONE W.I.B. S.G. (A.C. Mains). For S.G. and Pentode Sets. Send only 9/2, balance in 11 monthly instalments of 9/2.
EKO 3 F.20 (A.C. Mains). Also for S.G. and Pentode Sets. Send only 7/4, balance in 11 monthly instalments of 7/4.
ALL LEADING MAKERS OF ELIMINATORS from 4/7 first payment.
CELESTION C.10 LOUD SPEAKER in Oak. Send only 6/11, balance in 11 monthly instalments of 6/11. In Mahogany, 7/1.
CELESTION C.12 LOUD SPEAKER in Oak. Send only 10/4, balance in 11 monthly instalments of 10/4. In Mahogany, 10/9.
CELESTION C.20 LOUD SPEAKER in Oak. Send only 14/3, balance in 11 monthly instalments of 14/3. In Mahogany, 15/2.

THIS WEEK'S SPECIAL FEATURE THE "MAGIC" THREE. Build the wonderful set described in this and the last two issues. Complete kit of components, including cabinet and coils. Send only 15/-, balance in 11 monthly instalments of 14/-.

1930 MULLARD "ORGOLA," including cabinet and valves. Send only 20/-, balance in 11 monthly instalments of 20/-.
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COSSOR 1930 TWO-VALVE A.C. MAINS SET. Send only 19/3, balance in 11 monthly instalments of 19/3.
S.G. BROWN, MODEL B. Three-valve screened grid set. Complete kit and cabinet. Send only 18/-, balance in 10 monthly instalments of 18/-.
BOWYER-LOWE UNIVERSAL SHORT WAVE KIT including coils for 10 to 5,000 metres, and valves. Send only 46/4, balance in 11 monthly instalments of 25/6.
MAINS, COMPONENTS AND VALVES of every description are available on easy terms. Full details in our Catalogue. For example: **WESTINGHOUSE METAL RECTIFIER**, Type H.T.1, with Regentone Power Transformer, Type W.R.1. Send only 9/2, balance in 11 monthly instalments of 9/2.

ULTRA AIR CHROME U.12 CABINET MODEL LOUD SPEAKER. Send only 7/4, balance in 11 monthly instalments of 7/4.
ULTRA AIR CHROME TYPE F CHASSIS, 18 in. x 23 in. Send only 7/9, balance in 11 monthly instalments of 7/9.
BLUE SPOT 6K UNIT, with **SQUIRE MODEL 101 CONE KIT**. Send only 5/11, balance in 11 monthly instalments of 5/11.
EXIDE 120-volt H.T. Accumulator, Type W.J., in crates. Send only 6/11, balance in 11 monthly instalments of 6/11.
STANDARD WET H.T. 144-volt Battery, 10,000 m/a, absolutely complete. Send only 7/2, balance in 11 monthly instalments of 7/2. All parts for these batteries available.
THE ADAPTAGRAM converts your existing Radio Receiver to a modern Radio Gramophone. Perfectly simple. Takes practically any set. Garrard motor, R.T.H. Pick-up, Balanced Armature Loud Speaker. All fitted in a handsome polished Oak Cabinet. Send only 39/6, balance in 11 monthly instalments of 23/-.
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HEAR it but ONCE. Your ear will convince you there is no other reproducing unit, irrespective of price, to equal the Wates Star—its superlative tonal beauty and the amazing verve and sparkle of its performance. The Wates Star has been deliberately built for those who desire something more than the glut of "built down to a price" units can provide. True its cost is considerably higher—BUT by RESULTS alone and from the sensational interest caused at the Show, there is little doubt that those who do not inspect the Wates Star are missing Radio's "Best Yet."



Your set is only as good as its Speaker!



Sent against cash on 14 days approx. if your dealer cannot supply.

36/-
PRICE

4 coils, double magnets, upper adjustment for magnets, lower adjustment for armature. Works on newly discovered principle.

THE SHAFTESBURY RADIO CO.
(Dept. P.W.), 184-188, Shaftesbury Avenue, London, W.C.2.

Our Stand at Manchester Rad'o Exhibition is No. 63 M.B.

ALL APPLICATIONS for ADVERTISING SPACE in "POPULAR WIRELESS" must be made to the Sole Advertising Agents, **JOHN H. LILE, LTD.,** 4 LUDGATE CIRCUS, LONDON E.C.4. Phone: City 2261

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THE L.F. TRANSFORMER for perfection in wireless reception combined with full scale amplification and pure tonal quality.
CONCERT GRAND
 1st stage, 10/6
CONCERT GRAND
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BABY GRAND
 1st or 2nd stage, 8/6
 Model "A" Chokes for output or eliminator, 10/6
 All post paid and supplied with money-back guarantee if dissatisfied within 7 days.
 Sole Manufacturers:
L. PERSON & SON
 (Dept. 2), 63, Shaftesbury St., London N.1. Clerk. 7139.

REFINEMENTS FOR THE "MAGIC" THREE.

(Continued from page 390.)

cut the lead which comes off the moving vanes terminal of the differential reaction condenser (marked "Arm" on the blue print) and take the two ends so formed to the two terminals of the extra fixed condenser.

Now about the use of an output filter in the "Magic" Three. Since one of our main objects in the original design was the utmost simplicity and economy, we did not provide an output filter, and so long as you use an ordinary power valve in the last stage it is quite safe to dispense with it. If, however, you want to use either a super-power valve or a mains unit with this set it is advisable to incorporate a filter.

If you already have in your possession an output filter built up as a separate unit you can quite well use it with this set, simply connecting it up to the loud-speaker terminals, but if you desire to build a filter into the set it is quite a simple matter, and you should proceed as follows.

Fitting a Filter,

There is ample room on the baseboard near the left-hand side at the back (looking at the set from the rear), and you will require the following extra parts: One output filter choke of about 20 henries inductance and with a D.C. resistance of not more than 500 ohms. One 2-mfd. condenser will be needed in most cases, but if you are going to work the set from a D.C. mains H.T. unit you will require two or three condensers.

