REGISTERED AT THE G.P.O. AS A NEWSPAPER.

HIGHEST RADIO CIRCULATION IN THE WORLD

Popular Wireless

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SPECIAL LOUDSPEAKER NUMBER

Popular Wireless

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THE LATEST MIRACLE—
NEWS FROM AFRICA—
THE "MAGIC" DOES IT—
WINNIE'S WORDS—

RADIO NOTES & NEWS

"ARIEL'S" FORECAST—
THE "P.W." INDUCTOR—
SMART WORK—
ALF'S BUDGET—

An Accumulator Question.

IF there is a radio gang where you are staying—I don't suppose there will be; they get broken up by girls!—you might like to ask some of them whether they "top up" their batteries with distilled water. If they answer in the affirmative ask them why. Why do you do so yourself, anyway? If anyone vaguely mentions impurities, ask what impurities he is anxious to keep out of his battery, and *why*. I hope to have some reports about this from some or my keenest readers.

Wonderful Wireless.

I HAVE been rather short of good stories lately, about radio music coming freely from dog chains, gridirons, rat-traps, hanging shovels, and so on; hence I bid welcome to the statement of Canon Peile in the "Church Times" for June 30th. Writing of the church at Bonavista, Newfoundland, he says: "The new church has a copper roof, and in wet weather this roof, somehow or other, catches the wireless waves from Canada and America. As you stand there you can hear a confused mass of wireless programmes coming across the air."

The Latest Miracle.

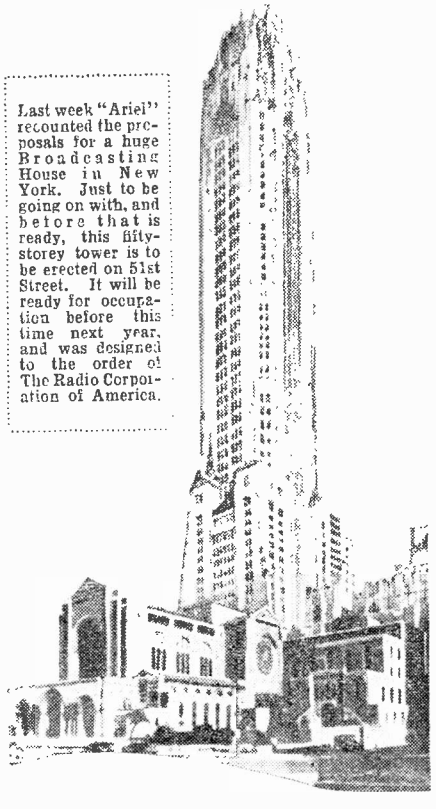
I'LL wager that the Canon has never heard the confused "mass" himself. However, having struck a good vein, he continues: "The church has no wireless instrument, but its roof catches these waves in the air, and the good folk of Bonavista can be seen standing beneath their church at times listening to their roof." Myes, and the bad folk buy receivers! Well, well, these true stories of receiverless radio are similar to that of the Indian rope trick: you never meet a person who will say that he has himself seen it.

News from Africa.

A READER kindly adds the following example to my collection of English as written by African natives: "Your name was highly recommended to me by the comfidential friend of mine that yow are the Best manufacture in a Graed City of london therefore as I wish to take Graed company with you kindly endeawour to forward your yealy catalogwe as well as sample s park. Hoping this will induce yow much proprietor to forward me per retureing mail coming, I am, etc." After all, there are much foggier bits in some of Browning's poems!

Diagnosis Extraordinary.

I HAVE already recorded the wonderful diagnosis made by a German doctor after examination of photographs of eyes, sent from Buenos Aires to Berlin by radio facsimile service. Even more remarkable is the correct diagnosis of heart disease, made by Dr. Calandae of Madrid. His patient was in Buenos Aires and he listened to the heart by direct radio telephonic means. The microphone was placed over it, the heart-beats thus being transmitted by radio. Will the year 2000 see us, Robot-like, courting our sweethearts by means of graphs, records of pulse acceleration and radio photographs of our heart action?



Last week "Ariel" recounted the proposals for a huge Broadcasting House in New York. Just to be going on with, and before that is ready, this fifty-storey tower is to be erected on 51st Street. It will be ready for occupation before this time next year, and was designed to the order of The Radio Corporation of America.

Longer Waves Score.

MAJOR KINGSFORD SMITH has put it beyond all doubt, in a telegram to Marconi's, that his radio equipment was vital to the success of the great flight to New York. He speaks of the "tremendous service it rendered me." What chiefly interests me in connection with the equipment which he took is that when the airman arrived here his machine was fitted with short-wave apparatus. At the last minute it was decided to add a transmitter for 600-800 metres, and this proved to be a "brain wave," for it was due to his ability to communicate with ships and coast stations that he got his bearings in the fog and so found his way to land.

The "Magic" Does It!

L. F. P. (Higham Ferrers) considers that one of his greatest radio thrills was his reception of some of the messages radiated from the "Southern Cross," another instance of the interest which the ability to read Morse adds to amateur radio work. He did the job with the "Magic" Three, which shows that the set is capable of handling a ticklish job when called upon. This particular interception, by the way, was done between 1 and 2 p.m.!

Overseas Papers, Please Copy!

I HAVE to thank L.F.P. for his friendly letter, though he *does* wag a forefinger at me for having stained my page with politics, a crime for which I plead mercy in spite of the fact that I do not realise that I am guilty. Take it as granted that any political flavour, real or imaginary, which is observed in "Notes and News" is a defect due to my ignorance of which is the best radio party. (Mr. L. F. Parker, 20, Wellingboro' Road, Higham Ferrers, Northamptonshire, would be pleased to correspond with anyone in Canada, Australia, U.S.A., etc. He is interested in short waves.)

Winnie's Words.

OUR lady secretary (Kitchen Dept.)—isn't that nice?—mentioned that her young man has made a "Sweetbread" receiver. Which, being translated, means "screened grid" receiver. The same young "Mrs. Malaprop" told her mistress—if the word be permitted!—that when she goes to "Weston Souvenir" for her holiday she will wear some lovely "grape machine" garments! No prizes for correct solutions.

Angling from a New Angle.

I WAS astonished the other day to see a photograph of Scots fishing in Loch Leven apparently to the accompaniment of a portable receiver, a Pye. I have

(*Continued on next page.*)

RADIO NOTES AND NEWS.

(*Continued from previous page.*)

never been allowed to make the slightest noise near anglers, except possibly far out at sea. They appear to think that fish won't eat if a man blows his nose in the same parish. My theory is that the Scots were trying to ascertain whether the fish would rise without bait. Why waste worms?

The July "Modern Wireless."

IF absence from the old home town, or some such pre-occupation this holiday season has caused you to forget "Modern Wireless" this month, you will probably be sorry when you know what you have missed—if you miss it. It is perhaps not too late to collar a copy. A special illustrated supplement about the Low-Frequency Transformer renders this number unusually valuable to all home constructors, and the issue contains also full details of the "Star-Turn" Four and the "Star Turn" Crystal Set, both of which incorporate the new "M.W." system of selective tuning. Do it now!

Playing on the Loud Speakers.

A READER down in Somerset has sent us a neat model of a switch devised and used by him for operating three loud speakers in serics, or singly or two at a time, all from the same valve set. We are exceedingly obliged to him for his nice letter, and kindness in making the model. The idea of using several loud speakers and of altering the adjustments of the set to suit the kind of music being received is gaining ground, especially in America, and I should not be surprised if in time to come radio receivers have to be "played."

"Ariel's" Intelligent Forecast.

OH, by the way, I was passing the door of the room where our technical men are allowed to play all day with what not, and as I heard from within sounds which indicated that something above sea-level was happening, I put on my best "innocent enquirer" look and entered. Were Messrs. Kendall and Rogers doing an Apache dance, or did my eyes deceive me? And that Mr. Dowding should slap Mr. Bird on the back is almost unthinkable! I must have my spectacles corrected. Anyhow, there was something special in the wind—THE "P.W." INDUCTOR.

The "P.W." Inductor.

IT will no doubt interest a large number of our readers to know that we shall shortly publish the details of a device which we have named the "P.W." Inductor, the purpose of which is to cut out interference from the local station on long waves. We believe that this will comfort many users of the simpler type of set, especially now that we have Brookmans Park working. The device can be added to sets externally or incorporated in new designs. It is admittedly simple. So was the first radio circuit, but it was rather useful, too. When one comes to ponder the matter, so many of the best ways of doing things are the simplest ways. Look out, then, for this little masterstroke of simplicity!

Smart Work.

THIS late listening-in into the small hours of the morning has its advantages. Not long ago two detectives were doing it in a Flying Squad van, and a voice from Scotland Yard informed them, in no uncertain terms, that a motor-car (registration number so-and-so) had been stolen. Indignant at such goings-on, the detectives kept a sharp look-out, and at about 3.30 a.m. saw the said car gaily careering along Northumberland Avenue.

Explanations followed, and the result was a charge at the Marylebone Police Court before Mr. Bingley. Which all goes to show that not everyone who can drive a car can "get away" with it.

Alf's Budget.

AGAIN seven pages by our active reader, A. W. M. of Middlesbrough. Having dragged his net through the ether and caught most of the telephony worth picking up, he is now learning Morse. When he can read at 25 w.p.m. he will find that he has occupation for the rest of his life. He advises would-be long-distance aspirants as follows. "Make an absorption wavemeter, calibrate your coils, keep a log and data book and correspond with others in other parts of the world." He states that his results have been got with an inside aerial and a poor "earth," and that he has nowt to do with any receiver unless the moving vanes of its variable condensers are at "earth potential."

SHORT WAVES.

"An American inventor's scheme to keep entire families warm in unheated houses in the coldest weather by means of radio is understood to be quite distinct from the idea of utilising hot air from the loud speaker."—"Punch."

* * *

Mrs. Waine: "I'm so worried. Tommy is five years old, and he cannot talk plainly yet."

Mr. Waine: "Don't worry. He'll probably turn out to be a wireless announcer."—"Answers."

* * *

THE HOWLING INFANTS.

A writer in a radio paper reminds us that "wireless is still in its infancy." That may account for the howls and general bad behaviour of the receiving sets one hears through so many open windows of an evening.—"The Bulletin & Scots Pictorial."

* * *

A WARNING—which only the wise will need!

Ah, woe unto the man who gives a friend,
Or sells, perchance, with money in the vend,
A radio. That man sure loseth all,
And seeks for peace the madhouse in the end.
"Radio Design."

* * *

Critics of wireless in the Free State complain that too much Erse is broadcast. Listeners-in have difficulty in distinguishing their own language from atmospherics.—"Punch."

* * *

Those wonderful Wireless Announcers,
Have gained "Double Blues" as pronouncers.
Take words such as idyll,
Or Cholmondeley or Fidyll,
They never trip over these nouns, sir,—
"Nonsericks."

* * *

Pat: "I see they are equipping all the new Fords with radio sets now."

Mike: "Sure, begorra, and why?"

Pat: "So they can get out-of-town!"—"Radio Digest."

Learning Morse.

LETTERS continue to dribble in from obliging readers who are expert telegraphists on the subject of the "stance" which is best for manipulating the Morse key. E. S. C. (N.W.1) went to a lot of trouble and produced a set of rules, with diagrams, and we are grateful to him. Chair to left-hand of key, first and second fingers on knob, and thumb underneath; third and fourth fingers hanging free. Send from wrist; hand and forearm level and in line with key. Do not rest arm or wrist on table. Grip on key should be loose, and whole action of sending free from rigidity or constraint. That's E. S. C.'s advice.

New S.W. Stations.

IN Melbourne there is a new short-wave station operating, with the call-sign V K 3 U Z, on a wave-length of 32 metres. It is crystal controlled, and the power is about 40 watts aerial output. Reports will be welcomed by Mr. L. Glew, Engineer, V K 3 U Z, Bowke Street, Melbourne.

A new Serbian transmitter has been observed to be testing at Belgrade on a wavelength of 30 metres. Its interval signal is in the form of metronome beats about 50 per minute. Listen for it on Mondays between nine and ten p.m.

Belgium Wakes Up.

ACCORDING to recent reports the "piracy" in Belgium has been very widespread, less than 10,000 licences being in force, although it is known that nearly a quarter of a million sets are in use. A Decree has now been issued providing for the registry of all sets. The licence fee is only seven shillings per annum, and failure to pay it is now punishable by a fine up to 2,000 francs and eight days in gaol.

A Fan's Gossip.

OUR valued correspondent Mr. Fred Easter, of Cincinatti, Ohio, packs his letters with information. Here is some of it. W 3 X A U, Philadelphia, works on 49·5 and 31·28 metres, 500 watts. Hours: 13.00 to 05.00 G.M.T. From 13.00 to 17.00 the 49·5-metres wave is used and from 17.00 to 05.00 the 31·28 metres, except on Thursdays and Fridays, when the 49·5 metres is used all day in order to avoid P C J.

K A 1 X R, the S.W. transmitter of K Z R M, Manila, now occasionally uses 25·36 metres.

The stations of the New York–Buenos Aires commercial telephone service are W L O on 14·1 metres and L S N on 14·15 metres. These sometimes use a distorting system.

An Early Riser.

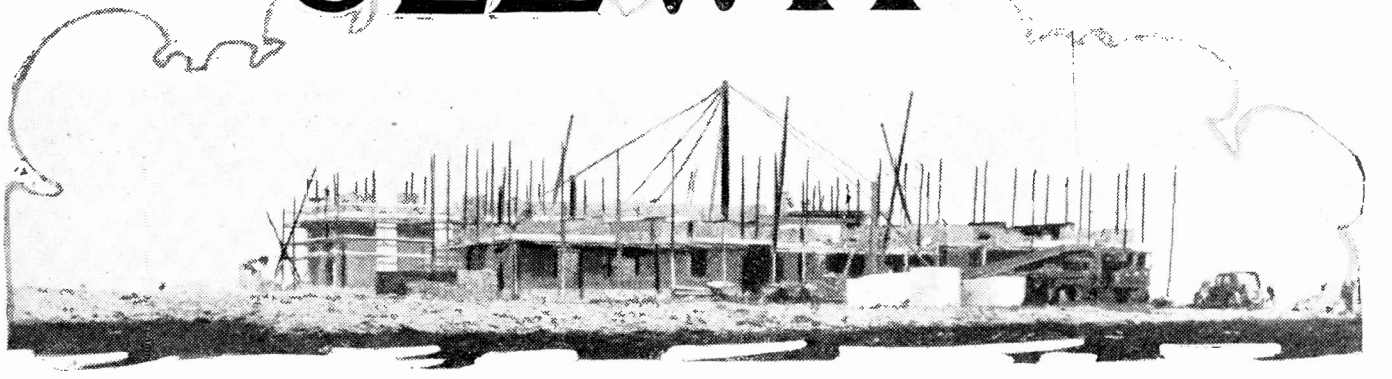
MR. DOUGLAS BRIGGS, Austin Friars, Newport, Mon., begs to report that, using the call signal G 2 Q I, he may possibly be heard working on 163 metres between nine and nine forty-five in the morning. C.W. and telephony. He works on 40 metres also, but at indefinite times. He would welcome and acknowledge reports on his transmissions, so if you stumble across him be matey and drop him a postcard full of report.

Hodge, the D.F.

THE Bradford Radio Society held a man-hunt at the end of last month, an endeavour to track by means of direction-finders a transmitter hidden on a moor. According to the "Bradford Telegraph and Argus" great interest was shown by the moor folk in the proceedings, and one old countryman, seeing a frame aerial being revolved, first one way and then the other, kindly said, "If it's t'wind tha'rt botherin' wi', ah can tell tha it's sou'-west!"

ARIEL.

"SLEWIT"



The second station of the Regional Scheme is rapidly rising from the moorland just outside Slaithwaite, at Moorside Edge. Here are some interesting details of this North Regional station, which is to operate on 301·5 and 479·2 metres.

From Our SPECIAL CORRESPONDENT.

SLAITHWAITE'S station grows apace. Every day the future home of the B.B.C.'s North Regional transmitter increases in height and in frontage, though it must be confessed that at the present juncture the building is so completely surrounded with a maze of scaffoldings and other building appurtenances that it is not at all an easy matter for the visitor to make out even its main features.

In general design, however, the North Regional station will comprise a rather squat though spacious building. It is being built almost entirely of red brick—perhaps by way of contradistinction to the Brookmans Park station, which is constructed mainly of grey stone.

A Stiff Climb !

Anyway, the building of the station is being pressed forward with all possible speed at the present time, for, owing to its high site and severely exposed position, constructional operations are able to proceed but slowly during the winter-time.

The station occupies a site on the crest of Moorside Edge, a moorland hill some 1,000 feet above the little Yorkshire woollen town of Slaithwaite. The aerial masts to be erected will be 500 feet high, thus enabling radio energy to be flung into space at an altitude of 1,500 feet above the neighbouring town.

You get a good bird's-eye view of Slaithwaite and its grey stone mills from the site of the broadcasting station on Moorside Edge. If you approach the station from the town of Slaithwaite you have a stiff climb of two miles before your destination is reached.

Nevertheless, your half-hour or so of uphill climbing is well worth the effort, for, quite apart from witnessing the steady growth of the B.B.C.'s North Regional station, you have from its site a view of moorland country and of the Pennine ranges second to none in the district.

The Proposed Wavelengths.

One thing is quite certain. The engineers at the future North Regional station, whoever they may be, will never suffer from any lack of fresh air, for on the calmest day the moorland breezes blow with a velocity that makes you pull your hat over your ears and walk through the stubble grass with a more than ordinary determination.

Slaithwaite is, of course, very proud of its new station. Perhaps it hoped to gain extensive publicity by the presence of the B.B.C.'s transmitter in the district, but, if such be the case, the industrious town has been doomed to disappointment, for the transmitter is to bear no other name than that of the "North Regional Station."

The North Regional station at Moorside Edge is to have the wave-lengths of 301·5 and 479·2 metres allotted to it.

The 479·2-metre wave-length is expected to give good service, for there will be a power of 50 kw. available for transmissions on this wave-length. The 301·5-metre wave-length will have a similar power available, if necessary, but it is not expected that transmission on this latter wave-length will cover so large an area.

