

BUILD THE "LOGSTATION" THREE (See Page 405)

Popular Wireless

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No. 257. Vol. XI.

INCORPORATING "WIRELESS"

May 7th, 1927.



Special Features in this Issue

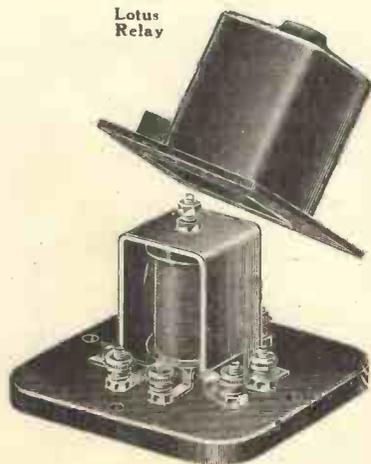
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HOW TO GET THOSE LOW NOTES. By G. P. Kendall, B.Sc.
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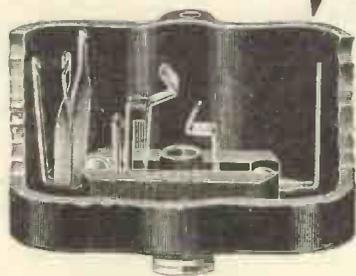
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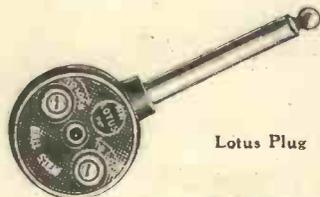


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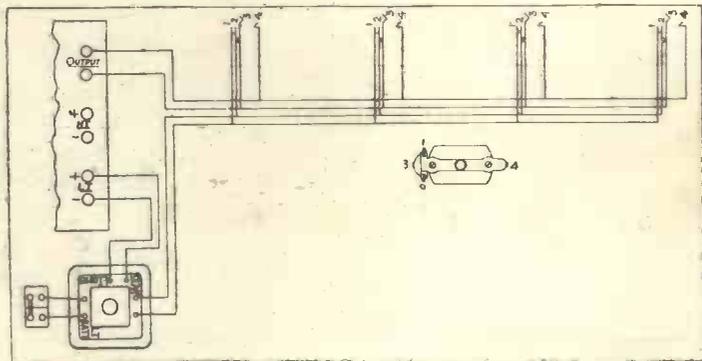
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P.W. 3

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Characteristics of the B.8 Valve

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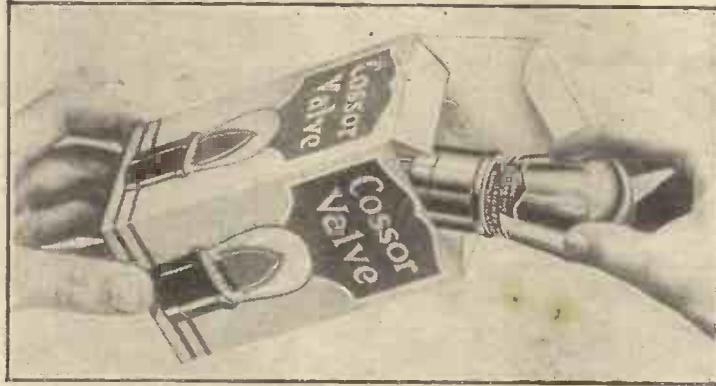
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Cossor



THE introduction of the Kalenised Filament by Cossor marked a significant Milestone in the progress of Radio.

It rendered possible for the first time the production of a Dull Emitter Valve which was immensely strong—almost proof against accidental breakage or premature burn-out. It cut to the bone the previous high costs of maintenance. Accumulators lasted for many weeks where before a recharge was necessary every few days.

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The rare combination of these three essential features—long service, economy and true-to-life reproduction—has made Cossor the most popular Valve on the British market. If you have still to purchase your first Cossor Valve a great musical treat awaits you. Buy them for your Receiver and you'll appreciate why Cossor has been spontaneously awarded the title "the melody maker."

For 2, 4, and 6-volt Accumulators in four types

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RADIO NOTES AND NEWS.

Signs of the Times—Lightning—The Moral—Anti-tax "Instinct"—Developments in South Africa—"Pirates" Looked After—"Wireless" Husbands—Kelvin on Wireless.

Signs of the Times.

FIRST there was communal listening, started by the B.B.C. Next came communal singing. Now I see there are communal aerials, looking like maypoles. Communal oscillating has died out, but communal grousing is still going on. Is all this herding a tendency resulting from "The more we are together"?