This is how you should proceed to wire in the output filter unit. Note that there is a wire going from the H.T. +2 terminal to the L.S. + terminal on the terminal strip. Remove this wire and instead wire H.T. +2 to one terminal of the filter choke. Next note that there is a wire going from the L.S. - terminal to the plate terminal of the third valve. Remove this wire and instead join the plate of the valve to the remaining side of your filter choke and one side of the 2-mfd. condenser.

Join the other side of the condenser to the L.S. - terminal. If the set is not to be used with a D.C. mains unit, just join the L.S. + terminal to H.T. + and the job is complete. If the set IS to be used with a D.C. mains H.T. unit, on the other hand, connect the L.S. + terminal to one side of your extra 2-mfd. condenser and join the remaining side of this condenser to H.T. -, which completes the job.

The MAGIC of Ready Radio

—SEE PAGE 397—

96 v. for 2 valves, 19/8
 115 v. for multi-valves, 27/9
TROMBA NO EXTRAS, CARR. PAID.
THE WET H.T. Postcard brings booklet, or 1/- full range of samples.
TROMBA ELECTRICAL CO.
 (Dept. W), 51, Chalk Farm Road, CAMDEN TOWN, N.W.1.
 C.O.D. Phone: Hampstead 0023.

Build your New Set NOW!

PAY AS YOU LISTEN

Why be satisfied with your old set, when for a small monthly payment you can build the very latest set yourself, or bring your old Receiver right up to date? Increase your reception 100%.

P.D.P. FOR Cash Terms

COMPLETE KITS for all Circuits supplied—see the following examples of our terms:—

MAGIC THREE KIT (including Valves, Oak Cabinet and Coils). Cash £9.2.0. Send only 16/8, bal. by 11 monthly payments of 16/8.

COSSOR 1930 KIT. CASH £8.15.0. Send only 16/-, bal. by 11 monthly payments of 16/8.

MULLARD ORGOLA KIT, including Oak Cabinet. Send only 14/3, bal. by 11 monthly payments of 14/3.

EKCO MODEL 3 F.20 (A.C.). CASH £3.19.6. Send only 7/3, bal. by 11 monthly payments of 7/3.

CELESTION C.12 (Oak). CASH £5.12.6. Send only 10/4, bal. by 11 monthly payments of 10/4.

KITS FOR THE MAGIC THREE, TITAN SETS, "P.W." FOUR, etc. Loud Speakers, H.T. Units, Accumulators, Moving Coil Speakers, Portables, etc.

Everything Wireless

ANY RECEIVER BUILT FOR 10/-

A nominal charge of 10/- only is made for building and testing any Receiver (Marconi Royalties extra).

QUICKEST DELIVERY IN LONDON. CARRIAGE FREE.

Call or send a list of your requirements.

QUOTATIONS BY RETURN OF POST.

The P.D.P. Co., Ltd.

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Phone: National 9846.

WIRELESS CABINET in oak 34'6

Carriage Paid, England and Wales. 2/- extra Scotland. This particularly useful little Cabinet is finished in Rich Jacobean or other shades. Will take Ebonite panel 18 in. x 7 in. across front. Large solid hinge top and 7 in. drop front as shown. Double doors with beading to cupboard in which is a loose baseboard. This is a very well made and well finished article, a really useful piece of furniture and an asset to any household.



O.C.A. FURNISHING CO.

(Dept. P.W.),

495, Fulham Road, S.W.6.

Opp. Chelsea Football Ground.

SIZE: 34 in. high x 22 in. wide x 16 in. deep. Quotations given for other sizes. Phone: Fulham 7012.

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Any make of L.F. Transformer, Loudspeaker or Headphones repaired and despatched within **48 HOURS—TWELVE MONTHS' GUARANTEE** with each repair, 4/- post free.

Terms to Trade.

TRANSFORMER REPAIR CO.,

"Repairs" Dept.,

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WILL-DAY LTD.

(THE BEST IN THE WEST)
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 (Opposite "Flamboyant" entrance to Piccadilly)
 OPEN TILL 7 P.M.
 WRITE FOR OUR CATALOGUE
 POSTAGE & FEE TO COLLECT

TECHNICAL NOTES.

(Continued from page 370.)

were detected 300 ft. below. Frequencies of 20 and 30 kilocycles were much louder than those between 40 and 100 kilocycles. Very long waves, of half a kilocycle, were detected without an amplifier through 900 ft. of rock. Such tests as these are important because of the use of similar methods for finding ore deposits.

"Synthetic" Broadcast.

The well-known American radio station, KDKA, of the Westinghouse Electric & Manufacturing Company, has lately been making some experiments with building up what they describe as "synthetic sounds." Dr. Frank Conrad, assistant chief engineer of the Westinghouse Company, conceived the idea of making up artificially the sound of the chimes of Big Ben, London.

This was done by analysing the sound very carefully into its component frequencies and then making up a number of oscillators, each giving one of the required frequencies. By combining the frequencies the same signal is carried to the transmitter and sent out on the air as would be produced by sounding the bell itself before a microphone.

To ensure absolute accuracy this artificial bell is set off by means of a second's pendulum operating in a vacuum.

Although this is very ingenious and interesting scientifically, I should have thought that for the simple purpose of

Going to Build a Set?

Don't Choose Hastily!

Tell you what to do—

Wait until you see

MODERN WIRELESS

The November issue, out next week, is a

GREAT GIFT NUMBER

with details for building

12 MAGNIFICENT SETS

of different types for all needs.

To avoid disappointment and secure this stupendous shilling's worth

ORDER YOUR COPY NOW.

reproducing the sound of Big Ben the easiest thing would have been to have made a number of gramophone records of the actual sound and to have reproduced these through the transmitter.

Research on the Electron.

I suppose every radio experimenter in these days knows about electrons, protons, atoms, and all the rest of it. The atom contains—or, to be more accurate, is partly made up of—a number of electrons. This applies to the atoms composing the metal of a valve filament just as to any other atoms. In certain circumstances some of the electrons are set free and may escape from the body of the substance.