The precise service-areas of the North Regional station's future transmissions are, of course, not known. It is calculated, however, that with either of the wave-lengths signal strength will be stronger east and west of the station than it will be north and south. There is no point of disadvantage here, however, for the greater mass of the north country's population is concentrated mainly to the east and to the west of the station.

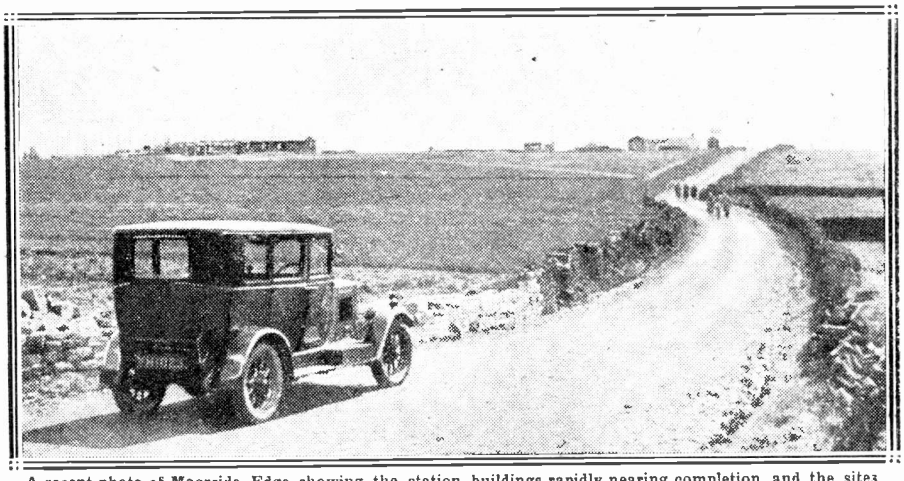
Installing The Apparatus.

The North Regional station will obtain its programmes by land-line from Manchester, and, to a lesser extent, from the Leeds studio. Leeds will constitute the "S. B." centre for this station.

The building of the North Regional station is proceeding at a rate which makes it probable that the transmitting plant will be installed in late September, or in October next. The installation of the necessary electrical gear, however, will not be an easy matter at that time of the year, for the fine summer weather will have departed, and any severe rains will render the conveyance of heavy materials to such a high site very difficult.

This fact, however, has been appreciated by the B.B.C. people, and they have gone to the trouble and expense of remaking and consolidating many long stretches of moorland roads in the vicinity of the station

VOICES FROM THE NORTH



A recent photo of Moorside Edge showing the station buildings rapidly nearing completion, and the sites of the three aerial masts, which are to be 500 feet high, the tops being 1,500 feet above Slaithwaite.

B.B.C. PROGRESS

A review of the financial advance made by our Broadcasters during the past year—That Empire Short-Wave—Broadcast S.O.S. and charity appeals—"The publicity fires of Television."

By THE EDITOR.

LICENCE figures still continue on the up-grade, and it would be a bold prophet who ventured to forecast "saturation point." The recently-issued B.B.C. report shows that there are now well over 3,000,000 licencees in the country, and there is every sign that broadcasting still continues to claim increasing numbers of new adherents.

Last year's figures showed an increase of 328,344 on 1928, and brought the total in force at the end of 1929 to 2,956,736. Since then the three-million mark has been passed, so that the B.B.C. is quite justified in claiming that there are no signs of retrogression. The financial return is also good, since it shows an income of £1,470,000 from licences, of which the B.B.C. received £944,301, against £871,764 in 1928, the Post Office £183,750, and the Treasury £341,949.

The latter sum may be regarded as a sort of unofficial entertainment tax, but when it is considered in relation to the money expended on programmes, which amounted to no more than £546,676, the listener has surely the right to ask whether the Exchequer is entitled to such a lion's share. And despite this "rake-off" the Government continue to haggle with the Colonies about the vexed question of an Empire short-wave station! Why not use some of the cash, which the Treasury has deducted from listeners' licence fees, to build an Empire Station?

S O S Successes.

During last year there were 881 S O S messages broadcast by the B.B.C.—an increase of 130 in the total compared with the previous year. There is the dramatic and often the pathetic in these calls. This is the reason why everyone listens with close attention as soon as S O S is announced. Less than half the calls have any success. Last year 41·6 per cent were successful, 54 per cent unsuccessful and in 4·4 per cent the result was unknown. The other appeals —those for help for deserving causes—had good responses. Forty-eight national appeals for charity resulted in £60,000 being sent, and local appeals brought in 24,000.

In soliciting aid for charity we doubt whether the B.B.C. has a more successful rival anywhere in the world. The figures given above speak for themselves.

Ambitious Plans.

We understand that plans for a big amusement centre, in which wireless television may ultimately play a part, are being developed, and Mr. John Rockefeller, junior, is now taking an interest in the proposal of Mr. Owen D. Young and other leaders in the electrical entertainment field to use the Rockefeller property, which the Metropolitan Opera Company rejected, as a new site.

According to the "Morning Post," while thus far television has been in too experimental a stage for public use or the practical dissemination of programmes from a central theatre, recent developments foreshadow the time when it may be possible to send programmes from one central point over a wide area.

When and if that time arrives the new amusement centre would send its programmes to millions throughout the country in theatres and private homes.

A Beautiful Vision!

This is but an example of the sudden flare up in the publicity fires of television. From America stories ha lately that certain expe perfected—or are about whereby the cinema and up and so enable, for exa be shown in London, or seen in theatres all over t

A beautiful vision! W clined to break into lyrical like this: The day is not when the whole world will performance at home—the being operated in Timbuctoo on. The style, however, has done to death. Perhaps it is a student of television," writes Robinson, in the "Observer," sudden announcements of wor new art with considerable amusement, and with some envy of the publicity organisation of the commercial interests concerned with the art in the United States." True. Too true!

SIGNALS FROM THE "SOUTHERN CROSS"

Mr. Old, a Nottingham Radio enthusiast who kept in touch with the "Southern Cross" during its epic transatlantic flight, and passed on many personal messages.

RECEPTION WRINKLES

If you use the cat's-whisker type of crystal set, avoid scratching the crystal heavily. A light pressure is usually far more likely to give good results.

* * *

When adjusting a double crystal type of detector always draw the adjusting control knob back before attempting to find a fresh surface, as in this way you avoid scraping the two crystal surfaces together.

* * *

Do not readjust your crystal more often than you need, as not only is this bad for the crystal but it often interferes with neighbours' reception.

Always be careful not to jolt or jar a crystal set unnecessarily as it is bad for the detector.

* * *

If your signals tend to fall off in weather it will probably be found that the aerial insulators are inadequate in number or that rain is spoiling them and making a conductive path across from aerial to "earth."

* * *

An ordinary H.F. choke inserted in the negative lead from an H.T. unit is often efficacious in getting rid of hum or distortion.

* * *

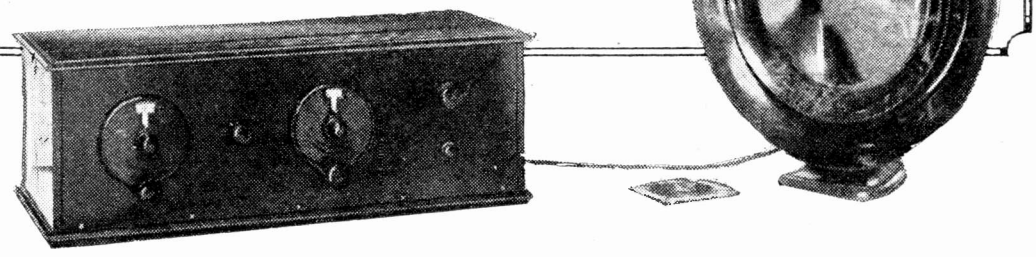
If the wrong voltage is applied to its screening grid the average S.G. valve misbehaves in a way that ordinary valves cannot do. Such a wrong voltage may send the valve into oscillation, causing unsteady and erratic reception.

* * *

Good contact is particularly important in a crystal set where resistance losses can be serious in the aerial or earth circuit.

TONE and TUNING

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



FOR my last article I had something to say about the importance of linearity of response throughout the receiver. I indicated that advantages in push-pull resistance-capacity magnification could be argued, but, practically, we were limited in our advance to technical perfection by the cost of valves.

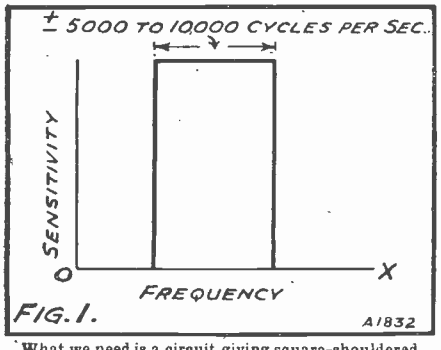
But there are other aspects of receiver design which are relevantly discussed when dealing with this question of quality of transmission.

In this article, "P.W.'s" Chief Radio Consultant explains how quality is affected by selectivity.

Ideal Response.

We select one ether disturbance from another by the use of tuned circuits. A tuned circuit may present either a much higher or a much lower impedance depending upon the method of connection to E.M.F.s of a certain unique frequency than to E.M.F.s of any other frequency. It is this phenomenon of "resonance" which lies at the root of all selection and tuning.

WHAT IT SHOULD DO—



What we need is a circuit giving square-shouldered response and letting in only a limited band of frequencies.

If you look at Fig. 1 you will see a diagram giving the ideal response curve of a receiver. This ideal square-shouldered curve shows that the ideal receiver lets in only a defined limited band of frequencies. This, depending upon conditions, should be able to be varied in width from 5,000 to 10,000 cycles per second.

A *single* tuned circuit, however, has response curves as shown in Fig. 2. As certain of the relative values of resistance, capacity and inductance are changed, the shape of the curve varies as shown in Fig. 2.

The particular point to notice is that the response, as represented by the vertical distances from the line of origin O——X in the figure, falls off more or less rapidly but always continuously. There is no abrupt "cut off" with any ratio of inductance resistance and capacity, and the ideal of Fig. 1 is in no case realised.

If we have a flat top response curve for example (A), the skirts of the response curve go sailing on outwards, and are not tucked in sharply over the hips according to the more modern cut.

If you are flat topped your frills flow out as a crinoline, tight-fitting skirts are only possible if the waist too is terribly pulled in. Thus the ideal top makes for a superfluous skirt, and narrow skirt sacrifices the flat top.

The Cascade Connection.

If you have a wide-skirted resonance curve, you pick up unwanted transmissions outside the spectrum of the desired station; if you get great selectivity you sacrifice the pick-up of the spectrum you want to receive. All the above arguments apply if you are trying to make only a single circuit selective.

If, however, you take several flat-topped circuits in cascade and these several flat-topped circuits have each wide skirts, a little consideration will show that the effect of cascade connection is to diminish the width of the skirt while preserving the flat top.

Because each ordinate has to be multiplied by itself as each cascade circuit is added, the maximum response is say, unity. Then the maximum response remains unity, since $1 \times 1 \times 1 \times 1 \times 1$. But at 5,000 cycles the response of one circuit is say 0·95.

Then $0{\cdot}95 \times 0{\cdot}95 \times 0{\cdot}95 \times 0{\cdot}95 = 0{\cdot}8$ (about). At 10,000 cycles the response of one circuit may be 0·8, but with four circuits $0{\cdot}8 \times 0{\cdot}8 \times 0{\cdot}8 \times 0{\cdot}8$ is 0·4 (about).

One Circuit or Several?

Now we have the four circuits giving

1 at the carrier-wave frequency.

1·0 very nearly at the carrier-wave frequency — 2,000.

0·8 at the carrier-wave frequency — 5,000.

0·4 at the carrier-wave frequency — 10,000.

But to get a reduction to 0·4 at 10,000 cycles with 1 circuit we should have something like:

1 at the carrier-wave frequency.

0·7 at the carrier-wave frequency — 2,000.

0·5 at the carrier-wave frequency — 5,000.

0·4 at the carrier-wave frequency — 10,000.

Thus the cascade connection of many rather flat circuits gives us a nearer approach to the ideal of Fig. 1 than if we try to cut down at the outer limit of frequency band by making *one* circuit very selective.

There is, further, the possibility of getting better quality reproduction by using high-frequency cascade connection, even though sensitivity is not the object of using high-frequency connection.

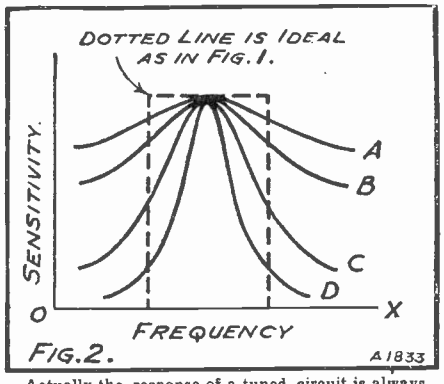
Phase Distortion, Too!

Most people think of high-frequency magnification as only useful in being selective and sensitive.

I insist that I can in one sense of the term make a highly selective receiver using only one high-frequency circuit, for reasons now to be explained, sacrifice quality.

You must take it from me that when a high-frequency tuned circuit has a response curve such as that in Fig. 2 (D) (very selective, inasmuch as the outer-frequency response is small) there is, besides an amplitude distortion, inasmuch as every part of the spectrum is not equally reproduced, a phase distortion.

—WHAT IT DOES!



Actually the response of a tuned circuit is always wide-skirted to some degree.

If you play a note of 3,000 say, this has a certain phase relation to the carrier-wave in the original disturbance. But the tuned circuit will increase this phase difference the greater the difference of frequency between side-band and carrier.

Thus the phases in the receiver disturbance will be different from those in the

(*Continued on page 527*)

LATEST BROADCASTING NEWS.

PLANS FOR THIS YEAR'S "PROMS."

A ST. PAUL'S RELAY—THE TIDWORTH TATTOO—"SKYLARKS" & "SOB STUFF," ETC.

THE 1930 season of Promenade concerts at Queen's Hall, the fourth arranged under the auspices of the B.B.C. and the thirty-sixth of the series, is framed on the orthodox lines.

It could not be otherwise. Accordingly, Mondays will be Wagner nights; Wednesdays will be devoted to Brahms and Bach, and Fridays to Beethoven.

On Tuesdays miscellaneous works will be given, and British composers will have their own evenings on Thursdays. Saturdays will, of course, be given over to popular programmes.

A St. Paul's Relay.

Evensong will be relayed from St. Paul's Cathedral at 3.15 p.m. on Sunday, July 27th. Everyone will hope that broadcasts from our London Mother Church will now be a regular feature of the programmes. We shall make a further announcement on the subject in the near future.

The Tidworth Tattoo.

Although most people will argue that military tattoos can be much more enjoyable when seen than when heard over the wireless, there are large numbers of listeners who like the relays each summer from Aldershot and Tidworth.

The Aldershot Tattoo has come and gone, but the Tidworth Tattoo is yet to be. It will be broadcast on the National wavelength.

Two Sunday Features.

Two religious broadcasts of outstanding interest are in the National programmes for Sunday afternoon, August 3rd and Wednesday afternoon, August 13th.

The first is an Old Contemptibles Service which is to be relayed from the Church of St. Martin-in-the-Fields, and the second a service from Norwich Cathedral, marking the 1,300th anniversary of the founding of the cathedral. (We hope to give further details of these broadcasts in our next issue.)

"Skylarks" and "Sob Stuff."

Charles Brewer's latest revue for Midland Regional listeners is due on Wednesday, July 30th, the humorous side of aviation being the theme. Mr. Brewer has called this show "Skylarks," and relies upon Alma Vane, Mary Wyndham, James Prodger, Alfred Butler and Charles Herbert with the Aerovue Chorus and a couple of pianists to keep it going. It should be an enjoyable item.

Gordon McConnel, who devises a similar type of programme for London listeners, is producing "Sob Stuff" on Monday, July 28th (National) and again the following evening (London Regional).

"Doon the Water."

Every year Scottish stations include a light programme feature entitled "Doon the Water," based on a trip in one of the pleasure boats from Glasgow down the Clyde.

This year the programme will be heard on Saturday, August 2nd, and will, as usual, be arranged by Tom Mailey, the cast including Meg Buchanan, Jean Taylor Smith, and Tom K. Uquhart of the Scottish National Players, and Helen M. Wallace and Harold M. Whiteman of the Ardrossan and Saltcoats Players.

Miss Gwendoline Mason.

A spot of harp music is down for Midland Regional listeners on Sunday afternoon, July 27th, when Miss Gwendoline Mason who, of course, is Welsh and who is recognised as a leading harpist at many important concerts in London and big provincial towns, will play a number of airs, including a Fantasia specially written for her by Herbert Bedford, and based on well-known old Welsh folk songs. We should add, perhaps, that Mr. Bedford is partly of Welsh extraction, although he does not seriously claim to have more than a quarter of Welsh blood in his veins.

THE PORTABLE AT THE PICNIC.

This holiday party is anxiously awaiting the weather forecast to know whether they ought to catch the steamer back home, or have another glorious day by the water.

TECHNICAL NOTES.

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

Curing Howling.

A READER wants to know why it is that howling, which occurs in an amplifier, may sometimes be overcome by the very simple process of reversing the leads to the low-frequency transformer. This is a very well-known effect, and for that reason some experimenters are rather apt to place too much reliance upon it.

I should mention that where the howling is really serious, you will probably find that the mere reversal of the L.F. transformer leads will not be sufficient to cure the trouble. The howling is often caused by reaction, and the reason the change-over of the leads has the effect of stopping the howling is because it removes the instability in the circuit by cutting out the reaction or feed-back.

Receiver Design.

I was talking a week or two ago about improvements in the design of radio receivers, and in this connection you will be interested to know that the question of tone control is now receiving more and more attention from set makers. Although we have long had different simple methods of volume control, tone control has not been so common, although it is quite as important.

Attempts have been made for years to provide some simple method of controlling the tone from an ordinary gramophone. For instance, little gadgets have been put on the market adapted to be fitted to the soundbox, so that when a record is being played the shrill tones can be softened down whilst the lower tones are reproduced with their proper "roundness," the whole thing being continually under the control of the operator.

Local Interference.

I often receive letters from listeners who have changed over from batteries to mains units and who then find that they suffer from local interference whereas they were quite free from this before the change-over.