Lightning.

ABOUT this time of the year comes the usual crop of queries and advice about protection of receivers from lightning. My contribution is: The chances of danger are small and few—but don't take them. If you cannot be bothered with marvellous switches, etc., just join your aerial and earth leads together when not using your set. Increased safety; no trouble or expense.

The Moral.

THERE was a young plumber of Park,
 To whom the angels beckoned,
 Because he would hark
 To a lightning spark,
 And believed in "Safety Second."

Anti-tax "Instinct."

FROM Genoa I get a report stating that an Italian Government Commission which has been studying the finance of broadcasting has adopted a resolution recommending a small tax. The message adds that all Italians are instinctively against the suggestion. Probably they feel that if Italy supplies the world with grand opera it ought to get jazz music for nothing.

Developments in South Africa.

AFTER a disappointing start, South African broadcasting has got its second wind. The "wind," by the way, is being raised by the South Broadcasting Co., Ltd., whose prospectus I have

before me. Jo'burg station is to go to Bloemfontein, a more powerful one taking its place, and pending this a relay station will be erected for Pretoria. Durban and Cape Town radio interests are expected to join the new venture, and broadcasting rights will be sought in North and South Rhodesia.

"Pirates" Looked After.

WHAT to me is a novel means of protection against unlicensed listeners is to be adopted by the Union Government. Every dealer will be obliged to render monthly lists of persons

but, even apart from that, I doubt the truth of the dictum. Wireless makes husbands attentive and observant, home-keeping, quiet, usefully occupied, and handy with their hands—all sovereign virtues in the eyes of the best kind of wife. Phew! some bugle-blowing!

Kelvin on Wireless.

AT the eighteenth Kelvin lecture, given by Prof. E. W. Marchant, the lecturer said that when the early experiments of Marconi on Salisbury Plain had been described to Lord Kelvin, he remarked: "Well, I would rather trust a boy and a pony." This is an instance of the same inexplicable lack of vision on the part of a mighty scientist as was displayed by Edison when he said television would have no practical application.

A Suggestion to the B.B.C.

I AM told that would-be broadcasters to the number of 200-300 are tested each week at 2 L O. I do not know who are the judges, but, although I am sure they are "all, all competent men" (and women), I beg to suggest that it would be interesting to let the public be the judge occasionally. Would it not be possible to arrange for a public "audition" by wireless, the opinions of listeners being submitted on specially printed post cards? In some such way we might discover artistes who might otherwise blush unseen before the microphone and be turned down.

Something Wrong Somewhere.

A DEAR old lady has complained to me that although she has listened carefully for eighteen months she has never once heard that famous "Wave band" her grandson talks such a lot about. I told her it was another name for the Aerial Force Band—and my conscience is quite serene.

(Continued on next page.)



Mr. Maclurcan, the famous Australian amateur (A2 CM). In the adjoining room can be seen a portion of his crystal-controlled transmitter.

buying sets and/or accessories. I anticipate that if there is any hole-and-corner work at all the thing will develop into a game of "Hunt the Dealer." A line service to telephone subscribers is also to be arranged.

"Wireless" Husbands.

MR. L. McMICHAEL said at a recent dinner that he thought wireless men made the worst husbands in the world. The dinner took place on April 1st,

NOTES AND NEWS.

(Continued from previous page.)

The Deaf Hear.

A EXPERIMENT on deaf and dumb persons in Croatia showed that 116 out of 120 deaf mutes were able to hear sounds by means of a 7-valve set, super-het. The joy which can be brought into the lives of the deaf by this means is incalculable, and makes it an imperative duty for scientists to investigate the matter exhaustively.

"P.W.'s" Travels.

I HAVE a typewritten post card from a Japanese reader with an address a foot long, and a name I regret I cannot decipher, though it looks fine. He tells me that at present Japan has five broadcasting stations, J O A K (I like that one), J O B K, J O D K, and J Q A K, all except the last having an output of 1 kw. Pity they don't try some short-wave work and give us a chance of hearing something from the Flowery Empire. By the way, has anybody done DX two-way work with Japan yet? I believe not; so there is, if I am not mistaken, another record vacant still.

Hungary in the Running.

NEW S from Hungary is that the Radiotelefono Hirmond Company of Budapest proposes to build a 60 kw. station similar to Langenberg. All right, the more the merrier, if there is room. But this sort of thing can't go on for ever.

The Long Way Round.