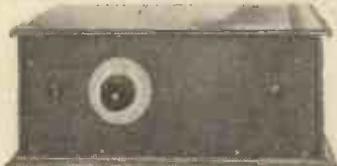
This is the way in which the electrons are released from the filament of the valve; owing to its heated condition electrons are

(Continued on next page.)

H.T. BATTERIES

H.T. BATTERIES.	EVER-READY.—60-v.
1/ P. & Post. (20/- free.)	7/-, 66-v. 7/6; 99-v.
SIEMENS.—60-v. 8/;	11/6; 120-v. 14/;
100-v. 13/; Power. 60-v.	Power. 65-v. 13/6;
13/6; 100-v. 22/6.	105-v. P. 24/; 120-v.
HERTRIX.—60-v. 8/;	2/ 27/6.
10-v. 13/; 120-v. 15/6;	GARNELITE.—60-v.
G.B. 1/6. Special	5/9; 100-v. 9/4. Fully
Portable Size, 9 x 5	guaranteed.
x 3, 100-v. 13/.	HELSESEN.—60-v.
Very highly recommended.	10/6; 99-v. 18/.

TALISMAN 7/6	TUNEWELL 7/9
DUAL COIL (Wearite) Magnetic Reaction	DUAL COIL 200/2000 Metres.



20 to 2,000 metres on this set. Tremendous volume and superlative quality.
KIT OF PARTS.—18 x 7 Panel, .0005 Variable S.M. Dial, Reaction (Differential), L.T. Switch, 3 Spring V.H., 2 Coil Sockets, 400-ohm B.B. Potentiometer, Neutrodyne B.B., Lewcos H.F. Choke (or R.I. Dual), Hyperin and Igranite J. NET CASH L.F. .0005 Fixed, 2 mfd. 2. Post 1/6 U.K. meg. Leak and Holder, 25,000-ohm to 60,000-ohm Wire-wound, 16 x 2 Strip, 10 Terminals, Wire, Screws, Baseboard.

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OAK CABINET, complete with cone speaker unit, 15/11; 4-way Battery Leads, 1/8; Wander Plugs, doz. 1/1; Large Sleeting, 3 for 9d.; Best R. & B. Twinflex, 12 yds. 1/3; Stranded Rubber, 12 yds. 1/-; 7 m/m Lead-in, 3 yds. 1/3; very small Terminals, doz. 1/-; .0005. .0003 S.L.F., 2/11; Phone Cords, from 9d.; Nickel W.O. Terminals, doz. 1/-; D.O.O. Wire, 4 lb. reels, 20 8d.; 22 9d.; 24 10d.; etc.; 18 & 16 Round T. copper, 9d.; 30 ft. best connecting wire, 10d.; Coil Plugs, 6d.; Engraved Terminals, 3d.; Alum Screens, 8 1/2 x 6, 1/3; Copper from 2/-; H.T. 100 volts, 8/11 fully guaranteed; good Headphones, pair 3/11; grand L.F. Transformers, 5/11; .06 2-volt Fuse and Holder, 8d.; Good Speaker Cone Units, 6/11; 50 ft. Electron, 1/-; Coloured Spade Terminals, 4 for 6d.; Grid Leak Clips, 3d.; Crocodile Clips, 3 for 4d.; Dead-beat V.-meters, 4/6 (for H.T. and L.T.); L.T. only, 3/6; pretty design S.M. Dials, 1/9 each; O.K. 4.5 Battery, 6 for 2/-; Cat's-eye Bulbs, 3d.; Testers, 3d.; Insulated Aerial Wire, 100 ft., 1/3; Heavy 7/2 Stranded Copper Aerial, 100 ft., 2/2.

THE LATEST "BEST WAY" TITAN FREE BOOK (with full wiring diagram) WITH "TITAN" THREE PARTS

"P.W." 2/2/29. Kit of parts approved by Editor. .0005 Variable, S.M. Dial, Micro .00005, L.F. 8/6 (add balance other), 2 Switches, TITAN COIL UNIT, R.I. H.F. Choke, .0002 and 2 of .0003 fixed, 2-meg. Leak, Holder, 2 Mansbridge Condensers, P.W. Standard Screen, 2 H.T. Fuses, 11 Engraved Terminals, Strip, Screws, Wire, Flex, Plugs, Baseboard, 14 x 7 Panel, Post 1/- U.K. Nett Cash. Not C.O.D. **65/-**
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 14 x 7 x 10 Cabinet L.T. 2 volts 3 Mullard Valves NOT C.O.D. H.T. 120 volts Case & Carr. 3/KUK

SPEAKER CABINETS

OAK 12/11
 Cheaper 9/6
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 All makes of Cone Units stocked.
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AC 2515 - £12 10 0
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2 volt or 4 volt.
Universal Resistor.
 Super H - 5/6 ea.
 Super Power 7/6
 Hyper Power 9/6
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COSSOR 1930 MELODY MAKER

Complete with Three Cossor Valves including Screened Grid, Cabinet in two-tone blue lacquer, together with silver-finished escatchoon, the kit contains everything necessary for home assembly.
 Price **£8.15.0**

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(3 in 1).
 Readings: 0-150 volts; 0-60 volts; 0-30 milliamps. Res. 5,000ohms. 8/6
 H.P., Det., R.C., 5/2 each; Power, 8/9, 2-v. or 4-v. Post 4d. (3 post free.)

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Build the "P.W." "MAGIC" 3

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COMPLETE RECEIVER IN CABINET, as shown, S.M. Tuning, 3 Dull Emitter Valves, Battery Leads, Grid Bias and Set of Coils. 12 Equal Monthly Payments of 14/3 OR with H.T. Battery, L.T. Battery, Cone Speaker Aerial. Ready to use. Tetsed OK. 12 Monthly Payments of 17/11 Carriage extra.