I have a letter before me at present from a reader who complains that since he put in an H.T. mains unit he has been incessantly bothered by interference from a flashing electric sign near by.

He says he is quite unable to cut out this interference, and he wants to know why he should be troubled with it now when he never noticed it before.

It is not always possible to say exactly what is the explanation in these cases, but there is no doubt that in the majority of cases the interference is actually transmitted over the electric supply wires and gets into the receiver via the mains unit leads.

When you are using an H.T. unit the high-tension part of your circuit is indirectly connected to the mains, and although regular hum is cut out by the smoothing circuits in the unit, any serious interference, such as that produced by the switching on and off of powerful electric signs, is bound to get through.

Sometimes, of course, you will get this kind of interference even when using batteries, the interference in this case being picked up by the aerial and other parts of the receiver direct.

It is very annoying; it is also, unfortunately, very difficult to cure, and in very serious cases there is sometimes, nothing for it but to go back to batteries or to use batteries when the interference is "on," and the mains unit when it is "off."

Double-Range Meters.

Most experimenters possess some sort of voltmeter—I mean a low-reading voltmeter up to, say, 6 or 10 volts, but comparatively few seem to feel the need for an instrument reading up to 100 or 150 volts, or for a milliammeter.

(*Continued on page 528.*)

"PHILEMON" GOES ABROAD

Our well-known contributor, who was long famous for his broadcast talks "Through My Window" tells of his adventures with "Belinda," a portable set, during a journey to Italy. Belinda is a talkative "young lady" who attracts a considerable amount of attention to herself and her guardian.

I AM writing this on the shore of Lake Maggiore waiting for the boat. The journey has had its excitements. Belinda started to talk as soon as we left Dover. It was amusing to see the disgusted looks on the faces of our fellow-passengers. "These wretched gramophone people!"—you know the kind of thing they say. But to take Belinda for a gramophone was too much, so I continued to annoy them. At 6.15: "Here is the first news," they edged a little nearer. At 6.30: "We are now going straight over to Lord's Cricket Ground," they gathered round. The first-class came from the upper deck and gathered round.

"Only One Belinda."

The whole ship gathered round. The captain forgot his wheel. The engine-room men came out like rabbits from a warren. The boat, with a heavy list to our side, was left to steer herself, like an old horse going home to the farm from market. Belinda was the centre of attraction. I could have had an O.B.E. for the asking. "That's a fine set you've got there," said a belted earl to me. "Yes," I replied, "it's Belinda." "Never heard of the make." "There is only one Belinda," I said, as proud as his lordship's butler.

Most of the crowd were going to Paris. They were all smiles as they bid Belinda good-bye. Our train was not crowded. As there were no "thirds," we went "second." Red plush! Fancy! I put Belinda on the seat, told her to be quiet, and went for some dinner.

A Little Difficulty.

I found it difficult to get Belinda to talk in the train. On the seat, on the floor—not a sound. I took her on my knee! She whimpered a little. I held her suspended out of the window. That was better, but inconvenient. How to get topside of the train's vibration? It was about nine o'clock. A small boy with adenoids and a long neck kept looking round the corner into our compartment. I enticed him in, gave him some chocolates, and stood him on his head between the seats. His long rubber-neck took the vibration famously. I stood Belinda on his upturned soles, and got the Fat Stock Prices splendidly. I stoked the "shock-absorber" with more chocolates.

Two "Conferences."

He was getting an ugly colour. But just when the Archbishop of Canterbury was being announced to speak on the Lambeth Conference, the youngster's mother spotted him by his feet! A different kind of conference followed. I trust the Lambeth Conference will be as lively! Exit mother and child! He came several times again in the morning, offering himself to be Belinda's footstool, but one such interview with his mother was enough for me. She was awful—what they call a virago! She was the first virago I have seen!

Having had the adenoids removed, I was at a loss. I then bethought me of the large coloured ball which we are going to throw at each other when we are bathing in the lake. I blew it up, not too tight. I put it between two valises, and sat Belinda on it, like a pouffé. Nothing could have been better. It was then about 10 p.m. I began to calibrate. It seemed the thing to do. What is the use of being abroad with Belinda unless you calibrate? I got on to the familiar mark of the National Programme, but Paris was chattering right on the top of it. I couldn't get clear. I could just hear some faint music which sounded like Tchaikovsky, but it was no go. Paris held Belinda's heart. But there were rivals in the offing. Just a little down the dial scale, somebody was "damning" something. When I got it more clearly, it was a gentleman in Berlin saying "Herren und Damen" at intervals in his address. Just a little above Radio Paris on the scale there was music which might have come from anywhere; the announcer spoke what sounded like Dutch. It was probably Huizen. Belinda was behaving like a perfect lady. We got Langenburg, and Oslo, without difficulty. And then, suddenly, two men in uniform stood in the doorway!

A Spot of Bother.

I switched off Belinda modestly cast down her eyes. The officials asked me something. I replied with one of the two French sentences I know, to the effect: "The hat of my aunt is blue and is cheap." They seemed angry, but then French officials always seem to me to be angry. They said something else, to which I replied with the second of my two sentences: "May I bring my doll to breakfast?" They pointed at Belinda. It was the finger of judgment. She had no licence in France. She had no licence anywhere in Europe, dear soul; and was "defendu," "vietato,"

(*Continued on page 532.*)

THE PORTABLE DOES A LITTLE ENTERTAINING.

A group of guests at a garden party given in the South of France welcome a "spot" of radio entertainment.

CURING FADING.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having benefited on many occasions by my weekly investment of 3d. I feel bound to write and point out an experience of mine, which I have not seen in print. It may be useful to your readers.

Recently I took down my set to rewire, etc. Having very carefully re-assembled, I have, since rewiring, been troubled with fading, preceded by a "muzziness" of notes. Certainly reaction, etc. was not so good as before rewiring, but until the fading occurred, the set performed well. This fading has troubled me a lot, and although every part was tested, the trouble was not located until yesterday. Possibly the solution would be obvious to you, but I think it would puzzle many an amateur.

I have a 2-mfd. condenser across the H.T., and when I re-assembled the set I forgot that on the transformer used in this set, I had, owing to the often occurring transformer whistle, reversed the secondary connections. When I re-assembled I omitted to do this, and as the condenser was used no squeal was heard, but the fading occurred. It is simple, but it is the last thing to look for.

Had I tested the set without the condenser, the squeal would have been heard, but it seems quite possible that there may be others troubled in the same way. My set is a "straight 3" but the same trouble could exist in any set. In last week's issue I notice the usual enquiry regarding transformer whistle, and as this develops with use in some transformers, it would be a useful point for those employing condensers across H.T., for no whistle would be heard, while the set might deteriorate even without the fading I experienced.

Having reversed the secondary connections the set is now nearly the desired 100 per cent mentioned in one of your articles. I have an output filter circuit, and Ultra Air Chrome Speaker fitted in a large cabinet. With a pentode in last stage it is good.

I seldom use earphones, but could get America on ultra short waves at loud-speaker strength, given favourable conditions, prior to rewiring. I hope this still maintains.

Yours faithfully,

Deal. J. T.

SOUTH AFRICAN RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—As I have been a keen reader of your excellent publication for the past few years, I think the following may be of interest to you.

For the past two months I have been consistently logging Rome on the loud speaker at audibility ranging from R4 to R6. My set is a home-constructed screen-grid, detector, and two stages of audio amplification. Thinking you may care to publish the H.F. side circuit diagram in "P.W.," I am sending on same.

That this is not freak reception is proved by the fact that any evening after our local Johannesburg has closed down I tune them in. My nearest stations are Cape Town and Durban, both 500 miles away, and Johannesburg 1,100 miles. Thus it can be seen that this outfit is pretty efficient as there is not a night in the year that I have not one or other of these stations on the loud speaker.

The distance from Rome to here is about 5,200 miles and I believe there the power used is 3 k.watts.

Yours faithfully,

D. C. SHANKS.
(Radio Z T 2 A.)

Coils	
H.F. coil 75 Grid coil 60 Reaction 50	300—550 metres.
H.F. coil 6 Grid coil 6 Reaction 5	19—50 metres.

P.O. Box 43, Humansdorp, S. Africa.

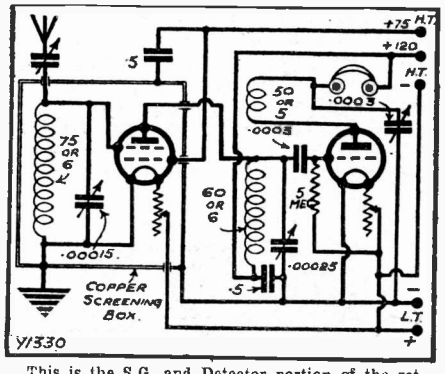
CORRESPONDENCE.

CURING FADING

SOUTH AFRICAN RECEPTION — THE "NEUTYPE" FOUR—THE "TINY" TWO.

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.

BRINGS IN THE WORLD!



This is the S.G. and Detector portion of the set used by Mr. Shanks in South Africa.

THE "NEUTYPE" FOUR.

The Editor, POPULAR WIRELESS.

Dear Sir,—Allow me to thank you and your technical staff for a remarkable set, the "Neutype" Four. I completed this circuit in two evenings and when the time came for a test out, I was greatly surprised and pleased at the results obtained.

I have been a regular reader of "P.W." for some years, and have hooked up many of your circuits, but the "Neutype" tops the bill for ease of operation, clarity, volume, and in fact everything that can be desired in a modern set (even to the elimination of the "B.P.s" in a degree or two!). I am using specified components with the exception of the transformer, which is a Ferranti A.F.3. I will not trouble you with a list of stations logged, but it will suffice to say that there were not a great number of European stations which I did not tune in on the speaker.

Thanking you again for a really good circuit.

Yours faithfully,

L. H. HOOPER.

Essex.

The Editor, POPULAR WIRELESS.

Dear Sir,—Perhaps the following hint will be useful to some of your readers who have made the "Neutype" Four. I found that a Brookmans Condenser, in series with the aerial terminal and the X coil, makes the best volume control and does not affect tone in the slightest degree. Wishing your paper and experts every success.

Yours faithfully,

W. G. GEORGE.

London, N.22.

THE "TINY" TWO.

The Editor, POPULAR WIRELESS.

Dear Sir,—The results obtained from this set are little short of remarkable. My brother and I got it up together during Easter, and the test out on an ordinary aerial gave every confidence of good results on a "tree aerial."

We packed same and went off for a trial in the country, to be precise the trial took place on Sneedhams Green, which is almost within the shadow of the Cotswold Hills. Using 100 ft. "tree aerial," 2 ft. iron rod for earth, Marconi H.L.210, and Lissen pentode with 100 volts on plate, the National (1554·4 metres) and Regional (479·2 metres) programmes were received at excellent loud-speaker strength, speech being readable at a distance of 14 yards. The pentode will work on 60 volts for plate, but the quality suffers slightly.

Radio Paris and Eiffel Tower were also received at fair strength.

Tests on my ordinary aerial after dark has shown that the set is not backward in DX, as Oslo, Langenburg, Milan, Rome, Dublin, Katowice, Glasgow, Frankfurt and Toulouse have all been received at loud-speaker strength.

Yours faithfully,

Gloucester. W. R.

SHORT-WAVE NOTES.

By W. L. S.

AS we are now in the thick of the season during which a great number of Canadians and Americans pour into this country, the London "hams" in particular have been receiving a fair crowd of visitors.

One of the greatest thrills connected with amateur radio is the meeting of a brother amateur who has previously been only a signal "on the air" to one, although he may be a close friend before the meeting.

I have had the opportunity of talking over matters with three or four visitors to this country just lately, although they have not all come from the States, and their views are rather interesting.

The Britisher Scores.

The one point on which all the Americans are unanimous is that the average Britisher is far more technically minded than his counterpart in the States, and although he has less money to spare on radio gear he makes better use of it.

We are apparently to be sympathised with on account of our particular location on the globe (which, I am afraid, cannot be altered at the moment!) compared with that of the States, for, while we are having our long spells of bad conditions here, there is hardly ever a time over there when some part of the world is not coming through well. This rather confirms my theory that I put up a fortnight or so ago.

Incidentally, things are still just as bad as ever here, and I am quite resigned to the fact that 1930 will go down in history as the "Black Year of Radio."

Short-wave supersonics still seem to be a controversial subject. After my recent work on the subject I am inclined to the view that, as a telephony receiver, the super-het. is unsurpassable. For amateur Morse work its advantages are very doubtful on account of the duplication of stations through receiving each one in the two positions, as the oscillator beats on the upper and lower side of their carriers.

I believe that the intermediate-frequency amplifier that follows the detector is capable of giving a greater amplification on signals and less on "mush" than a low-frequency amplifier giving the same overall "mag.," but otherwise there is nothing in it for C.W. work.

Another point I have noticed just recently is the effect of a screened-grid stage before the detector on the length of aerial necessary. Results are just what one would expect; with the screened-grid stage working well there is very little diminution in signal strength when one shortens the aerial, although with the same aerial coupled closely to the detector there is an enormous effect. The fact that practice follows theory is sufficiently unusual to warrant a mention of this effect.

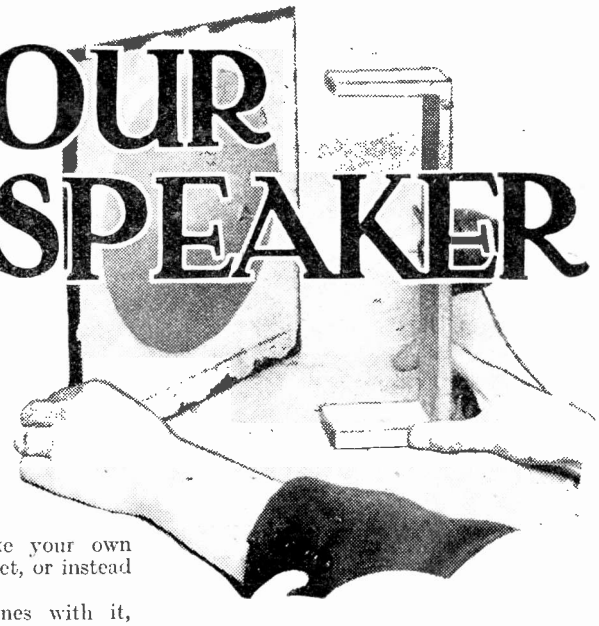
Incidentally, this might form a good test of whether a screened-grid stage is working properly.

Transatlantic Telephony.

The queer, unintelligible noises that are sometimes heard on the transatlantic 'phones are not due to single side-band telephony or any modification thereof, if my deductions are correct. I believe that, when secrecy is desired, they modulate the carrier-wave with a supersonic frequency, and that the modulation we hear is the difference between the speech frequencies and this supersonic frequency.

It should be possible to make it intelligible again, but I am not giving any hints in case I make myself unpopular with the authorities who desire secrecy.

MAKING YOUR OWN LOUDSPEAKER



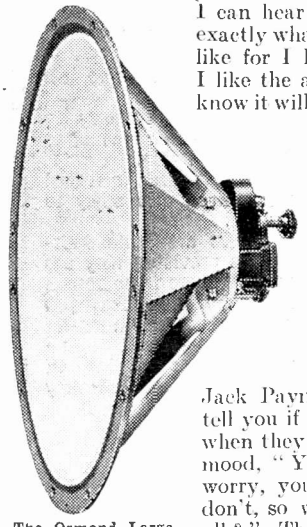
A practical article about a fascinating occupation at which every "P.W." reader should "have a go."

By ROBERT BLACK.

HAVE you ever seriously considered making your own loud speaker?

Perhaps you have already weighed up the pros and cons and thought to yourself something on the following lines.

"If I buy a complete loud speaker I *do* know exactly what I am getting. I go to the dealer's and I can hear it. I know exactly what it will look like for I have seen it. I like the appearance. I know it will tone beautifully with the furniture in the rest of the room, I have got the maker's name behind it, and, finally, I don't have to worry."



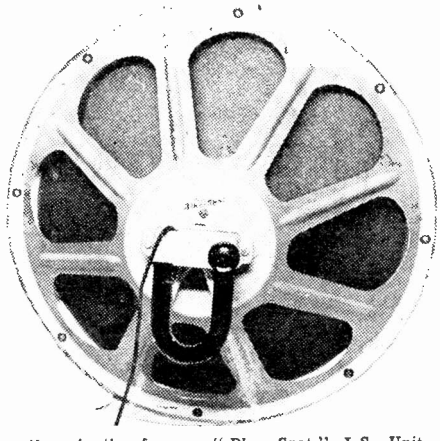
The Ormond Large Cone Chassis, with its adjustable unit.

Now as Jack Payne's lads will tell you if you listen in when they are in lively mood, "You die if you worry, you die if you don't, so why worry at all?" This idea that the making of a loud speaker is a worrying business ought to be nailed down once and for all, for on the contrary it is an interesting and profitable job. Think of the other side of the question for a moment.

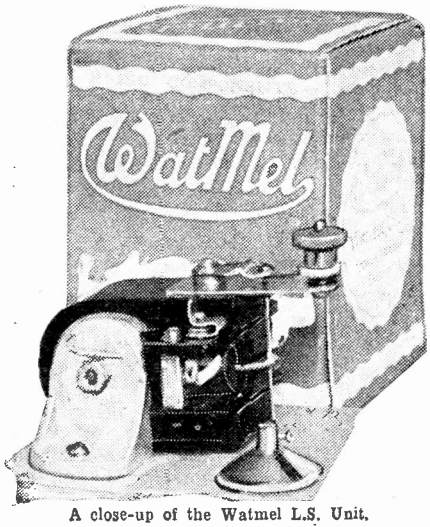
If instead of buying a complete loud speaker you buy a loud speaker unit and "make you own" all sorts of interesting possibilities are opened up. You can make your own cabinet, adapt, or buy a cabinet, or instead use a baffle-board.

You can try different cones with it, different methods of mounting the cone, and you can try different *sizes* of cone. The beauty of all these stunts is that they are accompanied by subtle differences of tone which if you are a musician, or have a musical ear, will be a constant source of satisfaction and pleasure.

If you are not particularly interested in the experimental side at present, the fact you will be saving money should be attractive. The unit is the heart and soul of the loud speaker and this you purchase ready-made. Having the unit, what else remains before you can listen to it?