TH E R E is a yarn going round to the effect that an amateur transmitter in California, failing to get into touch with another experimenter 50 miles off, suddenly remembered that the other fellow was frequently in communication with a Singapore amateur. Therefore he called up the Singapore man and gave his message, which was then re-transmitted back to California and duly received by the second man. All quite reasonable—but just think of it for a moment; probably it took quite half an hour!

"Safety First."

I LEARN that the public schools of Paris have been asked to take down their aerials because they might fall down during stormy weather and injure passers-by. If that isn't the limit! I say no more, but hope the report is exaggerated.

Peace First.

A MUCH more sensible interference by the authorities is that of the Watch Committee of the Sheffield City Council, which has recommended the enactment of a bye-law to control the use of loud speakers which cause a nuisance. We have probably all suffered from the blaring of a loud speaker owned by a man who, to judge by the way he advertises his noise, seems to think that he, and not the valves, is doing a sort of miracle.

Valve-Testing Extraordinary.

A WONDERFUL machine has been installed in the Westinghouse valve factory, which can test 30,000 valves daily. It consists of a revolving disc which carries valves, and when this revolves the valves are connected successively to circuits, which test them for the various "characteristics." "Dud" valves are

kicked out of their sockets by an electromagnetic plunger, but those which, though not good are reclaimable, are transferred to a moving band and carried to the "doctor."

Our New War.

ALTHOUGH the B.B.C. has, like any other concern run by business men would do, announced its willingness to negotiate with the Variety Lords, it by no means follows that they are prepared to buy music-hall "stars" at any price. We could, at a pinch, do without variety "stars." But could the music-hall magnates? Suppose the "stars" should take up the challenge and "call the bluff" on Sir O. Stoll and Mr. Gulliver, etc.!

More "P.W." Results.

E. A. C. (Lichfield) made our one-valve receiver, as described in the booklet given away with "P.W." in October last, added one stage of "note mag," and now romps in with no less than thirty home and continental stations. He has even heard Schenectady and Miami at 'phone strength. Is that money's worth or not? E. A. C. would be a holy terror with a "Span-Space Three."

"H.F." Accumulators.

AN OBSERVANT gentleman from Huddersfield sends me a clipping from the remarks of Mr. Mark Potter, in which Dr. Hazeltine, of neutrodyne fame, is accused of preferring to use accumulators for "both high and low-frequency current."

SHORT WAVES.

Looked up to—the schoolboy who claims to be the real nephew of a real wireless nuke.—"Sunday Pictorial."

"Wireless telephony causes people to stay at home and thus lessens the demand for clothing," writes a Government official. So that's why skirts are shorter!

By the use of headphones and a specially constructed microphone, an experimenter has listened to the sounds made by grubs while devouring apples. It is understood that the noise they made when spitting out the pips came through at loud-speaker strength.—"Electrician."

"Wireless talk gains beds for hospitals!" runs a headline in the "Daily Chronicle."

A hefty looking workman was overheard to remark in the tube the other day that it would probably gain a bed for a certain announcer before very long.

A Burton inventor has made a crystal set in a beer bottle. Our experimental laboratory staff reports that on test the Bass came out very well.—"Electrician."

"I heard Mr. — speaking quite clearly from New York."

"But I thought Mr. — was dead."
"Well, I don't know. He said it was New York he was speaking from."

"The invention of broadcasting has wholly changed the face of things musical," says Sir Walford Davis.

Perhaps that's why the voices of some "things musical" seem so un-holy.

We all know the insinuating tones in which the announcer breaks it to us that there is going to be a slight hitch in the radio programme. But he will really have to find a more elastic phrase, for 2 L O's minutes have latterly shown a tendency to be long ones.—"Star."

To investigate Empire wireless is to walk into a fog.—"Saturday Review."

A boy stood on the rolling deck,
Of a freighter out at sea,
And he warbled a tune
To the silver moon,
In the transmitter of X Y Zee.
—"Radio Digest."

My correspondent asks what kind of batteries are these. High and low-tension batteries are meant obviously; a slip of the pen. But an H.F. oscillating cell would be very useful. I'll see the technical staff and put it up to them. (You need a rest cure.—Ed. "P.W.")

That Miami Habit.

F. H. B. (Shepherdswell) doesn't see much in all this Miami excitement, for he has picked up W I O D twenty times since January 16th. I should mix it a bit, if I were you, F. H. B., or they will be asking you for a licence fee. But, of course, the attraction is that lady there who sings "Love's Old Sweet Song." You ought to have kept that dark. Game's up now.

Radio Forecasts.