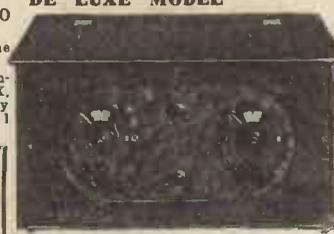
EXTRA ACCESSORIES

Lewcos Coils, 40 3/8, 100 4/8, 60X, 4/9, 250X, 6/6, X Set of 4 E.H.T., 10/-, X Igranite Shot, Wave, 10/- set, Mullard Power, 12/6, Det. 10/8 each, X Dairo, 7/8 & 5/8, X American Cabinets stocked, hinged lid, from 17/6.

SENSATIONAL OFFER IN LOUDSPEAKER SETS (NOT PARTS) DE LUXE MODEL

READY TO USE. In Handsome Cabinet. Receives London, 50B, 5XX, and many Continental Stations.

MULLARD MASTER 3 STAR CIRCUIT SIMPLIFIED



NO COILS TO CHANGE. JUST SWITCH ON—THAT'S ALL.

MULLARD MASTER 3 STAR CIRCUIT
 This new and wonderful set must appeal to Young and Old, amateur and experimenter—in fact, EVERYBODY! COMPLETE as shown, in Cabinet (hinged lid), all parts enclosed, Tunewell Dual Coil 200/2000 metres. 3 Latest D.E. Valves, Grid Bias, Battery Cords, 6/0 Motion Tuning. **READY FOR USE 69/6** Packing & Carr. Pass. 7/- NOT C.O.D.

EASY TERMS NO DEPOSIT. READY TO USE.
 DE LUXE SET SEND **12/11** FIRST MONTHLY PAYMENT. Balance in eleven monthly payments of 12/11. Carriage extra.
 NO REFERENCES. If a fat or householder send for 50B.

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PLEASE SEND DETAILED Orders over 25/- value will give LIST OF REQUIREMENTS, you a special quotation for each

"TITAN" ONE Panel, Baseboard, .0005 Variable, 4 in. Dial, 0/0 Switch, Wave-change and .0001 Reaction, Titan Coil Unit, Spring V.H., .001 and .0003 Fixed, H.F. Choke, 8 x 2, Wire, Flex, Screws, Terminals.
POST FREE. CASH NOT C.O.D. 37/6

"TITAN" TWO Special Cash Offer. S.M. Variable .0005, Reaction, 2 Switches, TITAN COIL UNIT, L.F. Transformer, 3 V. Holders, 3 Fixed Condensers, 2-meg. and Holder, 10 Named Terminals, Panel 12 x 7 Wire Screws, Flex, all Sundries, Baseboard, Wiring Diagram. NOT CABINET. **POST FREE. NOT C.O.D. 50/-**

LATEST OSRAM MUSIC MAGNET £9

includes CABINET (Oak), 3 Valves (1 S.G.), Kit of Parts, guaranteed as supplied by G.E.C. with full instructions.

OSRAM KIT EASY TERMS

12 monthly payments of **16/4**
 OR with H.T. Battery, L.T. Battery, Cone Speaker, Aerial, 12 monthly payments of **21/-**

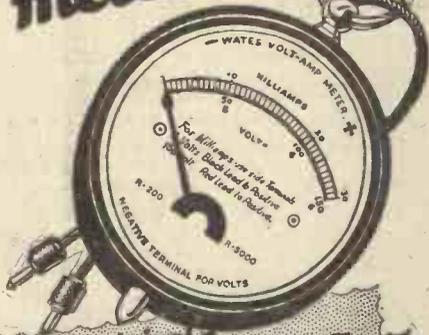
MULLARD CASH PRICE ORGOLA For Complete Lot

MULLARD KIT	£6 11 6
3 MULLARD VALVES	£2 18 0
18/- ORGOLA CABINET FOR Specially made for this Set by us. See what you save.	1 6
	£9 11 0

Carriage and Packing, 3/6.

Owing to an error, Cabinet was included in Titan Two kit of parts for 50/-. This does NOT include Cabinet.

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pinnacle of
meter value!



The original
WATES
three in one
VOLT AMP
RADIO TEST METER

Peak Value! Three readings on one dial, volts, H.T. and L.T., and milliamps, perfect accuracy, remarkable reliability, and so useful, many listeners would pay double its price rather than be without it! A sensation on its production, the Wates Meter still leads as the original and pre-eminent 3-in-1 meter. It makes set handling a science, and gives you the true appreciation of what good reception really is.

The "Wates" Range, Standard Model illustrated. Price 8/6. Case, 2/6 extra. Panel Mounting Model, 13/6. Panel Mounting Mill ammeters with Jewel Bearings, 0-50 or 0-25 M.A., 9/6.

Obtainable from Halford's Stores, Curry's Store and all Radio dealers, or direct.

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THE FAMOUS
3-in-1 METER **8/6**
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PLEASE be sure to mention
"POPULAR WIRELESS"
when communicating with
Advertisers. **THA WS**

The **MAGIC** of
Ready Radio

SEE PAGE 307.

TECHNICAL NOTES.

(Continued from previous page.)

released and, under the influence of the electric field maintained by the high-tension battery, these electrons pass away from the filament towards the anode and constitute what we call the anode current.

Scientists are always at work trying to elucidate still further the intricate problems connected with the atom and its constitution, and it is necessary, therefore, to keep up to date with results of their discoveries. You have heard of the simple theory that the atom consists of a central nucleus surrounded by planetary electrons.

According to more recent results the nucleus itself contains a concentrated store of force called the sub-nucleus; rotating around the sub-nucleus are very small and lightly charged particles which are kept in position under the combined influence of the attraction of the sub-nucleus and their own mutual repulsions. At further distances from the nucleus are the electrons which move around in their orbits.

Breaking Up The Atom.

Sometimes a disturbance arises in the nucleus of an atom, and one of the smaller and, as I have said, lightly charged parts is shot out of the atom at an enormous speed. This is known as an alpha particle, and may have a velocity as high as 10,000 miles per second.

The muzzle velocity of a high-speed shell from a gun is only from one to two miles per second, so you see that the alpha particle comes out of the atom at a really high speed. The speed, in fact, if it could be maintained, would take the alpha particle completely round the earth in about two and a half seconds!