Here is the famous "Blue Spot" L.S. Unit mounted on its chassis and ready for placing inside your own cabinet.



A close-up of the Watmel L.S. Unit.

Easily-Tried Improvements.

Well, it is provided with a little driving rod, and that driving rod has to be fixed to a cone, and that cone must be supported in some way, attention being paid to the effect of the support on the reproduction.

As no doubt you are aware, the unit and cone can be held in their correct relative positives on a proper "chassis."

If you have plenty of time and are moderately handy with tools you could make a wooden chassis or framework that will be absolutely satisfactory in use.

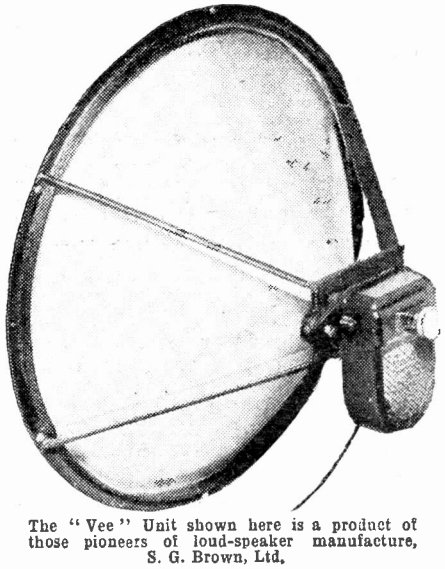
Various kinds of stiff paper, such as "kraft" can be tried for the cone, many of them being marked ready for cutting, and all of them being easily tried. If you like clean, crisp reproduction of the top stuff and high notes you will probably choose a stiffish paper, and there is plenty of room for experiment in doping and "loading" a paper cone.

There is a wide and interesting field of experiment in using thin wooden partitions, etc., for a diaphragm instead of a cone. One of the most natural effects I have ever heard was obtained by an ingenious householder who had a "serving-hatch" or trapdoor between his kitchen and dining-room, and who fitted up this as a "diaphragm."

Diaphragm Diversity.

Thin wood was used, fitting exactly into the hole in the wall, and an ordinary L.S. unit was fitted direct to the centre of the trap-door which thus became a wooden "diaphragm."

Worked from a three-valve set, the volume was ample for both rooms. The quality was unusually good, as the whole wall between the rooms was acting as a baffle. Anyone who has tried such a stunt will admit that one of the most interesting things about radio reception is the making of one's own loud speaker.



The "Vee" Unit shown here is a product of those pioneers of loud-speaker manufacture, S. G. Brown, Ltd.

FROM THE TECHNICAL EDITOR'S NOTE-BOOK.

Tested and Found—?

GECOPHONE MOVING-COIL SPEAKER.

THE moving-coil type of speaker is rapidly gaining popularity, and the latest people to commence manufacturing this type are the G.E.C.

I do not think that there has ever been any doubt as to the superiority of the moving-coil system in the minds of amateurs, but there must naturally have been a certain amount of—well, suspicion, against a speaker costing so much more than the simple cones and being built on relatively heavy lines.

Perhaps it was thought that even if fine results could be obtained it would only be so if a very powerful set were employed. This is not, of course, strictly the case. You want a *good* set because a moving-coil speaker can always show up faults.

Of the G.E.C. moving-coil speaker the makers say:

". . . The suspension device and the speech coil former are machined from one piece of duralumin, and as the number of separate parts to be secured to the cone is reduced to a minimum, the most potent source of chatter in a moving-coil speaker is thereby eliminated.

"The machining throughout is to fine limits, and this enables an extremely small gap to be employed between the field magnets and the coil, with its attendant high efficiency and great sensitivity. Only 10 watts are required to energise the field magnets at very high magnetic flux density.

"The framework of the diaphragm is of aluminium, so that while it is comparatively light it is rigid, and it is firmly clamped to the pot to support the cone at its periphery. This cone is of impregnated paper, and it is suspended by very flexible calf skin, with a generous rim of felt at the diaphragm edge where it makes contact with a baffle.

"The Gecophone moving-coil loud speaker is designed both for A.C. and D.C. main supplies.

"In the case of the A.C. model a rectifying unit forms part of the speaker chassis, and is surmounted by a valve holder carrying an Osram U5 full-wave rectifier. Valve rectification has been adopted because of the advantages it offers in the simplification of the smoothing system, and the uniformity of the output voltage.

"This A.C. model is suitable for use on mains having a pressure of 200/260 volts, with a frequency between 50 and 80 cycles, and clearly marked terminals, with an ebonite safety cover, conduce to correct connection to these mains.

"An input transformer is incorporated in this model, and as it is centre-tapped, it permits a choice to be made of two impedances to match up with the output valve of the set to which it is connected. This transformer, because of its centre-tapping in its primary winding renders the use of an extra intermediary transformer unnecessary when employed in conjunction with a pull-push amplifier.

"Furthermore, in view of this transformer, the loud speaker can be used direct in the anode circuit of the output valve in any type of set, or with a choke condenser output filter, a provision which makes for safety as well as contributing to general efficiency.

"The D.C. model incorporate all the features of the A.C. model with the exception of the rectifying unit. An adequate smoothing device copes with the mains input in such a way that a remarkable background silence is secured.

"Like the A.C. Model, an input transformer forms an integral part of the unit, thereby offering just the same facilities for connection. Ample safeguards are employed, so that it can be connected with impunity on any mains within a 200/260-volt range. Its sensitivity and quality of volume are a revelation.

"One of the fundamental factors in the successful performance of a moving-coil loud speaker is the inclusion of a baffle. While both the Gecophone moving-coil loud speakers dealt with above are available in chassis form only, and therefore require the provision of a baffle for full efficiency, they can also be obtained mounted in a baffle.

"The baffle adopted as a standard is a singularly attractive one in the shape of a small easel. The loud-speaker chassis is firmly affixed to this in such a way that there is no undue tension at the point of amalgamation, and no possibility of the centre pole-piece in the magnet pot failing to maintain its essential right angle to the face of the diaphragm frame."

So, as you can see, this G.E.C. product is very far from being a haphazard design. And as you also will have gathered it does not work as such. Actually its results are very fine. Its sensitivity is of an exceptionally high character, indeed, I think it is by far the most sensitive moving-coil speaker I have ever come across.

It is more sensitive than the average cone speaker, so you will agree that in this respect it is rather wonderful.

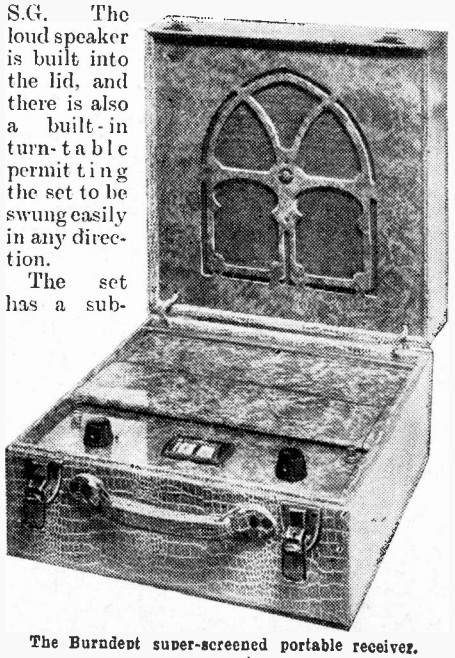
And it gives you full bass together with a brilliant upper register. It can be successfully operated with quite an ordinary kind of set, such as a Det. 2 L.F. three.

I think it deserves 100 points out of 100 for its all-round efficiency as judged by present-day standards, which are a lot superior to those of only a year or two ago.

BURNDEPT PORTABLE SET.

We have had an opportunity of testing the Burndept Super Screened Portable Set. This receiver employs four valves, one of which is an S.G. The loud speaker is built into the lid, and there is also a built-in turn-table permitting the set to be swung easily in any direction.

The set has a substantial and handsome leather case with a walnut finish. Wavechange is available with one simple switch.



The Burndept super-screened portable receiver.

It is not an unduly heavy outfit, more particularly when it is remembered that, unlike some portables which have been offered to the public, it has an adequate battery equipment.

The results it gives are well above the average. The quality of reproduction compares favourably with that of any set of any type, and it is completely stable in operation.

There is not the slightest tendency towards instability on either wave-band and this, in a portable having an out-of-the-ordinary degree of sensitivity, is quite surprising. The controls are perfectly straightforward and are simple in character and pleasant to handle.

Station-searching is facilitated by the provision of accessible and smooth-running controls.

On test we had no difficulty whatever in locating half a dozen stations in daylight, and these were received at full loud-speaker strength. At night, of course, the range of the instrument is considerably extended.

Should an even greater number of distant stations be required, aerial and earth terminals are provided so that an extra-ordinary antenna can be used.

The Burndept Super Screened Portable, complete with valves and including royalties, costs £23 10s. in either a walnut or mahogany finish.

A GRID-LEAK HOLDER.

A neat device which will doubtless find its way into the gadget boxes of many constructors is the new Burne-Jones grid-leak holder. It is a very simple but very useful little article.

There are two clips, which will accommodate any ordinary grid leak easily and securely, and two terminals fixed on a bakelite base drilled for baseboard mounting. The article is completely satisfactory, and costs only 6d.

When you are Buying—

23.—A MILLIAMMETER.

A milliammeter should have a low resistance—the lower the better. Some of the cheap ones have higher resistances than is advisable for such instruments if they are to be used for checking anode currents in valve sets.

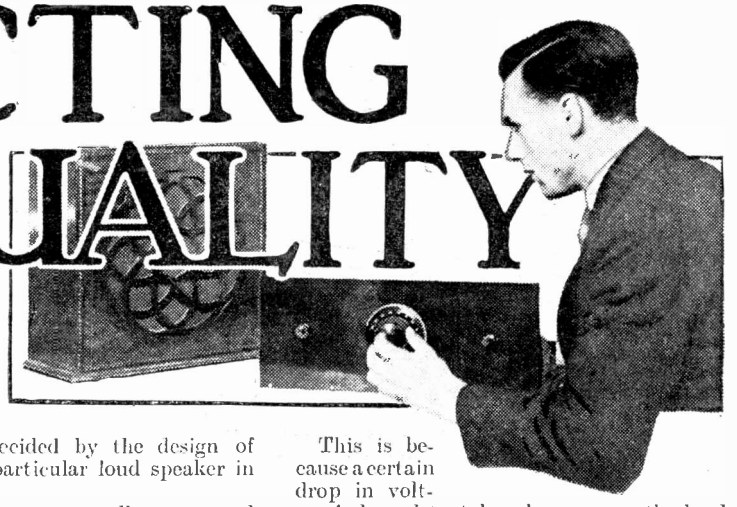
Always see that the scale adequately covers the ranges you are likely to work over—but don't have too great a margin or your readings will tend to be less easily readable.

If you want to deal with currents up to 20 milliamperes a meter reading to 25 would prove quite suitable.

Many of the remarks made in regard to voltmeters last week also apply to milliammeters.

Multi-range meters are quite satisfactory propositions providing they are of reputable make. There is no reason at all why a meter should not show you several ranges, for it is merely a matter of resistance shunts—there is no mechanical "wangle" about it. Of course, the shunts must be accurately arranged.

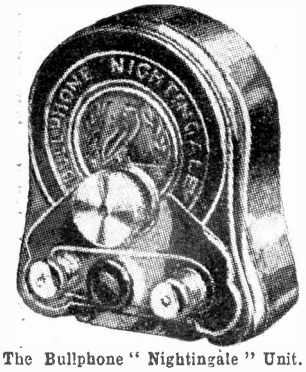
CORRECTING YOUR QUALITY



Some practical hints on overcoming those little faults in the set which prevent you from getting the best results from your loud speaker.

By A. S. CLARK.

NO matter how good your loud speaker—no matter how large your aerial—no matter how many valves you have—and no matter how superior your set is, unless it is being worked properly you cannot even hope to get passable quality! You can go on tuning-in all night, or adjusting your loud speaker for hours on end, and avail yourself nothing.



The Bullphone "Nightingale" Unit.

It is a great pity that sets capable of giving good quality should be allowed to go on pouring out "noise": because the adjustments necessary to correct the quality are so easily carried out.

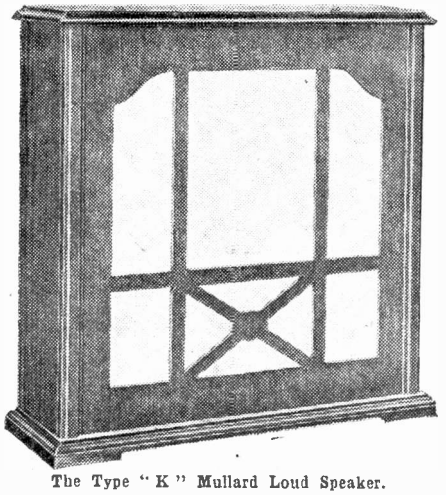
Avoid Overloading.

Strictly speaking an uneven overall response curve is distortion in itself, but this is not the distortion which gets on one's nerves. The shape of the response curve really only determines the tone or pitch of the results.

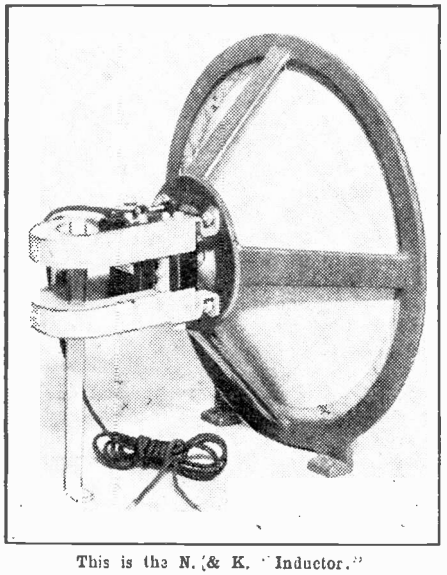
Also the question of what is the best pitch is a matter of personal opinion entirely. It is decided by the design of the set and the particular loud speaker in use.

The distortion we are really concerned with is of the "horrid" type, which produces tinny, screechy, boomy or rattly reproduction, and is generally caused by overloading, incorrect grid bias, or a poor H.T. supply.

Probably the first of these, namely overloading the last valve in the set, is the most common cause of bad quality. It is literally impossible to get good quality without a power valve of some sort in the last position (referring to working a loud-speaker, of course).



The Type "K" Mullard Loud Speaker.



This is the N. & K. "Inductor."

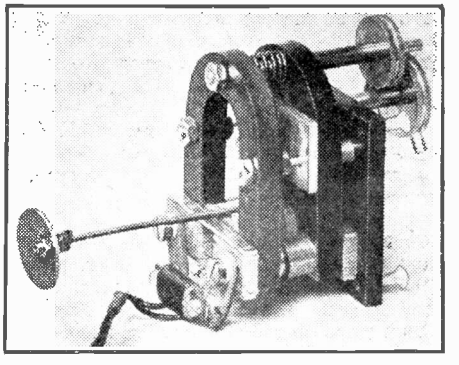
Yet in spite of this, many sets are working or trying to work a loud speaker, after an ordinary L.F. valve. Give your speaker a fair chance and use a power valve, and don't try to get more volume out of it than it can handle.

G.B. and H.T. Voltages.

You will find that most makers give a table with their power valves showing the correct values of grid bias for various H.T. voltages. The plate voltages given apply to the voltage at the plate of the valve, and not the actual voltage of the H.T. battery.

If, however, you are using an output choke of good quality these two voltages will be near enough the same. When your loud speaker is connected directly into the plate circuit of the last valve you should allow about 20 volts off the H.T. value before looking up the right grid bias voltage.

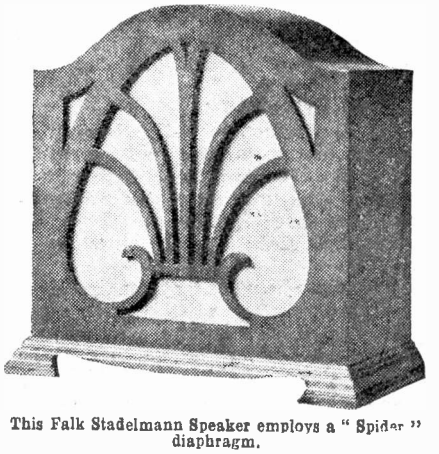
This is because a certain drop in voltage is bound to take place across the loud speaker winding. If you know the D.C. resistance of the speaker and the current being passed by the last valve you can of course work out the exact voltage drop by Ohm's Law.



The well-known Wates "Star" L.S. Unit.

When a dry battery is running down, its internal resistance goes up, and may produce L.F. instability by causing back-coupling between valves. Such instability does not always show up in the form of a howl or whistle. It may simply cause distortion to take place.

The way to prevent such battery coupling is by inserting decoupling resistances (with shunting condensers) in the H.T. leads. The detector H.T. supply lead is usually the most effective point.



This Falk Stadelmann Speaker employs a "Spider" diaphragm.

CAPT. ECKERSLEY'S QUERY CORNER

SHORT-WAVE STATIONS HEARD ON LONG-WAVES—SHALL I GET A HYDROMETER?—GRID-LEAK VALUES—A SHOCK FROM THE AERIAL.

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, comments upon radio queries submitted by "P.W." readers. But don't address your queries to Captain Eckersley—a selection of those received by the Query Department in the ordinary way will be dealt with by him.

Short-Wave Stations Heard on Long-Waves.

W. S. (Cambridge).—"I am using a perfectly straightforward set consisting of a detector and two L.F. stages, the aerial circuit being of the tapped coil type. This receiver is quite selective and I have no difficulty in cutting out or separating the Brookmans Park transmission on the medium wave-band.

"When, however, I switch over to 5 X X, I find that the Regional transmitter at Brookmans Park tends to cause interference. I cannot understand this. What is the explanation?"

"A straightforward circuit" consists in an inductance tuned by a condenser. On switching to long waves a new inductance (sixteen or more times the value of the medium wave range inductance) is switched into circuit.

An untuned inductance has an impedance which remains very much the same value over the range of frequencies as between say 200 and 500 metres wave-length. This constant impedance, as apart from a tuned circuit impedance, is enough to offer a high resistance to the passage of all high-frequency currents.