I HEAR that they are actually trying their hands at radio forecasts in Milwaukee. "Good volume and distance to the east on Monday night; poor distance and probably fading to the south," and so forth. I confess I am an unbeliever in the inspiration of such reports, but am open to conviction, and hope some Milwaukee "fan" will let me know how they work out in practice.

"Open-air" Valve.

I READ in a north-country paper that Mr. Elman B. Myers has succeeded in producing a valve which will work "in the open air,"—i.e. no vacuum tube is used. Mr. Myers is a clever or lucky man if he has done that, and holds a potential fortune. Unfortunately, I can trace no patent in his name corresponding to this from 1925 up to the present date. Anyone heard of it, please?

New Stock of "Talks."

TH E new summer stock of "talks" is more formidable than ever, and shows that the B.B.C. is still determined to educate us in spite of ourselves. My view is that that sort of thing is all right if you like that sort of thing. But the net result on the general mind will be akin to the results obtained by reading papers of the "Snippy Bits" type, enabling one to talk superficially on all subjects whilst understanding few of them.

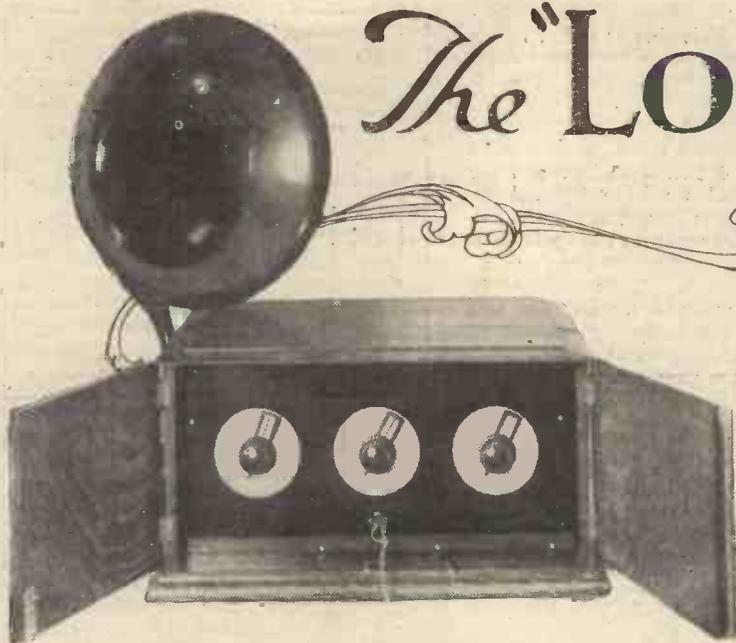
"Modern Wireless."

I HAVE just been looking at a copy of this month's "Modern Wireless," and cannot remember ever seeing such a variety of really good live "dope" collected in a single issue of any wireless periodical. Four receiving sets are fully described, while additional articles on the famous "Combine Five" and the "Black Prince" are also included. Besides all this we have Sir Oliver Lodge, Capt. P. P. Eckersley, Dr. J. H. T. Roberts, Percy Harris, and many other well-known writers contributing to the pages of "M. W."

A Good Bob's Worth.

I F you want a portable set you will find all you require in the special articles on portable sets, or if you want a set to run directly off the mains you can build the "K.L.1 Two," which takes all its juice from the electric light supply. Then, again, if you want—but there's no need to go any further, whatever you require you will find it well worth your while to beg, borrow, or otherwise obtain this month's "Modern Wireless." **ARIEL.**

The "Logstation" Three



An efficient modern three-valve receiver.

Designed, Built and Described by
H. J. BARTON CHAPPEL, Wh.Sch., B.Sc.,
A.C.G.I., D.I.C., A.M.I.R.E.

THERE is no denying the fact that at the present time the three-valve receiver is enjoying a large degree of favour amongst listeners, and a little reflection will reveal many sound reasons for this popularity. With three valves there are three courses open to adoption, viz: (a) Detector and two L.F. stages; (b) two H.F. stages and detector; and (c) H.F., detector and L.F., but it depends upon individual requirements and tastes as to which combination is chosen. Speaking broadly, for one is treading upon dangerous ground if any attempt is made to be dogmatic, we may classify these as being (a) for local working; (b) for distant stations on the telephones, with the local station frequently at loud-speaker strength; while (c) can be looked upon as the happy medium. It gives many stations at fair to full loud-speaker strength, with an addi-

reasonable degree of selectivity is incorporated to cut out the local transmission when fairly close to the broadcasting station.

Moderate H.T. Consumption.