Owing to this very high velocity the alpha particles are quite uncontrollable in the way in which the ordinary thermal electrons are controlled. If we could make use of the alpha particles we should then have an emission of the opposite kind from that which we use at present—that is, a positive instead of a negative emission.

Coils and Screening.

I spoke recently about the question of the design of coils and the use of so-called "fieldless" coils in lieu of screening. Of course, "fieldless" coils are not by any means true to their description, and therefore in many cases screening is really necessary.

In some cases long-wave and medium-wave transformers may be placed upon the same former, but these should be placed at least one inch apart.

At the same time you must remember that this space should, if possible, be made rather larger and a similar remark applies to the placing of the screens. There is always a certain amount of energy-loss in the screen—that is, if the screen is serving any purpose whatever—in fact the very purpose of the screen is to absorb stray energy. It follows that the heavier the work the screen is doing the greater the energy losses and, other things being equal, the lower the efficiency per stage.

Compactness and Efficiency.

The practical result of this is that too great compactness should not be aimed at if you want efficiency, and too great

(Continued on next page.)

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You can obtain absolutely any Wireless Set, Loud Speaker, Eliminator, Batteries, Valves, etc., on payment of a

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without absolutely any fuss or formalities, for

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(ACTUALLY) FINANCE THEMSELVES

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COSSOR. 1930 Three-Valve Screened-Grid Set. 15/- with order only.

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EXIDE. Wet H.T. Batteries. 120 volts. 6/11 with order only.

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LONDON, N.5. Phone: North 4430.

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THE REPRODUCER WITH A STEREOSCOPIC EFFECT

A Linen diaphragm, steel chassis built, loud speaker kit for home construction



Constructed in half an hour with a screw-driver. Size 20" x 20". Has a double lined diaphragm and adjustable damping attachment. Will take any popular Cone Movement, "G.E.C.," "Blue Spot," "Triotron," "Hegra," "Brown," etc. Kit includes dope, brush, instructions & ornamental sides.

21/- Postage 1/3.

For best results use a TWIN CONE MOVEMENT, 15/-. Postage 6d.
Patents and Reg. Pending.

GREEN & FAULCONBRIDGE LTD
COVENTRY

TECHNICAL NOTES.

(Continued from previous page.)

reliance should not be placed upon screening. It is true that screening or shielding has made possible very much greater compactness in assembly, but the point to bear clearly in mind is that this advantage, like most other advantages, is gained at the cost of incidental disadvantages and in the result there must always be a compromise between the two.

A Curious Fault.

A reader points out a curious trouble which he has experienced which proved to be very difficult to locate and asks me to give the information in these Notes in case it may be useful to others. He finds that when working with a set using S.G. amplification, the condenser between the filament and the screen grid must be connected to the negative end of the filament the same as the other condensers. It appeared to me to be fairly obvious that oscillation trouble might be set up. Of course, the bypass condensers in the set should be connected to the same end of the filament.

A Pentode Hint.

I remarked recently on the importance of proper values of grid-bias and high-tension voltages in general, and these remarks have special significance in certain particular cases. For instance, in the case of a pentode valve, as I mentioned some little time back, the choke or other component which is in the anode circuit will have the effect of causing a reduction in the voltage which ultimately reaches the anode, and this must be allowed for.

It is desirable in some cases to introduce a resistance in the H.T. supply to the grid of the valve (the grid which receives the high-tension) and a condenser between the grid in question and the negative end of the filament, this arrangement constituting, of course, a simple form of filter.

The actual voltage on the grid in question should not differ greatly from the voltage on the anode, and therefore the value of the resistance must not be unduly high although, of course, we have to bear in mind that the current involved is very small. If the current were zero then theoretically the resistance could be infinite and the smaller the current the larger the resistance which may be used without causing an undue drop in the voltage. The condenser may be a fixed condenser of perhaps one to two microfarads, and for the resistance I should say 8,000 to 10,000 ohms.

Selectivity—

The relative importance of sensitivity and selectivity was raised and discussed in a very interesting way by a contributor in this paper a few weeks back. He pointed out that selectivity was a much misunderstood term and that lack of selectivity was often blamed for what was, in fact, neither more nor less than lack of sensitivity.

As a matter of fact, it is impossible to draw any hard and fast line as to sensitivity and selectivity. Strictly speaking, I suppose selectivity would be defined as the property of a receiving circuit to respond to a particular wave-length whilst being unresponsive to wave-lengths in the close vicinity. Selectivity, according to some such definition as

(Continued on next page.)



The choice of critics

BULGIN

RADIO PRODUCTS

THE EXPERTS SAY —CENTRE TAPPED FOR SELECTIVITY!

**THE
BULGIN MULTI-COIL**

IS CENTRE TAPPED ON BOTH WAVE RANGES OF 220 TO 600 AND 1,000 TO 2,500 METRES. YOU WILL FIND NO TROUBLE WITH BROOKMAN'S PARK OR ANY OTHER STATION IF YOU INCORPORATE THIS EXCELLENT NEW TUNER. IT HAS BEEN DESIGNED STRICTLY IN ACCORDANCE WITH MODERN VALVE THEORY.

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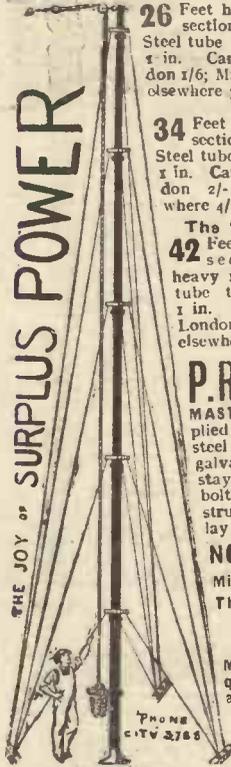
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DAMP PROOF! ROT PROOF!!



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TECHNICAL NOTES.