Thus the local Brookmans Park emissions of relatively high frequency simply pile up a voltage across the long-wave inductance regardless of the "tuning" effect by which we normally select programmes. A smaller inductance and a larger condenser to select 5 X X gets over the trouble, but in essence one wants to make the tuning effect apart from the fine impedance effect of the inductance predominant. Anything then for more *selectivity*.

Try a smaller inductance, try a weaker coupling or fine coupled circuit of H.F. tuned stages, all of which should cure the trouble.

* * *

Shall I Get a Hydrometer?

T. R. (Birmingham).—"I have just bought a new accumulator, and I want to keep it in first-class condition. I have been told that the colour of the plates is an indication of the state of charge, and I have also been informed that a hydrometer is essential.

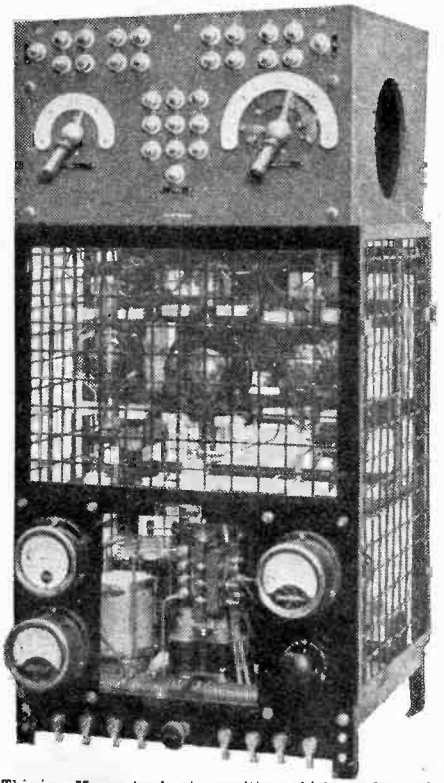
"Is it possible for me to tell from the colour of the plates exactly what condition the battery is in, or must I buy a hydrometer?

It is practically impossible to tell the amount of charge in a battery by judging the colour of the plates. The colour of the plates is a general indication of the condition of the battery rather than a quantitative measure of its existing charge.

The hydrometer is an infallible method, as it measures a perfectly definite quantity. Buy a hydrometer, then, and see that the specific gravity of the acid is kept right relatively to charge and absolutely as regards evaporation.

If the specific gravity is changed absolutely through evaporation, always add distilled water. The relative specific gravity of the liquid gives a measure of the charge.

TRANSMITTER TECHNIQUE



This is a Marconi valve transmitter, which can be used for continuous wave work, or for I.C.W. Note the "all-in" simplicity as compared with earlier apparatus.

Grid-Leak Values.

B. N. M. (Hendon).—"I have a one-valve receiver, and I find that if I replace the 2-meg. grid leak with one having a value of 5 megs. I get much letter reception. Why should this higher value give me increased sensitivity?

"I notice that in practically every published design the value of the grid leak is 2 megohms."

The grid-leak method of detection depends upon the positive excursions of grid voltage collecting electrons (i.e. a negative charge) on the grid, which, since there is a high-resistance path to earth in the grid leak, take time to leak away and to produce a non-proportionate effect as between positive and negative grid excursions.

In other words the negative grid voltage excursions are ineffective in producing anode current and so give rectification by eliminating one half of the charges of the total H.F. grid voltage charge.

Obviously the greater the value of grid leak the more pronounced this effect. But what of linearity of response?

As too high value of leak produces distortion, so it is always a balance between quantity and quality. The 2-meg. leak maybe is high enough for good quality; given other constants, the 5-meg. grid leak is more sensitive but does not give such good quality.

* * *

A Shock from the Aerial.

"PERPLEXED" (South Shields).—"Recently, fearing that my aerial might get struck by lightning, I disconnected this during a storm. Later on, after the storm had ceased, I attempted to connect this to the set, and received a violent shock. Why did I get this shock?"

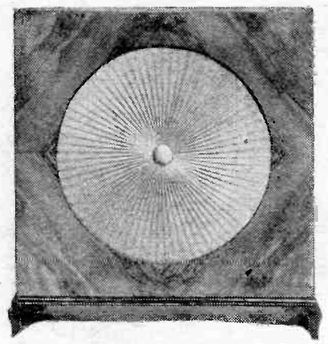
You got this shock because the aerial got charged up as an insulated conductor. The celebrated Franklin (the first one, not "C. M.," who designed the beam station transmitters) flew a kite on a conducting wire and he insulated the wire from earth and drew considerable sparks from his kite-carried conductor.

As you go up and up into the air the electric potential of earth increases with increasing height. In a thunderstorm this potential increases more rapidly than when the electric state of the atmosphere is more stable.

So if you put a wire into the air it collects a charge, and this charge, since the wire is a conductor, spreads itself evenly over the wire. But when you, an earthed body, touch the wire, the charge passes in you to earth and you give a jump!

Moral, if, as you should, you disconnect your aerial during a thunderstorm, earth it as well. Use a switch which in the off position earths the aerial; in the "on" position connects the aerial to the set.

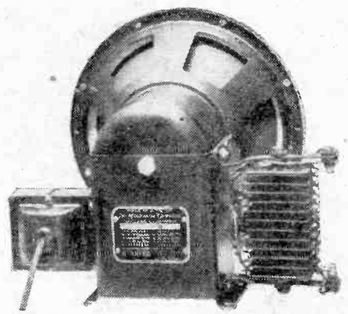
LET "P.W." HELP YOU TO CHOOSE YOUR NEW LOUD SPEAKER—



This attractively-finished instrument is the Loewe Cone Type Loud Speaker.

In any case you probably go home and think it all over, you recall all the prons and cons, balance for and against, and after all your trouble you find that you are very much in the position from which you started. So what are you going to do now?

The first thing to do is to cheer up. The sure and solid truth of the matter is this. There is an enormous variety of loud speakers from which to choose, every type has its own enthusiastic adherents, and nearly every enthusiast believes so firmly in his own favourite that he cannot help thinking that all the others are poor in comparison.



The dry rectifier shown attached to the framework is used in this A.C. version of the "Magnavox" X-core Moving-Coil instrument.

The Search for Perfection.

Actually and as a matter of technical interest there is no really *perfect* loud speaker at all. That does not matter very much because not one person in five thousand could recognise perfection if they heard it!

The point to remember is that the modern loud speaker is a very good instrument indeed. There are several different types, and these types have their different advantages and limitations. From the point of view of programme-enjoyment they have one thing in common—they are all good!

All this talk about the excellence of one type of loud speaker, or the still greater excellence of another type, is a sure proof of one fact—a proof that there is a steady search for perfection. There is a keen desire for realistic reproduction. There is an enormous and very critical audience concentrating upon every different detail of the loud speaker's performance.

Unwanted Resonances.

The fact that we are still progressing and finality has not been reached should not blind us from seeing that we have gone a very long way in our quest for quality. Let us see where the modern loud speaker, which you can buy at the shop round the corner, really stands when compared with its predecessor.

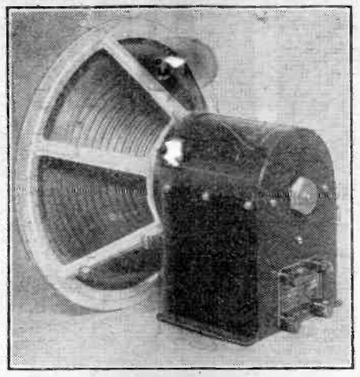
The loud speaker of a few years ago was simply a glorified telephone earpiece. There is no necessity for me to enter into the action of it here, as this has often been dealt with in articles in "P.W.," and in any case most readers will have an idea of the action of the diaphragm.

In the earlier types very pronounced resonance effects were common. That is to say, the peculiarities of its construction tended to make the loud speaker exaggerate certain frequencies at the expense of certain other frequencies.

Incapable of reproducing the deep notes of the organ or the boom of drums, nevertheless these old-fashioned small-horn loud speakers were sometimes very good when reproducing speech, and their sensitivity was frequently phenomenal.

Experiments with the size and shape of the horn of loud speakers soon began, and are still going on, but public attention was largely directed away from these by the advent of the cone speaker. Breaking right away from the older type, this class of loud speaker uses a large conical diaphragm, driven by a unit to which it is joined by a short driving rod. The prospective purchaser will find many points of real interest in this class of instrument.

A great deal of attention has been paid to the driving unit itself and every detail of its action has been overhauled with a view to improvement. For instance, the air gap between the armature and the magnet, across which the magnetic action takes place, early came in for attention.



Above is an up-to-date D.C. version of the B.T.H. "R.K.," forerunner of all the moving-coil loud speakers. Below (to the left) is shown a Burndept Cabinet Cone (price £2 10s. in oak or mahogany). Beside it is the Ferranti D.C. chassis, of which Cabinet and Pedestal models are obtainable.

The methods of applying the magnetic force across this were greatly improved by the "balanced armature," and not only was the sensitivity of the instrument increased but its evenness of response and ability to reproduce different musical frequencies without showing marked preferences for certain notes on the audibility scale were greatly enhanced.

Cone and Coil.

Side by side with these improvements in the magnetic action many other equally important improvements were being effected. A very wide variety of materials has been experimented with in the search for the perfect cone diaphragm, and all sorts of likely and unlikely substances have shared popular favour at different times.

A stiffened paper or "cardboard" foundation is still commonly used, and among other substances adopted have been various skins, parchment, doped linen and so forth.

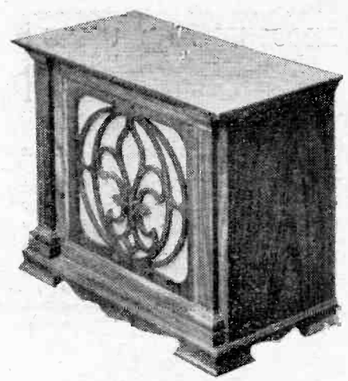
Development along these lines was in itself sufficiently promising when the whole situation was once again altered fundamentally by the arrival of another type altogether—the moving-coil loud speaker. Using a large conical diaphragm similar to that of the ordinary cone loud speaker, its principle of action is entirely different from that of the other types.

The result is that there are now in common use three different main types of loud speaker—viz. those in which a horn is employed; those in which a large diaphragm is driven by an electro-magnetic L.S. unit; and those in which the driving force is a moving coil.

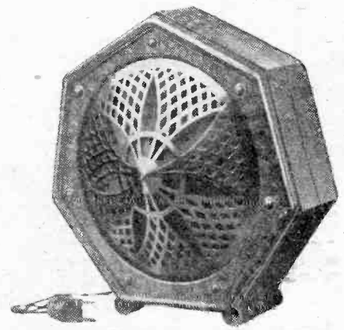
In the latter type of speaker no sensitively-trembling armature is used, but affixed to the centre of the diaphragm is a light coil of fine wire, through which the set's output is passed. The coil, centred on the diaphragm, is placed in an intensely powerful magnetic field, and every variation of current through it causes it to alter its position. It thus moves the diaphragm to and fro in accordance with the received currents.

A New Departure.

There were some very remarkable differences between this and the preceding methods of reproduction. One outstanding fact was that the moving coil itself was its own driving and restoring force, not dependent on springs and similar resonance-producing mechanism. Another feature of great importance was its robust construction and generous size, allowing it to handle enormous volume.



This attractive Kolster Brandes model employs a balanced armature.



This Philips Loud Speaker is fitted in a moulded bakelite cabinet, and an ingenious lead-switch gives three different impedance values.

Long Life.

So much for the main characteristics of the types at present on the market. How do these fundamental differences affect the purchaser?

"How long will it last?" is one question that crops up immediately, and in this respect all modern loud speakers are really satisfactory. Used properly they will "carry on" year after year—in fact, most disused loud speakers have been "improved away," supplanted by better instruments, long before they were worn out. A silent

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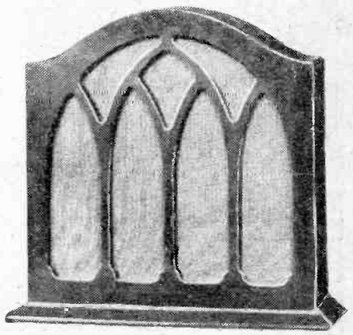
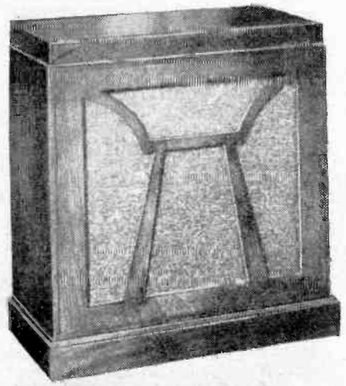
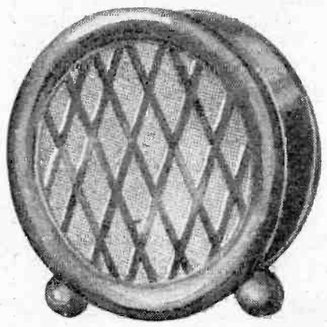


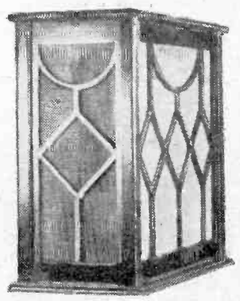
Look at the Wonderful Variety of Modern Loud Speakers now Available!

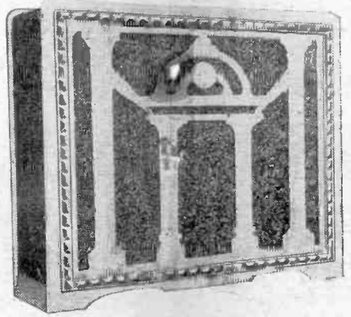
Of the five loud speakers in the centre below, the first is a Triotron, employing a balanced-armature unit. Next comes a linen-diaphragm speaker, made by Moores, of Liverpool, and in the centre is one of the Ultra Electric Ltd. models. The chassis model, standing beside it, is an "Undy" product, and last of the centre five is the famous Z30, made by Celestion, Ltd.

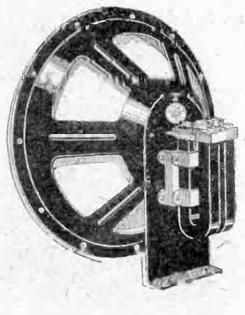


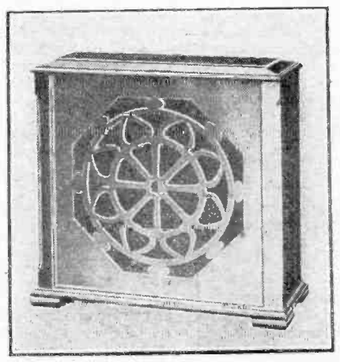
The famous Lissen Moving-Coil Speaker is available in both permanent magnet and electro-magnetic types, or without this handsome cabinet if cost is a first consideration.

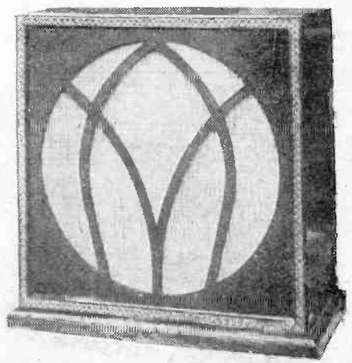












Above is the Amplion Standard Cabinet-Cone, which employs a sensitive balanced-armature unit. It can be obtained in oak, mahogany, or walnut, and alternative values of impedance are available.

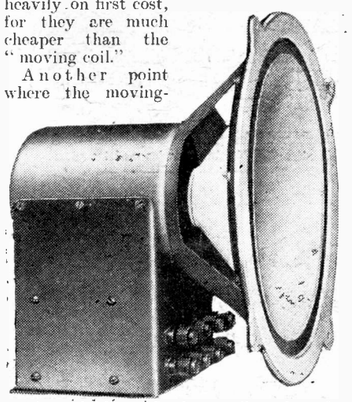
—WHATEVER YOUR NEEDS THERE IS ONE MADE TO SUIT *YOU!*

CHOOSING AND USING LOUD SPEAKERS.

(*Continued from previous page.*)

tribute to the great progress made in the last few years!

Assuming long life for all types, what about first cost, running cost, and quality of service rendered? Cone types score heavily on first cost, for they are much cheaper than the "moving coil."



Bakers, of Selhurst, Croydon, are the makers of this moving-coil, which, like all such assemblies, is used in conjunction with a baffle-board or cabinet.

Another point where the moving-coil loud speaker compares unfavourably is in running cost. The "cone," once purchased, has merely to be fed from the set's loud-speaker terminals, and will go on giving splendid service without further expense. The "moving coil" needs "feeding."

(It is true that some moving-coil speakers *do* get their field-magnetism from permanent magnets, and so, like the cone types, have no running costs. But the mains-driven or the battery-fed types are far more commonly used.)

Comparative Costs.

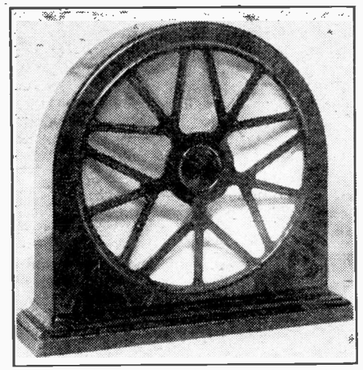
If you have electric light in the house you can drive a moving-coil speaker from the mains and hardly notice its upkeep cost, for the power consumption is quite low, and is usually less than that of an ordinary lamp. With D.C. mains the field winding simply goes straight across the mains, but with A.C. mains some form of rectifier is needed, and this usually puts up the first cost of the instrument.

As an alternative to driving from the mains there is the moving-coil speaker that is battery-driven, a very large 6-volt accumulator being commonly employed for the purpose. This battery, of course, has to be recharged, so the method has no advantage in running cost as compared with the direct-mains-driven type.

Apart from this question of running cost, there is quality.

How does the moving-coil *quality* compare with the "cone"?

Theoretically the "moving coil" should be better, and most people having heard a good M.C. speaker operating properly will claim that for quality it stands supreme. (Nevertheless not *all* M.C. speakers can beat *all* the cone types, and personally I would much prefer a good "cone" to a poor "moving coil.")