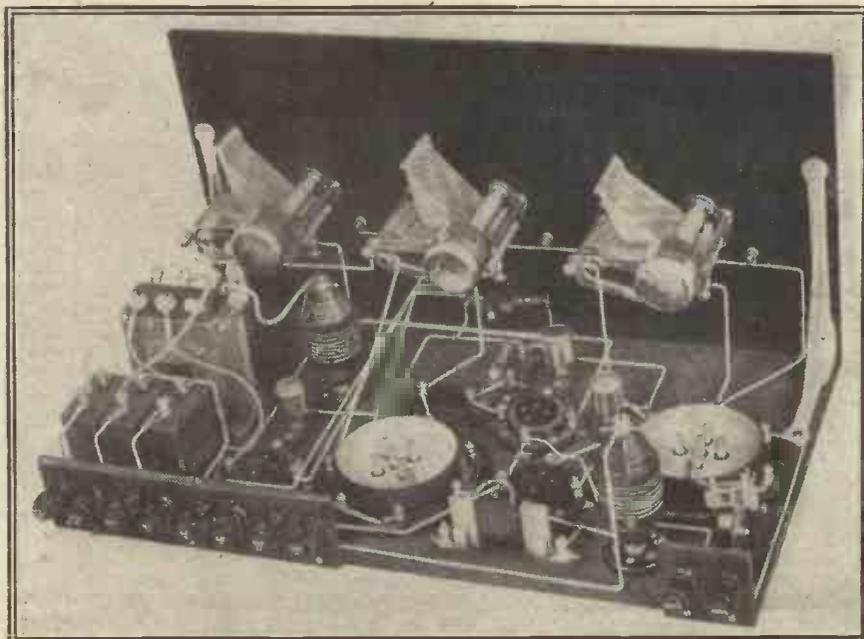
With three valves in use, the demands on the H.T. and L.T. batteries are not excessive, indeed, with the low-consumption valves on the market the visits to the charging station can be made few and far between, also there is a good return in performance and enjoyment, brought about by the choice of stations, for the labour and cost involved in the construction of the receiver. In addition, it must not be forgotten that there are many constructors who feel that anything above three valves is liable to become unduly complicated to handle, generally a mistaken impression with the matching and ganging of components that is now possible, but an impression

once gained is often difficult to efface. In any case, as mentioned previously, the possession of a three-valve receiver which
(Continued on next page.)

COMPONENTS AND MATERIALS REQUIRED.

- 1 Ebonart panel, 18 in. by 9 in. by $\frac{1}{4}$ in. (Redfern's Rubber Works, Ltd.)
- 1 Oak cabinet, De Luxe Concert Model, 12 in. deep, with loose baseboard 10 in. deep (Pickett Bros.).
- 3 Antiphonic valve holders, with terminals (Garnett, Whiteley & Co., Ltd.).
- 1 Multiple fixed condenser (.0001 to .0015) (C. A. Vandervell & Co., Ltd.).
- 3 Fixed resistors with bases, to suit chosen valves (Burndept Wireless, Ltd.).
- 1 Multi-ratio low-frequency transformer (Radio Instruments, Ltd.).
- 2 .0005 S.L.F. condensers with dual indicator dials (Ormond Engineering Co., Ltd.).
- 1 .0003 S.L.F. condenser with dual indicator dial (Ormond Engineering Co., Ltd.).
- 2 Double tapped coils, 250-550 metres and 1,000-2,000 metres (Burne-Jones & Co., Ltd.).
- 2 Split primary aerial coils, 250-550 metres and 1,000-2,000 metres
- 2 Screening cases and six-pin bases for above (Burne-)
- 1 Radio jack No. 4, filament single control (Garnett, Whiteley & Co., Ltd.).
- 1 Jack plug (Garnett, Whiteley & Co., Ltd.).
- 2 High-frequency chokes (L. McMichael, Ltd.).
- 1 Dumetohm 2 megohm grid leak with clips and base (Dubilier Condenser Co. (1925), Ltd.).
- 1 Type 610 .0003 grid condenser (Dubilier Condenser Co. (1925), Ltd.).
- 3 2 mfd. Mansbridge condensers (Dubilier Condenser Co. (1925), Ltd.).
- 10 Insulated terminals (Aerial, Earth, G.B.-, G.B.+, L.T.-, L.T.+, H.T.-, H.T.+1, H.T.+2, and H.T.+3) (Belling and Lee, Ltd.).
- 1 Spring clip (Peto-Scott & Co., Ltd.).
- 2 Drilled ebonite terminal strips, 8 in. by 2 in. by $\frac{1}{2}$ in. and 2 in. by $\frac{1}{4}$ in.
- 1 Pair large panel brackets

Quantity of Glazite for wiring up, rubber-covered flex, four spade tags, wood screws, etc.