(Continued from previous page.)

the above, would evidently be greater the smaller the wave-length interval between the tuned-in wave-length and the nearest wave-length which could be perceptibly received.

—and Sensitivity. But you have to bear in mind that if a nearby wave-length is so faint as to be practically inaudible, and by some means you sufficiently increase the sensitivity of the set, this nearby wave-length will become audible, and therefore you will have to go to a wave-length further away from the desired wave-length in order again to reach an inaudible point. The result of all this is that, other things being equal, the selectivity will apparently become less (or the tuning will seem to become broader) as the sensitivity is increased.

You will notice I said "other things being equal," because many of you will know from your own experience that a very sensitive set may also be a very selective one, and it may at first sight seem that the above remark is contrary to ordinary experience. But if you think about it for a moment you will see that it is because of the very fact which I have mentioned above that a super-sensitive set must also be a super-selective one.

Weak Signals. If you are receiving very weak signals (for instance, signals from a distant station), then clearly the first requirement of the set, quite apart from any question of selectivity, is a sufficient sensitivity. No amount of selectivity in the world will enable you to pick up clearly a feeble signal if the set is not sufficiently sensitive. You will often hear a person say that he cannot pick up distant signals because his set is not sufficiently selective, but, in nine cases out of ten, the real reason is that his set is not sufficiently sensitive.

It is impossible to know whether the set is also, in fact, sufficiently selective until we have settled the question of the sensitivity first. Having got the set sensitive enough to receive the required distant station, then comes the question as to whether neighbouring wave-lengths can be excluded so as not to swamp the desired signals. Here we have a clear question of selectivity, and, inasmuch as we have already presupposed that the set is extra sensitive, the need for sharp selectivity is emphasised. In this way we have come to associate together selectivity and sensitivity because the second necessarily calls for the first, and this has no doubt given rise to the mistaken notion that a set which is sensitive is automatically selective.

SUNRIPE COMPETITION.

Messrs. R. & J. Hill regret that they are unable to publish the names of the prize-winners of their recent Sunripe Competition in this issue. The Awards therefore will be advertised as soon as possible in a forthcoming issue.

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The MAGIC of
Ready Radio

SEE PAGE 397.

A RAPID GUIDE TO RADIO

A JUMPING-OFF SERIES FOR THE NEW AMATEUR

By "Pentode"



IF you have got electric light laid on you will know that you buy electricity in much the same way that you buy gas. There is a meter and this registers the amount you use. And, curiously enough, electrical measurements are very similar in application to gas or water measurements.

But electrical pressure is not reckoned in pounds per square inch, but in VOLTS; these represent the Electro-Motive Force (E.M.F.) of the supply. Don't let these terms get mixed up. You will often come across Volts and E.M.F. and you must think of them coupled in this way: "There is here an E.M.F. of so-and-so-many Volts." E.M.F. (Electro-Motive Force) is the same sort of term as "A Head of Water," as used by plumbers. These people talk about "A Head of Water of so-and-so-many foot-pounds pressure."

A Complete Circuit.

I stress this point because we have several other words and abbreviations referring to electrical pressure to deal with. For instance, we often speak of *Voltage*, and again of *Potential* instead of E.M.F.

Perhaps it is better to deal with the units, and, at least for the time being, leave the broader terms to look after themselves.

To revert for a moment to our cells, which we were discussing last week, and which we shall be dallying with for yet another week or two, we found that when we joined the two plates or elements of a cell together with a piece of wire there was a flow of current, a complete circuit having been completed.

The reason why a current of electricity flowed was because the one plate or element of the cell was made deficient of electrons by a chemical action, and there was a flow of electrons through the connecting wire which attempted to restore the electron equilibrium of the plates.

Now note this point. The amount of current flowing depends upon the pressure (Voltage or E.M.F.), and the *Resistance* offered by the path the current flows through.

Explaining Resistance.

Resistance is measured in *Ohms* and is quite an easy thing to understand. There is no mechanical term that offers a close simile, but our water-pipe provides something of an illustration. Supposing all water-pipes were filled with cotton wool. A thin water-pipe with loosely-packed cotton wool in it might enable as much water to be pumped through it in a given time at a certain pressure as a bigger pipe with more tightly-packed cotton wool. In general, you would say that the thinner the pipe and the longer the pipe and the more tightly packed the cotton wool the greater the *Resistance* to water flow offered.

And so with electricity. Some metals offer less resistance to electricity than

others (copper is a much better conductor than iron), while the thicker and shorter any piece of metal is the less resistance it will offer.

Electrical RESISTANCE is measured in OHMS.

What The Ampere Is.

Current flow is reckoned in AMPERES. An AMPERE is the flowing of a certain amount of current in a certain amount of time. It is not the Unit of quantity like the gallon is in reference to water. But we will not dwell on that point. Suffice it to know for the time being that for all practical purposes the AMPERE is the Electrical Unit of dimensions of electrical current, and that the *Volt* is the unit of electrical pressure.

Prof. Ohm, a worthy electrical pioneer, evolved the law that is named after him, and Ohm's Law is with no exception the most useful bit of stuff that can be found in any electrical text-book. Ohm's Law says that it takes ONE VOLT of electrical

It is a common belief that the theory of wireless is dry-as-dust sort of stuff that concerns only the engineer and scientist. This is quite wrong, for, told in the right way, it makes fascinating reading. Further, even a superficial knowledge of the subject will prove invaluable to either listener or constructor, and make the tasks of set-building and maintenance easier and more interesting. But it should be noted that this series is not confined to theory alone. Skillfully welded into the articles will be a vast amount of information directly relative to the assembling and operation of radio receivers. Hints and tips concerning all phases of "household wireless" will be given, and it is our firm belief that every reader of "P.W." will find something in the series of individual interest.

3. SIXPENNY-WORTH OF ELECTRICITY.

pressure to drive ONE AMPERE of current through ONE OHM of Resistance.