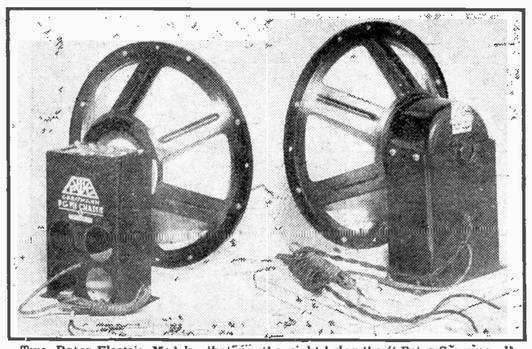


In this Whiteley Boneham instrument the cone is placed behind the driving unit.

The Question of Quality.

This question of quality is one on which many rash statements have been made. You will sometimes hear it said that moving coils are too "boomy"; but whilst this was true of earlier models, it certainly is not an inherent fault in later types, which are marvellously bright and crisp in their rendering of "the top stuff."

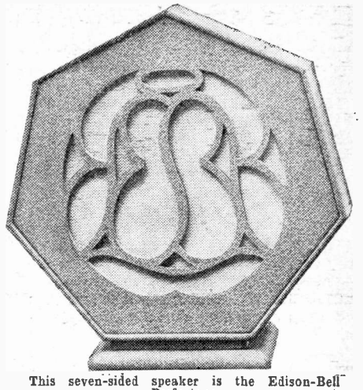
In general, if you can afford a good price for a loud speaker, it will pay you to do so, but the questions of cost are too involved to dogmatise over. If you fancy one of the "moving coils," don't forget to ascertain its running costs. (These can be worked out accurately by the dealer.)



Two Rotor-Electric Models, that on the right being the "Peter Grassman" Moving-Coil.

Remember, too, that your results will not depend for quality upon the loud speaker alone. That is merely one end of a chain, every link of which is important.

The set itself, the valves, the proper maintenance of the batteries—all these are important. And so also is the method of connecting the loud speaker to the set.



This seven-sided speaker is the Edison-Bell Perfectone.

The ideal method (especially where several rooms are to be "wired" for radio reception, and where large volume is required) is to use an "output filter." This takes the form of a choke-condenser circuit or of an output transformer, and has many advantages.

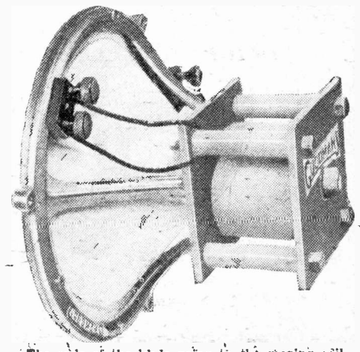
The more expensive moving-coil speakers not only contain their own "filters," but are recommended for use with certain valves, H.T. voltages, etc., and all such makers' hints should be studied beforehand. With less expensive speakers and less ambitious output requirements, the question of filters is less important, but it is always well worth considering.

Some Final Hints.

The leads to other rooms, etc., should be permanently wired, as trailing flex is very unsatisfactory. Where extensions are to be used a filter circuit becomes essential, for otherwise the extensions must be treated as "live" wiring and this is obviously inadvisable.

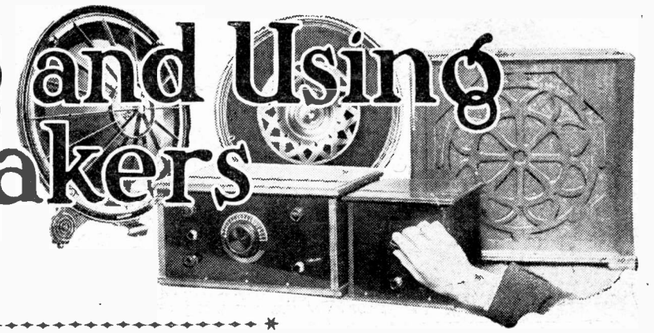
Standing near a bare wall, a loud speaker seems "brighter," and placed before a curtain it may lose a tendency to "ring" a little on certain notes, so be sure to find which position in the room seems to suit it best.

Another factor that makes a great deal of difference to the enjoyment obtainable from a loud speaker is the method of volume control. Gadgets for this are obtainable everywhere, and full details for fitting it are issued with the volume control.



The ends of the leads going to the moving coil are clearly shown in this Goodman M.C. Speaker.

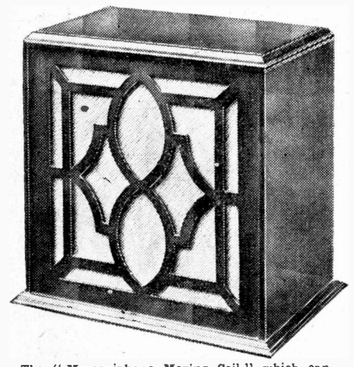
Choosing and Using Loudspeakers



BY P. R. BIRD

A practical talk about the various types, the ways in which they work, and the methods of getting best results.

NOWADAYS not many people are hardy enough to buy a loud speaker by its appearance alone, or on the strength of what the first salesman says about it. Usually a few enquiries are made among friends, but the results from this method are apt to be rather puzzling.



The "Marconiphone Moving Coil," which can be obtained for A.C. or D.C. mains drive, or for battery operation.

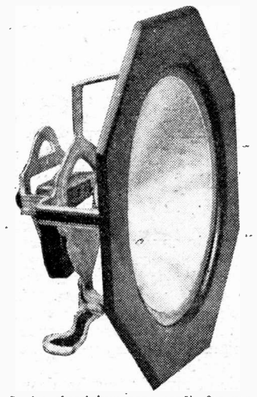
You find that different people have different ideas, the only similarity being that each considers his own fundamentally right and everyone else's idea fundamentally wrong. You speak to Jones for instance, and you find that he is superbly certain.

Other People's Ideas.

"I've got a so-and-so," he says. "It's simply wonderful! You ought to get one. You ought to hear mine. You ought to come round and listen to it."

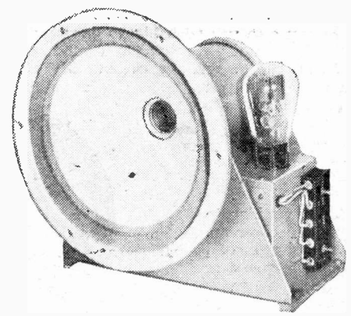
You do, and very likely you wish you had not! Jones may be a good fellow—but his idea of music is not your idea of it.

Or perhaps you speak to Smith—a quiet, knowing chap in whose radio judgment you have faith. But Smith—himself a quiet man—likes a really *loud* speaker.



This Squire aluminium cone cradle for use with any standard unit retails at 15 -.

You do not have to go to his house to hear it, you can listen to it in the road. The power is phenomenal and the likeness to a band unmistakable.



This Gecophone Moving Coil Speaker is for use with A.C. mains, the valve shown being the necessary rectifier.

hear all about peaking and middle-range-resonance, and you will come away from him with thousands of technical terms ringing in your ears and dull despair in your heart.

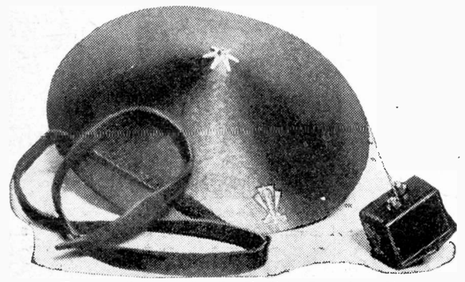
Then you call on a dealer. He reverses the whole business once again. He shows you this, he shows you that, he shows you the other. Sometimes you get a world of help from him. Sometimes you don't.

Get it Demonstrated.

Sometimes you get the impression that he does not care a hang what he sells you, so long as he does sell it. While on the other hand he may be an obliging and efficient salesman who will willingly demonstrate any model in which you are interested.

(*Continued on next page.*)

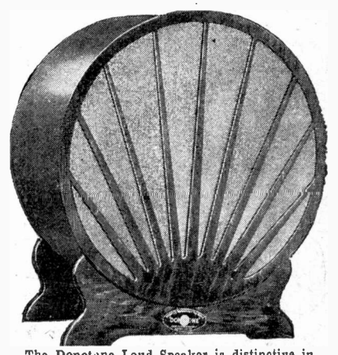
READY TO BUILD YOUR OWN.



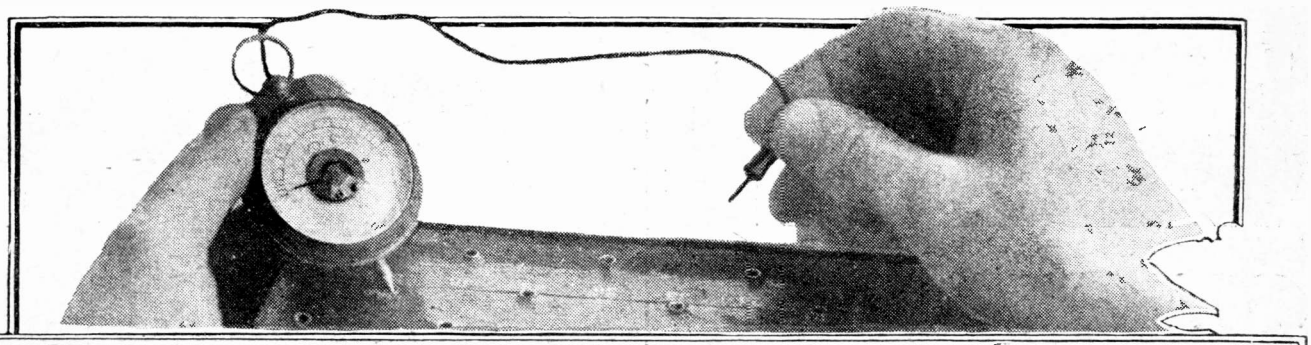
Here are the parts for the Six-Sixty Cone Assembly.

You could hear the drums, you could hear the flutes, but your ear drums ached for days! And when Smith tells you how much it costs him for that outfit you shake your head and sadly fade away. (Wonderful it certainly was, and probably worth its cost, but *where's the money to come from?*)

So you try again and this time you ask the acknowledged local radio expert. You immediately release a flood! He'll talk to you earnestly about a falling characteristic, and he will carry on about cut-off for hours. From him you will



The Donotone Loud Speaker is distinctive in both principle and appearance.



CAN THE VOLTMETER LIE?

Invaluable as the voltmeter is to the experimenter, there are many little points about the use of it which are worth knowing and are clearly set forth below.

By R. W. HALLOWS, M.A.

THERE used to be a saying that the camera could not lie, which was more or less taken for granted until the first producer of faked photographs appeared with pictures showing all kinds of incredible subjects. So with the voltmeter.

Most of us are content to take it, so long as the instrument is of known accuracy, that the readings which it shows are correct. Actually it can lie as hard and as effectively as the camera!

Principle of a Voltmeter.

Let us see what electromagnetic voltmeters really do. Their action depends upon the basic fact that a magnetised needle suspended in the field of a coil is deflected in one direction or the other when current passes through the windings, the amount of the deflection depending upon the strength of the current.

This is the principle of the moving-iron voltmeter; the moving-coil voltmeter is a development of it. Here we have a coil, carrying a pointer, suspended in the field of a permanent magnet. The coil moves, carrying the pointer with it, when current is passed into the windings.

Suppose that we take a milliammeter reading from 0 to 100 and place in series with it enough resistance to bring the total of the outside resistance *plus* that of the windings to 1,000 ohms. Then by Ohm's Law each volt will drive one milliampere through 1,000 ohms, and we can make a scale reading from 0 to 100 volts.

So far so good, but remember that for a full-scale deflection, or in other words a reading of 100 volts, a current of 100 milliamperes is necessary. This we should call a low-resistance voltmeter; its resistance is actually 10 ohms per volt.

High-Resistance Meter.

We can make a high-resistance instrument by taking a milliammeter reading from 0 to 1 milliampere and obtaining a total resistance of 100,000 ohms with it. Since 100 volts drive 1 milliampere through 100,000 ohms, the instrument can be calibrated to read from 0 to 100, only 1 milliampere being required for a full-scale deflection. Such an instrument is said to have a resistance of 1,000 ohms per volt.

Let us see how each of these instruments can lie when used to measure voltages in the wireless set. A high-tension battery with an original E.M.F. of 108 volts has been in use for some months.

We wonder whether it is still in good condition. We apply to it first of all the low-resistance voltmeter, and are rather surprised to find that the reading obtained is only 22 volts.

We are still more surprised when on using the high-resistance instrument we note a reading of 99 volts. Both instruments are known to be accurate. Clearly one has lied. Which is it?

The answer, strange as it may seem, is both! From the practical point of view, considering, that is, whether the battery is up to the work of supplying the plates of the valves, the low-resistance instrument has given the truer reading.

But it has not measured the real E.M.F. of the battery. Neither has the high-resistance instrument, for it is actually something rather higher than the 99 volts that it shows. "How the? Why the? What the?"

Exactly; it is very perplexing, is it not? When a dry-cell battery has been in use for some time, its internal resistance, which was at first not more than a small fraction of an ohm per cell, rises enormously.

Internal Resistance of Battery.

The E.M.F., when a battery is old, has to drive current through the considerable resistance not only of the voltmeter, but also of the battery itself. Hence with a battery that has seen much service, the low-resistance instrument gives a reading which is far below the real one.

If we were to short circuit an old battery through a milliammeter, we might find that it could not supply so much as 25 milliamperes.

As the receiving set will draw from 5 to 35 milliamperes in the ordinary way the low-resistance voltmeter does give us a fairly good indication of the fitness or otherwise of the battery to undertake the work in hand.

The high-resistance meter does not. Even when it is on its last legs the battery can provide the fraction of a milliampere needed for a big movement of the needle, and if we take a reading with the battery not under load we obtain a completely erroneous idea of its state.

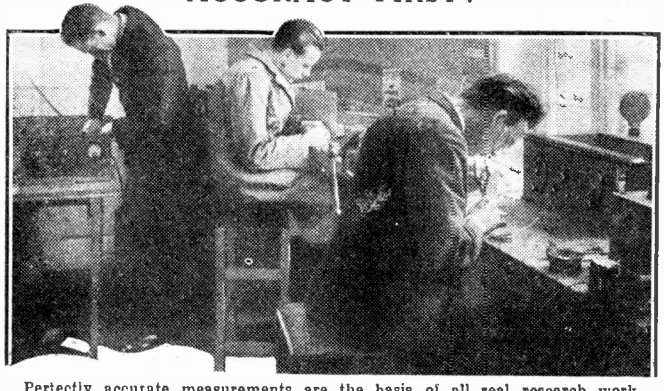
With what kind of filament voltage are the valves in the receiving set operating? Muggs pulls out one of them and connects the voltmeter across the low-tension terminals of its holder.

The Correct Method.

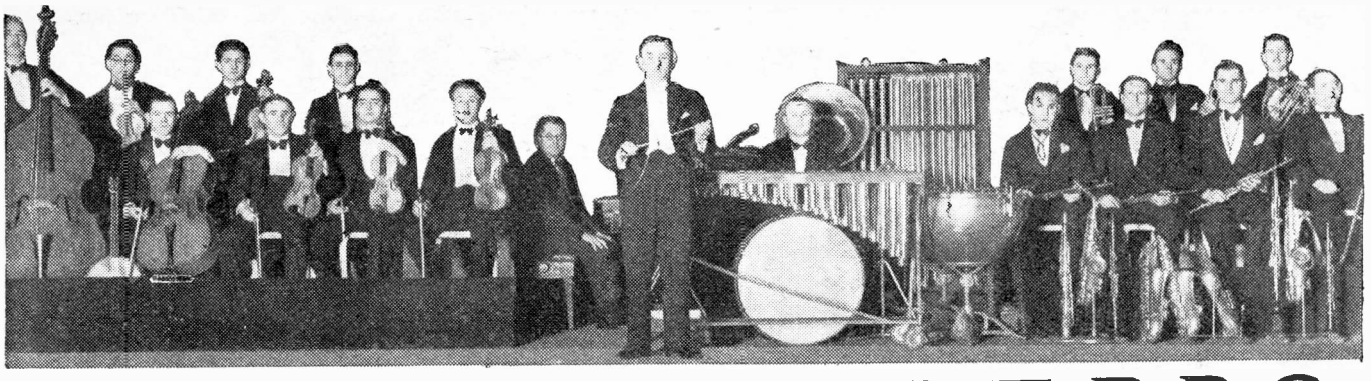
He is surprised to find first of all that though a good deal of resistance is in use the filament voltage is surprisingly high, and secondly that his manipulation of the rheostat produces only the tiniest changes in the voltmeter readings.

Has this rheostat broken down? Not a bit of it! Let Muggs replace the valve in its holder, keeping the voltmeter connected up, and he will find that the rheostat has a big effect. With the valve out of its holder the instrument lies; withthe valve in place it gives a fairly accurate reading.

ACCURACY FIRST!



Perfectly accurate measurements are the basis of all real research work. This illustration shows a section of the research laboratory in which the Robinson Stenode Radiostat was evolved.



IF I CONTROLLED THE B.B.C.

by CECILY COURTNEIDGE

This popular artiste has some very revolutionary ideas about broadcasting, and we leave it to "P.W." readers to decide for themselves just how seriously she wants her remarks to be taken!

THE hard, sane, practical man of affairs will tell you that day-dreaming is a waste of time. If that is the case, I must find some excuse for doing so in this article. And that is easy! Why, day-dreaming is one of the most important things in the world.

Wireless itself would not exist but for the day-dreams of Lodge, Marconi, and others. The whole of civilisation is founded upon the fantastic visions of primitive peoples. So that's that. Day-dreaming is henceforth permissible.

A Little "Supposing."

But let's do a little "supposing." Suppose that I controlled the B.B.C.! What should I do with it? How should I control it? What alterations would I make in the programmes? Or in and amongst the official machinery and workers of Savoy Hill? What would be my justification for controlling the B.B.C. at all?

That's also easy. The wireless programme is similar to a huge revue in that there is a little bit of everything, and each separate item must be good. And I am accustomed to revue. Although I know little or nothing of the inside working of the B.B.C., I flatter myself that I know something about my own sphere of action.

So I think that I should endeavour to run all the weekly programmes on the lines of a tremendous and comprehensive revue. Everything would be worth while, everything would suit somebody, each separate item would be an integral part of the whole.

You may say that that is how the B.B.C. is forming its programmes to-day. Too true! Perhaps my day-dreams are a little too close to reality. So let's go farther afield and suggest improvements and alterations that have never been thought of or carried out before.

The First Step.

First, then, I would make it compulsory for the Press to publish in series above the printed broadcast programmes, the photographs of the announcers.

In this way, the languishing heart of a maiden in Oswaldtwistle would be satisfied, and the said maiden might even wonder why she had ever loved the announcer's "golden voice" at all, and would go straight away to marry that nice young man who takes her to the pictures.

For similar reasons, I would make marriage compulsory for Jack Payne, who is too eligible a bachelor to sing such stirring love ditties into the microphone night after night. Should he dare to defy me and refuse to marry, an equally good solution would soon present itself.

I should marshal all his listeners, and compel them to sing the songs to him until the padding in the studio became necessary for more reasons than one.

DIRECTOR GENERAL?

Miss Cecily Courtneidge, the famous radio and revue artiste, who is scoring such a tremendous success in "The House That Jack Built," at the Winter Garden, says she would run broadcasting as a "tremendous and comprehensive revue" if she controlled it.

The wireless licence would next present itself to me for amendment, and I think that I should either halve its cost, or abolish it entirely. The deficit could be made up by a small tax on all tremulous tenors and wobbling sopranos, and a very large tax indeed on comedians who failed to be funny.

Listeners also could be reformed. The writers of letters of complaint would each receive six months hard labour in the studios—this would easily wipe out my salary list!—and all others would be forced to say what they really thought of the programmes.

In this way I should learn what the public really wanted. But perhaps these frightful schemes would be a little too revolutionary. We should soon have no listening public whatever.

Seriously, though, what reforms could be carried out by the B.B.C.? At one time, the charge of too much "sameness" in the programmes and failure to suit all tastes could easily be levelled, but with the new scheme of alternative programmes, all programme reforms go by the board.

There will be something to suit everyone part of the time. And who wants to listen-in all the time, anyway? Only those who are sick or bedridden, and such listeners, curiously enough, are the last to complain. On the contrary, they usually praise the programmes and seem to think them of superlative excellence. No, any reforms I make at Savoy Hill must be on the administrative side.

An Official Act.

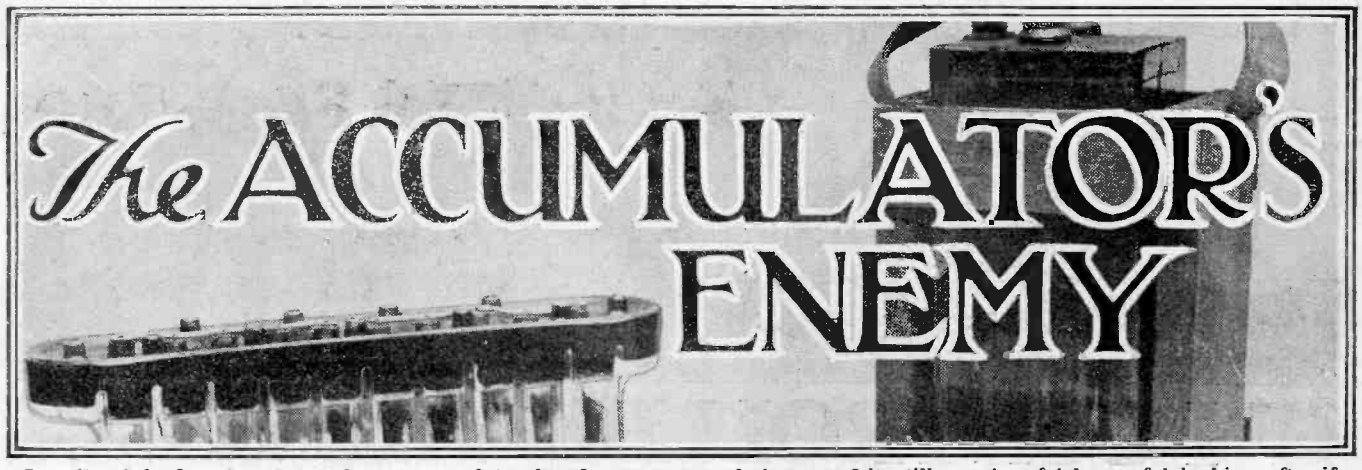
For some time there have been movements afoot for providing the blind and bedridden with sets and licences. I should make this an official act. A doctor's certificate would be sufficient in either case for me to order licence-free sets to be sent and installed.

Also, I would see that the B.B.C. did more than transmit programmes; I would institute a special department that would attend to the reception side as well. It is obviously absurd to try to make wireless transmission more and more perfect when the receiving set still remains at fault.

It is true that some manufacturers give an "After care" service, but I would do more. B.B.C. engineers would ensure that listeners obtained the fullest possible enjoyment and service out of their sets by visiting their homes and examining the apparatus.

(*Continued on page* 531.)

The ACCUMULATOR'S ENEMY



In spite of the fact that the modern accumulator has been enormously improved it still requires fairly careful looking after if it is to remain in first-rate working order. In this article the dreaded "sulphate" is dealt with.

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

AS every amateur of experience knows, sulphating is the great bugbear of all accumulator work. Even the best cell will succumb to the insidious attacks of the lead sulphate enemy if it is carelessly used for any length of time, whilst cheap and inefficient accumulators are quickly rendered more or less totally inactive by it.

The appearance of a sulphated positive accumulator plate.

Yet, surprising as it may seem, lead sulphate, which is so often the cause of an accumulator's ruin, is absolutely essential to the normal working of the cell. When an accumulator is properly discharged, both the spongy lead on the negative plate and the lead peroxide on the positive plate are converted into lead sulphate: but, during the subsequent re-charging of the cell, the latter substance is reconverted into spongy lead and lead peroxide on the negative and positive plates respectively.

Two Forms of Sulphate.

There is a great deal of difference, however, between the lead sulphate which is formed during the normal course of chemical actions taking place within the accumulator, and the lead sulphate which appears as a patchy white mass on the plates when the cell has been improperly used.

The former substance (which is generally termed the "normal" lead sulphate) is not a simple lead sulphate at all. In reality, it has a complex composition, consisting of true lead sulphate chemically combined with sulphuric acid, and, owing to this fact, it is less stable than ordinary lead sulphate; it is readily changed back again into spongy lead and lead peroxide during the normal process of re-charging the cell. It is the presence of this convertible form of lead sulphate which imparts the greyish-whiteness to the plates of an accumulator when it is nearing its run-down condition.

Over Discharging.

When, however, an accumulator is discharged too much, or when it is allowed to remain for any great length of time in a normally discharged condition, a portion of the convertible lead sulphate changes into true lead sulphate. This process goes on at both plates, but more particularly at the positive plate of the cell.

At first the change from the convertible form of lead sulphate to the ordinary form of that substance does not proceed evenly all over the plates. Therefore, the pure white masses of ordinary lead sulphate appear on the plates in patches, which "grow" until eventually they cover the plates entirely.

Many samples of ordinary water contain iron and sulphates as impurities. These, too, set up little chemical actions in the cells when an accumulator becomes "sulphated."

Thus it will be seen that the manufacturers' exhortation to use only the purest acid, together with distilled water, is no fad, for the employment of such materials are vitally necessary to the continued health of the accumulator.

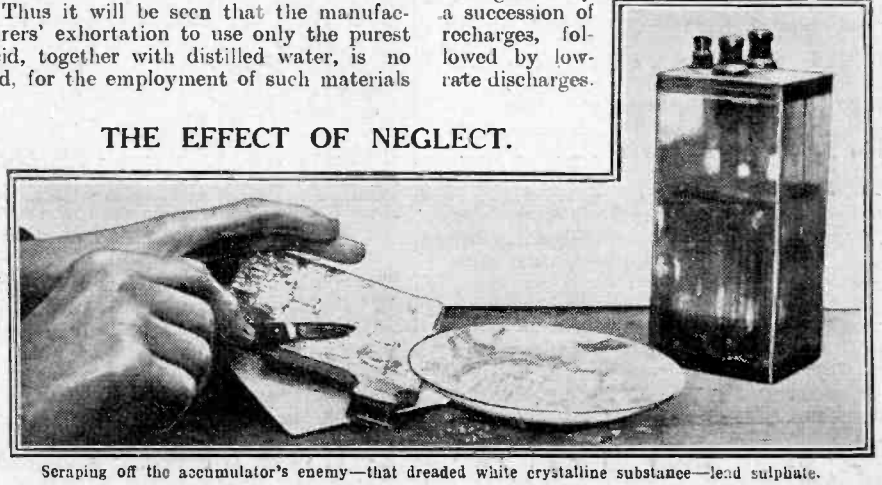
Simple Explanation.

You may, perhaps, ask why the formation of insoluble lead sulphate ruins an accumulator. The explanation, however, is very simple. For one thing, the insoluble form of lead sulphate is *not* reconvertible into spongy lead or lead peroxide as is the normally-formed complex sulphate.

Hence, the insoluble sulphate, by covering up the active material of the accumulator plates, more or less completely prevents the necessary interchange of the latter substance during the discharging and recharging of the cell. Insoluble lead sulphate is a slight conductor. Hence, leakages and short-circuits are liable to occur between the plates of a sulphated cell. Finally, the formation of insoluble sulphate causes the material of the plates to shred and flake away.

Curing Slight Sulphation.

A badly sulphated accumulator is fit only for the scrap heap. Slight and medium cases can generally be cured either by removing the plates and immersing them in an ammonium acetate solution in order to dissolve away the sulphate, or else by emptying out the acid from the cell, and filling up with ammonium acetate solution, and so dissolving out the sulphate. Or, on the other hand, such accumulators may be remedied, if the degree of sulphation is not great, by a succession of recharges, followed by low-rate discharges.



Scraping off the accumulator's enemy—that dreaded white crystalline substance—lead sulphate.

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

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. Lile, 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 reception. 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.

CONE QUALITY THAT "FELL OFF."

F. J. L. (Sheerness, Kent).—"Using a —— cone loud speaker, I got such beautiful tone and quality that I decided I would put the whole affair into a bigger and better cabinet (my job is cabinet-making), and, knowing nothing about the wireless part of it, I was careful to shift it en bloc, simply building the new cabinet round the old one.

"At first it went fine, but somehow it seemed to fall off later, and all the 'truth' and sharpness went from the music and speech. Looking for the cause of this, I could see nothing wrong except one screw a bit loose, and that seemed to be a 'fixer' and nothing to do with the working parts. I tightened it, but no better.

"Please give me advice as to how to find the cause? I am tempted to put it back again into its old position, but for the fact that at first it *did* work well in the new. Why should it go off like this? (I am enclosing sketch showing position of screw that was loose.)"

Your little sketch has solved the mystery for it indicates that the entire loud-speaker unit is held in position by this loosened screw. When the screw became loose the unit moved slightly on its frame, and though you have now tightened the screw matters are not improved because the unit is not placed "square" with the cone.

What you must do is to undo that screw again and find the old setting (or position) of the unit relative to the cone. Probably when the screw got loose the unit *dropped* a little, so try raising it a little higher than its present setting, at the same time looking carefully to see if it appears out of line to the right or left.

If the cone has a soft material (such as "kid") for a surrounding support, see that this "sets" evenly and is not strained to one side or the other.

By using care you could try it whilst signals are coming through quite safely, the essential part of the test being *slight* movements of the unit on its support to find the position in which it drives the cone squarely to and fro, without any side-pressure.

When satisfied with the position, tighten up the screw and the job is done.

THE L.S. ADJUSTING SCREW.

"CONE" (Buntingford).—"What does the adjusting screw on a cone loud speaker actually do? I have been surprised to find how much depends on getting this adjustment 'just right' for volume and tone."

The adjusting screw enables the position of the permanent magnets to be varied relative to the armature that is actuated by them.

Normally, the armature is still, but when current "strengthens" the magnet the armature is attracted, thus pulling the diaphragm to which it is attached by the driving rod. The closer the magnet is to the armature the greater the pull for a given current.

But if the armature is too close it will touch the magnets when a loud signal comes along, and this causes a most unpleasant rattle.

The best way to set the speaker is to listen carefully whilst slowly adjusting, and bring the strength up and up till the magnet touches, immediately slackening off just a little to give the necessary clearance but retaining as much of the volume as possible.

IMPROVING SELECTIVITY.

K. T. (Falmouth).—"I am holidaymaking and touring in this district with a couple of friends and to liven up evenings I brought my 'Magic' Three along. It goes splendidly here; in fact, I get so many extra foreigners now that Daventry (5 G B) doesn't 'butt in,' that I should like to get better selectivity when I return home.

"I had been told before that my 'Magic' was not as sharp-tuned as others of exactly the same kind. Is it likely to be the fault of the set, or of something in the position, or what?"

Your selectivity may be affected by several factors the chief of which are outlined below:

First of all, there is the question of coils. Cheap and inefficient coils are one of the most fruitful causes of poor selectivity. They are really very false economy, if your conditions are such as to require a high degree of selectivity. The really good ones, such as the Lissen, Lewcos, etc., are well worth while and have a great influence on the general efficiency of your receiver.

The cause of poor selectivity with a "Magic" set is sometimes to be found in the coil holders. There are a certain number of specimens on the market made of very low-grade moulded material which introduce very considerable H.F. losses into the circuit.

These, we have found, are definitely quite capable of reducing the overall selectivity very considerably, and a little care should be exercised here. See that your coil sockets are of really good quality and by some reputable maker, and then you can dismiss this particular detail.

The aerial and earth are also very potent factors in deciding the degree of selectivity which you will obtain, and it cannot be emphasised too much that a very large aerial is really a hopeless proposition under modern conditions of crowded wavelengths. It is far better to use an aerial of only moderate size, and depend upon the great power and sensitivity of your "Magic" receiver to give you the range and volume you desire.

THE AERIAL AND EARTH.

Do not forget, too, that an inefficient aerial can spoil your selectivity just as effectively as a very large one, so if you have any cause to think that something is preventing you from getting the results you expect, take a look at your aerial and ask yourself whether its efficiency is being spoiled by being run too close to walls, iron fall pipes or gutters, and so on.

Above all, remember that it is a most undesirable practice to take your aerial lead-in for any very considerable distance indoors, particularly if that means taking it along walls, and on no account yield to the temptation to use twisted flex for the aerial and earth lead indoors. Always keep them well separated from one another, and if you use any form of earthing switch, be sure that it is satisfactory from the H.F. point of view.

A good earth is a pretty obvious requirement in the interests of selectivity and general efficiency, but nevertheless, it is a point which many people seem to forget. A poor, high-resistance earth, a long earth lead, or an earth lead of too thin a gauge of wire is one of those things which you can depend upon to spoil your results with complete certainty, and this is one of the first questions you should go into if you feel that your selectivity is not up to scratch.

A connection to a doubtful sort of gas-pipe, a single small earth-pin in dry earth, and so on, is definitely not good enough if you desire to get the best possible selectivity of which your receiver is capable. What you want is a short and direct lead to a water-pipe, with a good sound connection thereto, a good-sized earth-pin in damp soil, or one or other of the well-known schemes for obtaining a really low-resistance earth connection.

MILLIAMMETER FOR DETECTING DISTORTION.

G. S. (Gateshead).—"When running normally my last valve takes about 15 or 16 milliamps, and I want to watch variations in this current to check distortion. For this purpose I have a choice of two milliammeters, one reading up to twenty milliamps, and the other reading up to fifty milliamps. Which would be better?"

(*Continued on page* 528.)

CAN WE HELP YOU WITH YOUR SET?

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 by 'phone or in person at Fleetway House or Tallis House.

TECHNICAL TWISTERS

No. 19. THE EARTHING SWITCH

CAN YOU FILL IN THE MISSING LETTERS?

The aerial should always be . . . . . when not in use.

The correct place for the earthing switch is out of doors, immediately . . . . . the aerial.

If the earth plate is directly beneath the lead-in, the wires to the earthing switch can be . . . . . which is the ideal arrangement.

To maintain good contact, the earthing switch should be provided with a . . . . . to protect it from the . . . . . and a wooden box is quite suitable for this.

Last week's missing words (in order) were: Insulated, Earth; Condenser; Short; Aerial, Joint.

TONE AND TUNING.

(Continued from page 599.)

transmitter, and this will militate against the true reproduction of transients.

All this may seem rather trying and difficult, but the practical point is that cascade connection (i.e., H.F. magnification), where each circuit is rather highly damped, should give better *quality* for a given selectivity than if the same selectivity is obtained by forcing one circuit.

The perfect quality receiver then uses, say, two or three rather highly damped high-frequency circuits, push-pull grid-leak rectification with up to 300 volts high tension and push-pull low-frequency amplification and no transformers.

The receiver is made ubiquitous by making the damping of the tuned circuits variable by including ganged variable resistances in each tuned circuit which, when reduced to a minimum introduces a large measure of sensitivity and selectivity for picking up distant stations.

There must be, lastly, a volume control in the low-frequency end so as to reproduce speech and music at the correct relative volume without leaving one's chair.

With such a receiver, where every component has resulted from calculation and not guess-work, and where these main principles have been followed, one might definitely criticise transmission. Until then we must wait for various things to happen in connection with true transient transmission.

RADIOTORIAL QUESTIONS AND ANSWERS.

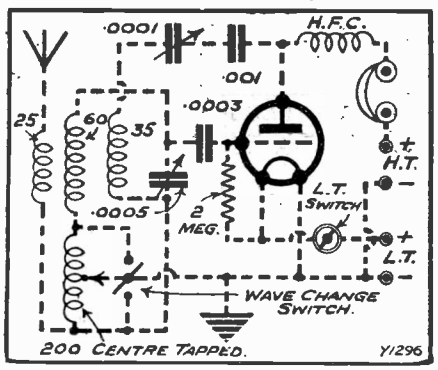
(*Continued from page* 526.)

"I should be inclined to take the twenty milliamp one except for the fact that when the output valve is not biassed it takes well over thirty milliamps which, of course, is far too much for the smaller range instrument, but well within the scale of the bigger one."

"As your main purpose is to check distortion we certainly recommend you to get the twenty-milliamp instrument in preference to that with the higher range, on account of its wider scale.