This means that we can always wash out any one of these factors so long as we know the other two,

$$\text{for } C (\text{Current}) = \frac{V (\text{Voltage})}{R (\text{Resistance})}$$

$$\text{and } V = C \times R, \text{ and } R = \frac{V}{C}$$

Supposing you found that 2 amperes of current were flowing in one of those single-cell circuits I described last week, and that the Electrical Pressure was 2 volts. Well, Resistance equals Voltage divided by

Current, and in this case that is $\frac{2}{2}$ which is 1,

so that you know your circuit has 1 ohm of resistance.

If you knew only that the resistance were 1 ohm and the current flow 2 amperes you could quickly work out the voltage by multiplying the two figures together. Let us dash through a few examples, resistance

100 ohms, voltage 250; what is the current flow in amperes? Dividing 250 by 100

$$\frac{V}{R} \text{ we see that the answer is } 2.5.$$

The E.M.F. (or potential or voltage!) is 105 volts, and the current flow is 3 amperes; what is the resistance in ohms that is being encountered? Here we divide the voltage by the resistance, that is 105 by 3 and the result is 35.

Some Interesting Problems.

A current of half an ampere is flowing through a circuit known to have the resistance of 100 ohms; what is the pressure in volts? In this instance the two factors are multiplied together, for $V = C \times R$ remember. The answer most obviously is 50 volts.

What about a few calculations for you to do yourself and compare with the answers I shall give next week? Perhaps, you will find it interesting to take up a pencil and work out the simple problems. I assure you that it will be well worth your while, for a thorough knowledge of Ohm's Law is absolutely vital to your progress.

$R = 12$ ohms, $C = 1.5$ amperes; what is the voltage? $V = 250$ volts, $R = 1000$ ohms; what is the current? $C = 6$ amperes, $V = 12$ volts; what is the resistance? $C = 1$ ampere, $R = 6$ ohms; what is the voltage? $R = 185$ ohms, $C = \frac{1}{2}$ amp.; what is the voltage?

Before I close this week I think I had better say just a few words more about the ampere. You will by now have got a pretty fair idea of Ohm's Law and how to work out the value of the unknown factor when you know the other two, but I want to make sure that you completely grasp the significance of current.

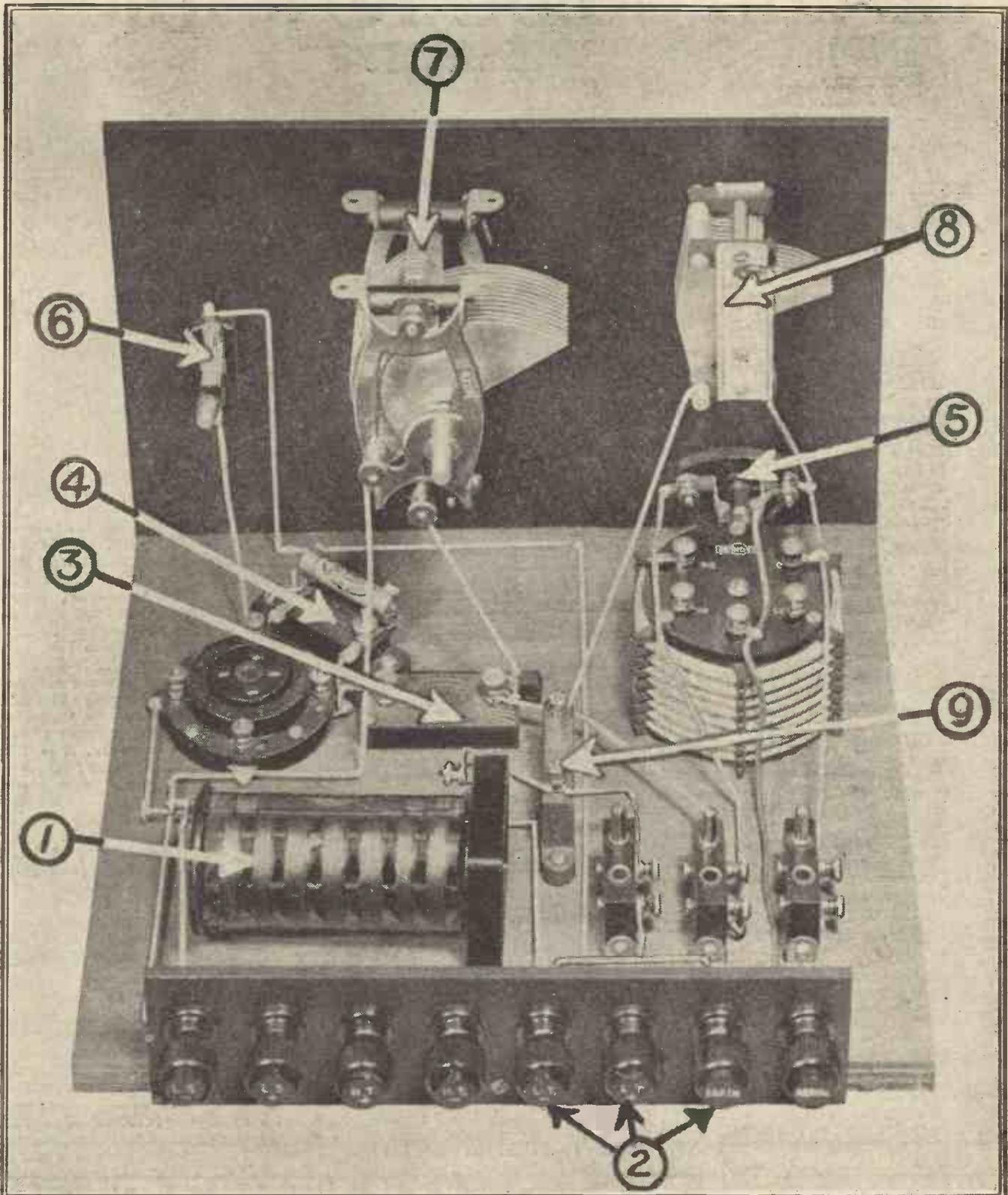
More About The Ampere.

If you do not you will meet with confusion when you come up against the use of A.C. electric-supply mains, especially in connection with rectification. But of these matters more anon. For the time being we must get back to that awkward ampere.

As I have said this is the unit of electrical current and not quantity. It represents the amount of current that flows in a certain space of time. You would speak of a water supply in terms of gallons per second, and this would form a very close analogy.

Actually the unit of quantity in electricity is the Coulomb, but this is a word you will very seldom, if ever, meet with in "P.W." Ohm's Law will fulfil all your requirements, but it is important that you should not think of the ampere as representing so many pints of electricity as it were. Bear in mind that it is the unit of electrical flow or current.

CLOSE-UPS FOR CONSTRUCTORS.—No. 3.



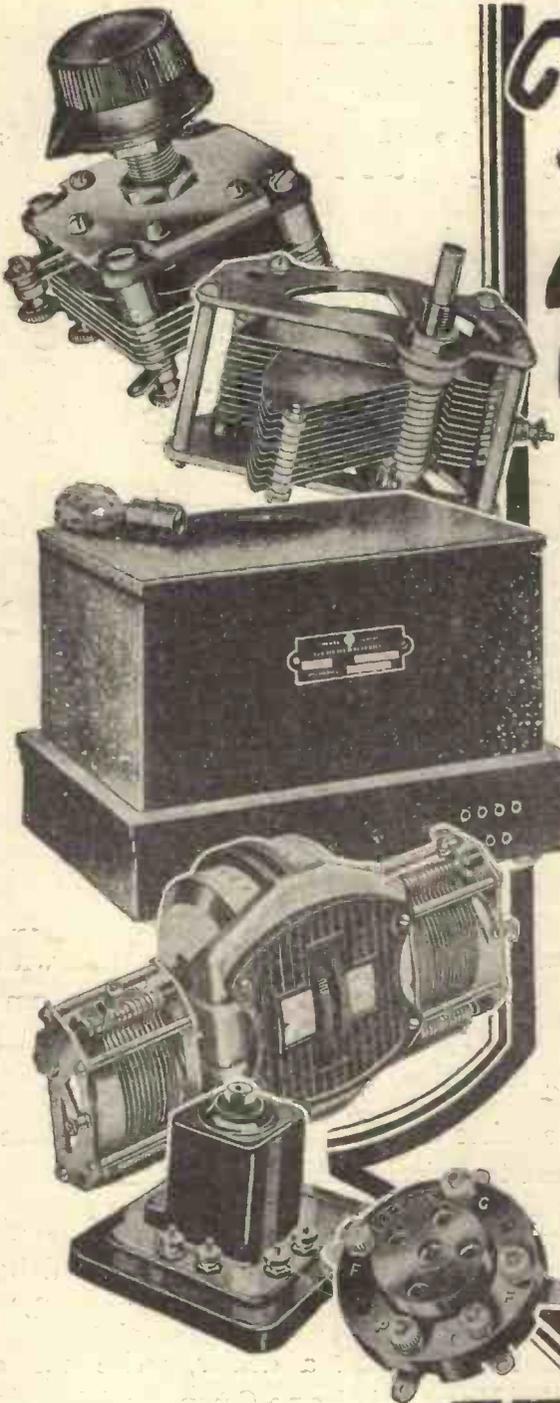
THERE are one or two points of quite exceptional interest in this simple one-valve wave-change set. You will notice at (1) that the H.F. choke has been mounted on its side to keep it out of the way so that it does not impede the operation of inserting or removing the valve and coils.

This does not affect the working of this component any more than the placing of the fixed condenser at (3) on its side has any ill-effect. This condenser can be fixed either vertically or horizontally, but the one indicated by (9) is built for vertical mounting only.

By the way, note how the grid leak at (4) is placed so as to make the grid lead as short as possible. Note also that the earth terminal at (2) is joined to L.T. — and not L.T. +; an important connection this.

At (5) and (6) you see the wave-change and the on-off switches which are of similar types, but which do totally different jobs.

In this set the reaction variable condenser at (8) is smaller in physical size than the tuning variable at (7), but it might not have been smaller in size and capacity with other makes and another circuit.



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In a good set each unit, however small, must be perfectly made. It is because components are so important both to the quality of reception and the ease in building, that Lotus components are recommended almost universally by technical men and the press. Lotus units are made in one of the most modern radio factories in this country. They are made to an exceptionally high standard and each one—large or small—is carefully tested before it leaves the works. You can depend upon Lotus components. Put them into your next set.

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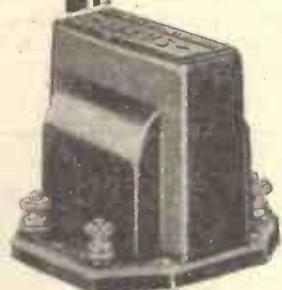
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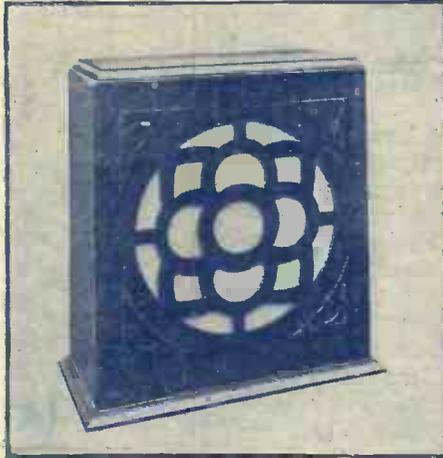


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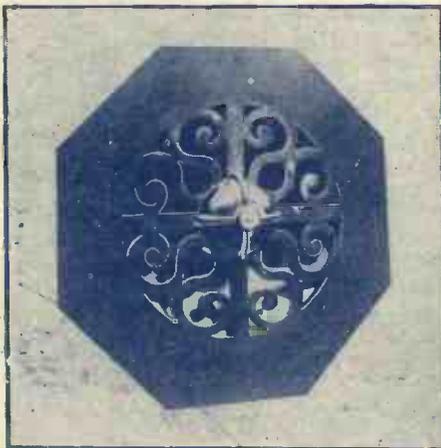


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