The needle kicks given by even a good milliammeter are not very big, and it is, therefore, advisable to use an instrument which is nearly "all out" when reading the anode current which is to be checked. When this is the case small variations in average anode current are shown quite plainly, but even so the needle will have to be watched carefully.

POPULAR "WIRELETS" No. 14



The dotted lines show the connections for a plug-in coil one-valver, with easy switching for long waves, the "components" for which were given last week.

On the other hand an instrument capable of taking a much higher maximum reading shows the average anode variations proportionally to this greater figure, which means that your actual needle movements will be smaller than before. So for your purpose the 20 milliammeter scale reading will be better than the 50 milliammeter scale.

The fact that you will not be able to take direct readings of the anode current when no grid bias is being used should not worry you at all, for this is a measurement that need never be taken under ordinary working conditions.

IS THE VALVE "GOING"?

B. J. D. (Exeter).—"Reception seemed to be falling off in strength, and in tone to a lesser degree, so I got a friend to bring his milliammeter round to check the last valve's output current. Instead of the usual 16 it had dropped to 11 milliamps, all H.T. and G.B. battery voltages being right. Do you think the valve's filament emission is going? (I've used it constantly since Christmas, 1927.)"

Probably it is a failure of the filament emission that is causing your symptoms, and you will find it rapidly getting worse till the set is not worth listening to. You have had good service from the valve, but now you need a new one.

H.F. COUPLING.

T. C. H. (Guernsey, C.I.).—"I have become very interested in the 'Magic' H.F. Unit, which I am thinking of adding to my own 'Magic' Two. But the one I have seen working uses a resistance and H.F. choke for coupling. Is this the usual arrangement, as choke and resistance don't seem ideal for an S.G. valve? I always understood tuned anode was better, yet this set gave wonderful distance when the H.F. unit was added."

The "Magic" H.F. Unit employs a form of "parallel-feed," in which the detector's grid circuit acts like a tuned anode circuit. The H.F. choke in the unit is, of course, necessary to supply the path from H.T. + to plate, and the resistance with its large condenser is not for H.F. coupling, but actually for battery de-coupling purposes.

FINAL ADJUSTMENTS OF THE POTENTIOMETER.

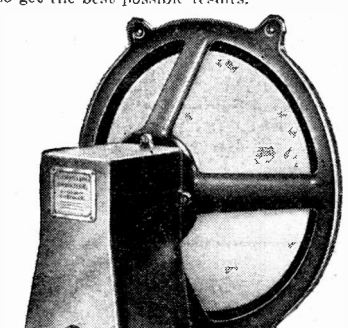
E. S. (West Hartlepool).—"I get fine reception but do not understand the potentiometer on the baseboard (Magic Four), nor how it should be operated. What is the best position?"

You will find that if you place the slider right along at the positive end (the end nearest the 25,000 ohm anti-motor-boating resistance) volume is good, but reaction tends to be a little ploppy. With the slider at the opposite end, on the other hand, reaction becomes exceedingly smooth, but volume on weak distant stations is not, as a rule, quite so good. Evidently something in the nature of a compromise adjustment is needed, and this is how you should set about finding it.

Start off with, say, 60 volts applied to terminal H.T. + 3, and then turn to the potentiometer. Start with the slider right along at the positive end and test the reaction control. You will probably find that the set goes into oscillation with a slight plop (care first having been taken to see that the two dials are in step, and that you are not tuned to the local station.) Now take the slider gradually along towards the negative end of the potentiometer, testing the reaction as you do so.

You will presently find that reaction becomes smooth and you should stop your adjustment at this point. Now tune-in a weak distant station and note the strength you obtain. Next reduce the voltage on H.T. + 3 to, say, 50 volts, and readjust the potentiometer. Now observe what signal strength you get, and you will quite likely find that it is slightly better because you are now able to set the slider of the potentiometer a little further towards the positive end without making the reaction become ploppy.

A little testing on these lines will soon find an H.T. voltage which will enable you to get the potentiometer slider well along towards the positive end, and so get the best possible results.



This is the "Silver Ghost" Inductor Dynamic Chassis, a new Lamplugh product that retails at £3 10s.

WHAT DO *YOU* THINK ABOUT THIS?

A Yeovil reader of "P.W." who had a quality set (Det. and 2 L.F., with choke-filtered output to M.C. speaker) was really *satisfied* with various minor improvements to tone, etc., when suddenly the set's quality went "all to pieces," volume dropped considerably, and the last valve's milliammeter showed pronounced kicks, though grid bias, H.T., and super-power valve itself were proved to be O.K.

Everything else looked all right. Can you guess

WHAT WAS WRONG?

N.B.—There is no prize for answering this, but from time to time we shall give a radio problem (followed the next week by the answer) in the hope that readers will find them both interesting and instructive. (Look out for the solution to above next week.)

If you have ever had trouble with lacquer you guessed last week's problem easily enough, for all that had happened was that the re-lacquering of terminals, etc., was carried out irrespective of contact surfaces, and the lacquer was acting as an insulator.

TECHNICAL NOTES.

(*Continued from page* 510.)

Low-reading ammeters are fairly common, but milliammeters, probably owing to their greater cost, are not so commonly used by amateurs.

As a matter of fact, it is a good investment to have an instrument which will enable you to test the voltage output of high-tension batteries, H.T. mains units, and so on, and also one by which you can determine the milliamperes which are passing in the anode circuit of a receiver.

There are, as you know, combined instruments on the market which will read volts, ohms, and amperes over a considerable range, and these are very useful. Naturally, they involve the outlay of a certain amount of money, and also I always think that some of these combined instruments are apt to be a little inaccurate.

Combined Instruments.

I have before me a letter from a reader who has what he calls a "double voltmeter," reading on one scale from 0 to 6 volts, and on the other scale from 0 to 120 volts. He gives the resistances of these two circuits, and wants to know whether it will be possible to graduate the scales to read milliamperes.

The resistances which he gives are 160 ohms for the 0 to 6-volt scale, and 3,200 ohms for the 0 to 120-volt scale. This means that if 6 volts be applied to the 6-volt terminals the instrument will give a full scale reading, and, since the resistance of that circuit is 160 ohms, the current passing through the instrument will be 37·5 milliamps.

In the same way, if 120 volts be applied to the 120-volt terminals the instrument will give a full scale reading, and, since the resistance of that circuit is 3,200 ohms, the current passing through the instrument will be again 37·5 milliamps.

My correspondent wants to know whether he would be in order in graduating the scale to a maximum of 37·5 milliamps and then using the instrument as a milliammeter, and, if the answer is in the negative, what are the objections to the scheme?

Changing Conditions.

The answer is not entirely in the negative, although there are certain objections to the use of this instrument in the way suggested. It is perfectly true that when 37·5 milliamps. are passing through the instrument the needle moves over a full scale deflection, and therefore it will obviously serve as a milliammeter.

The objection lies in the fact that the winding—more particularly the high-resistance winding—will introduce a resistance into the circuit which may have the effect of altering very materially the conditions in the circuit from what they were before the instrument was introduced.

For example, in order to use the instrument on the 0 to 120-volt terminals we have to introduce the resistance of 3,200 ohms into the circuit which is being tested, and, unless the resistance of that circuit is already large compared to 3,200 ohms, the introduction of this resistance will alter the circuit conditions materially.

(*Continued on page* 530.)

TECHNICAL NOTES.

(Continued from page 528.)

The result will be that the current indicated in milliamps will be materially less than it was before the milliammeter was introduced into the circuit. This objection will not be so serious when the low-resistance winding is used, but it may still be an important objection.

Internal Resistance.

It is essential that an ammeter (including the milliammeter) should have an internal resistance so low that it does not seriously alter the total resistance in the circuit in which it is used; if it does, and unless the resistance of the rest of the circuit is known, its readings are obviously useless.

In the same way, a voltmeter should have a resistance so *high* that the current it draws from the circuit which is tested is too small to upset appreciably the conditions obtaining before the instrument was connected to the circuit.

Altering the Circuit.

I should remark that this voltmeter in question strikes me as having too low a resistance (I mean for use as a voltmeter), particularly on the high-voltage scale. If the voltmeter is used for testing a 6-volt accumulator, obviously a current of 37·5 milliamps will not appreciably upset the voltage of the accumulator.

But if the instrument is being used for testing the voltage of a high-tension dry battery or H.T. mains unit of around 120 volts, the current of 37·5 milliamps will almost certainly bring down the output voltage very considerably; or, to be more accurate, an ordinary dry battery having a voltage of 120 volts will give an apparent reading of much less than this amount when connected to this particular voltmeter.

Strength of Reception.

A very interesting question is raised by the following letter, in which a reader of these notes says:

"I imagine that only a limited amount of energy is radiated from the aerial of a transmitter and that receivers tuned to the wave-length of the transmitter only function by virtue of absorbing a small proportion of that energy.

"Has it ever been ascertained what number of receiving aerials can be energised by a transmitter? And is it possible for so many receivers to be tuned to a transmitter so that complete absorption of all the available energy occurs?"

It has never been ascertained, so far as I am aware, how many receiving aerials can be energised by a transmitter and it would, in any case, be impossible to arrive at such a figure without defining what is the minimum

(Continued on next page)

TECHNICAL NOTES.

(Continued from previous page.)

energy to be received by each receiving aerial. The only thing you can say is that the total energy received by the various aerials in the aggregate cannot exceed the energy radiated by the transmitter.

Shielding.

You have to remember that the electro-magnetic energy passing in the "field" of the transmitter (which field includes all the various receiving aerials) is being dissipated or absorbed by every conductor in the field, whether it be a receiving aerial or a steel girder building or any other object which has the slightest electrical conductivity.

Many amateurs are rather apt to suppose that the electro-magnetic energy goes around, so to speak, picking out receiving aerials and carefully avoiding any object which is not ostensibly an aerial. This is very far from the case, and there is no difference (so far as the electro-magnetic energy running itself to ground is concerned) between a receiving aerial and the steel girder work of a modern building; indeed, the latter is infinitely more effective as a "sink" of radio energy than any receiving aerial; and that is why reception is usually comparatively poor at any point within the interior of a steel girder building. This, indeed, is the principle of "shielding."

Question of Selectivity.

The question as to how many receiving aerials can be adequately energised by a given station is practically the same as the question as to the maximum distance from a transmitter at which a receiver may pick up the signals. The answer is that it depends upon the sensitivity of the receiver in question.

IF I CONTROLLED THE B.B.C.

(Continued from page 523.)

carrying out repairs where necessary for small and reasonable fees, or for nothing where hardship rendered payment impossible.

"Fantastic!" you say? Perhaps, but what else is there to suggest? Very little. The B.B.C. knows what it is about. Mistakes here and there are naturally made; an institution that never made mistakes would be inhuman. Besides, it is admitted on every hand that British broadcasting is the best in the world.

And I agree. Few countries have so regular a service, or such a comprehensive one. Many have to put up with advertisements for Somebody's Soap being inserted here and there; others cannot even get a programme at all.

No, gentlemen of the B.B.C., on second thoughts I would not accept the post of Lady High Controller even if you offered it to me. I should probably make a mess of things, and you seem to be quite all right as you are. Eight years of broadcasting has taught you many things of which I remain ignorant.

So carry on with the good work. The way in which new and different programmes appear night after night, and the way in which fresh talent is always being discovered is a source of perpetual amazement to me. The B.B.C. supplies entertainment, education, uplift and enjoyment all rolled into one. Could anyone do better? I think not. Anyhow, I don't intend to try!

Causton

"PHILEMON" GOES ABROAD.

(*Continued from page* 511.)

and "verboten" to boot! Still the fingers pointed. I broke into an understanding smile: "But certainly!" I said, and switched on. As luck would have it, it was dance music from somewhere. Their faces softened. Their hearts melted. They embraced each other. They fox-trotted up and down the corridor. They smiled with black moustaches and white teeth! They saluted and left me in peace.

Radio Toulouse.

I had heard of Toulouse. What I had heard, indeed, made me shy of turning Belinda southward to face the music. The train was now roaring through the night. It was getting late. "Toulouse or not Toulouse?" I debated with myself. In a weak moment I wished to hear Toulouse. I began to search the Universe for Toulouse. I came slowly down the dial from Vienna to Oslo and Langenburg; all faint, because Belinda was giving them the cold shoulder.

Then, suddenly, a blast! Toulouse! Belinda fell on her side. A panel of the compartment was blown out. The toupée of the virago was blown through. It fell on Belinda. I seized it and ran with it into the next compartment. The virago was attired for a bad night. "Madam has lost her knitting, perhaps?" I said, and retreated.

Belinda "Let's the Cat Out."

You know what a morning is like after a night in the train. I felt like that. At 10.15 a.m. the "Daily Service" would have been a relief. I was trying to get into touch with England, when I heard down the corridor the sounds of the approaching Customs Officers. I had been warned that I might have trouble there with Belinda. I had just time to put her mackintosh on, and place her among the suitcases, when the officers appeared. Belinda looked just like a suitcase. I felt she would pass in the crowd.

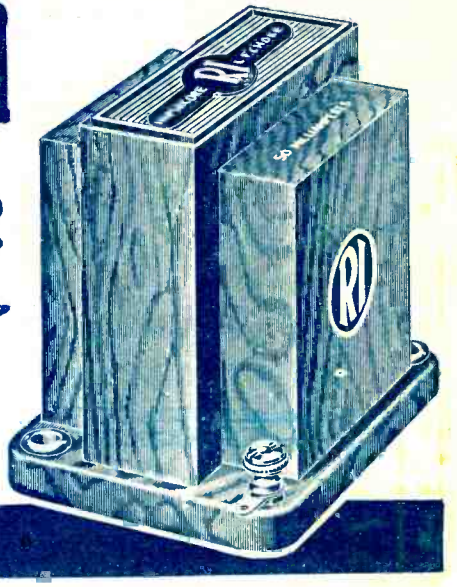
Had I anything to declare? I waved my hands over the suitcases and Belinda, and said I thought not. Then, horrors, Belinda began to talk! I hadn't switched her off! She was speaking an awful language, but she was distinctly speaking. I was debating in my mind whether I should say she was a pet canary, or an unborn child, when I caught the smile on the official face. "Now I'm in for it!" I thought.

The smile became a beam. "Ah!" said the officer, "that is Huizen. You have a fine set, signor. May I see?" I uncovered Belinda. She shone radiantly. The officer looked at her, opened her, shut her, looked again, listened to Huizen, smiled more and more broadly. "I am," he said in broken English, "how do you say?—a fan!" And he shook my hand. "I like your English programmes," he said; "I like your—Jack Payne!" And we shook hands again, and he saluted and went away smiling seraphically! I kissed Belinda!

Here at Last!

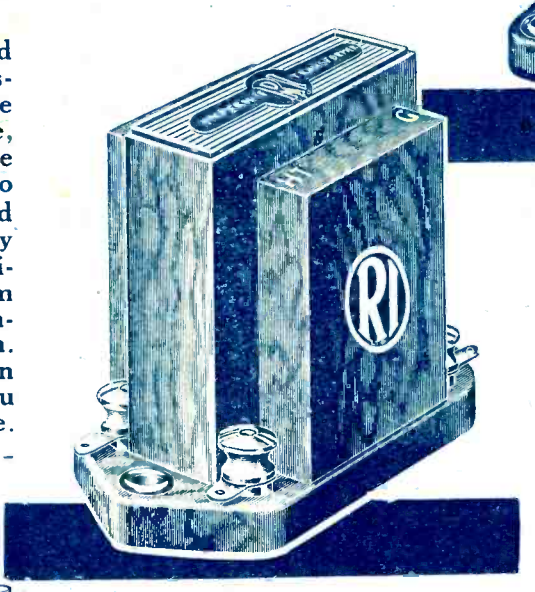
So here we are on the shore of the lake. I shall soon be across, with Belinda, in the wilds on the other side. There is a blue sky. It is piping hot. Addio!

Better Sound and Greater Volume for Mains and Battery Operated Receivers



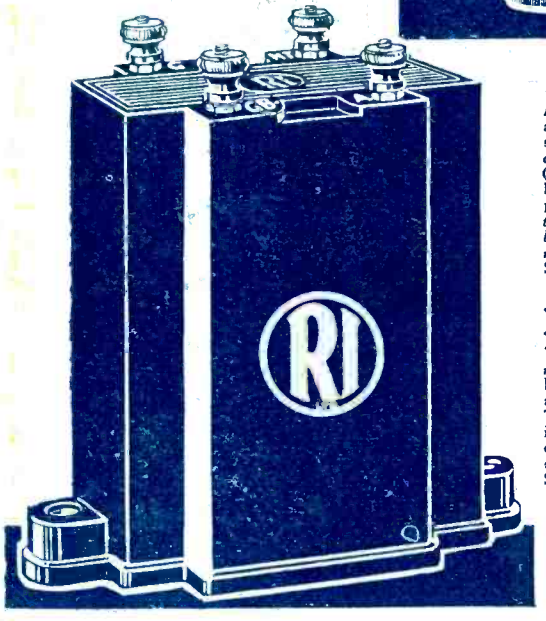
Hypermu and Hypermite Transformers and the latest L.F. Choke, the Hypercore, each give additional efficiency to modern circuits and modern valves. They occupy an absolutely minimum space with minimum weight and give tremendously improved reception. You'll be more than satisfied with your set if you fit either or all of the three.

Write for descriptive, illustrated leaflets.



HYPERCORE

The first commercial L.F. Choke with a core of new nickel iron. *Less than half the size and weight* of chokes built with silicon iron cores, yet has an inductance of 30 henries. Enormously improves quality of reception and sets new standard for L.F. Choke efficiency in smoothing equipment and filter output circuits. Weight 18 ozs. Size, 2 x 2½ x 2½ ins. **17/6**



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READ WHAT THE WIRELESS PRESS SAYS ABOUT HYPERCORE

The "Hypercore" gave perfect satisfaction, and was just as good from the smoothing point of view as a large standard choke of 20 henries weighing *THREE TIMES as much* . . . . . As an output choke the "Hypercore" *can be used in any normal receiver with complete satisfaction* . . . . . the R.I. "Hypercore" *points the way to the extensive use of this type of component* in mains units and for similar purposes.

The NICKEL-ALLOY CORES are the secret of the success of these three components. No other metal is so efficient.

R.I. LTD., "MADRIGAL" WORKS, PURLEY WAY, CROYDON.

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