The lay-out of the "Logstation" Three allows ample wiring and component spacing without any sacrifice in compactness.

THE "LOGSTATION" THREE.

(Continued from previous page.)

enables the owner to tune in with comparative ease, say, six to a dozen stations on the loud speaker, with many others on the telephones, meets the demands of a large proportion of listeners. The presentation of this three-valver to the readers of this journal was inspired by a consideration of these facts, and constructors will find it a sound proposition to make it

request, but other manufacturers will supply to specification. It is similar to L_1 , but is provided with two extra tapping points, 5 and 6, symmetrical with respect to 3 and 4, a fact made clear by reference to Fig. 2. It will be seen that there are 10 turns between 2 and 3 and 1 and 6, while 5 turns separate 3 and 4 and 6 and 5, and for the Daventry coil we have 30 and 20 turns respectively in lieu of the 10 and 5, the windings being made on the usual sized formers provided with a metal screen and six-pin base. The feed from C_3 goes to either of terminals 3 and 4, while Reinartz reaction is made possible by taking the .0003 variable condenser, C_6 , to one end of the coil L_3 , the circuit to L.T. — being

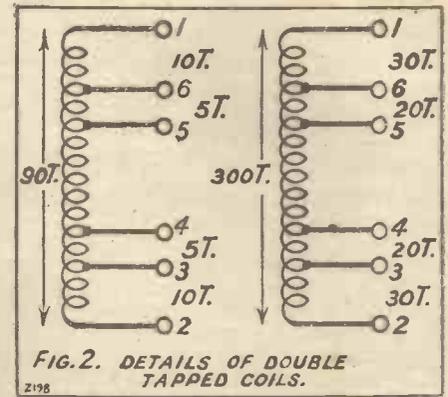


FIG. 2. DETAILS OF DOUBLE TAPPED COILS.

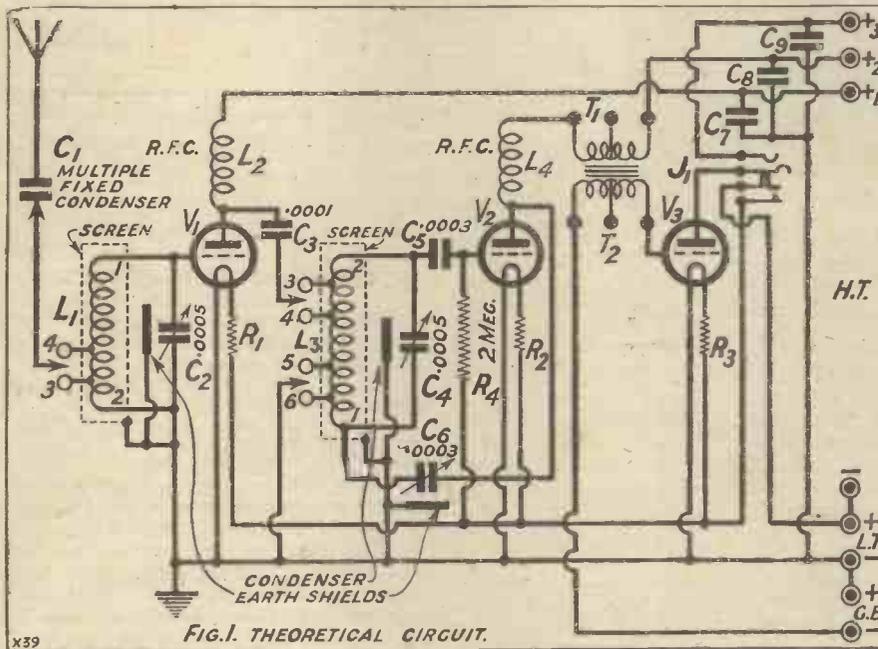


FIG. 1. THEORETICAL CIRCUIT.

up. Tests have extended over a considerable period, and the performance has been found entirely satisfactory in every way.

Circuit Details to Note.

Turning to the circuit diagram of Fig. 1, what details are revealed by a careful examination? The aerial connection to L_1 is by way of a multiple fixed condenser C_1 , with the object of increasing selectivity, and allowing the capacity and inductance of the aerial to be combined efficiently with the tuned grid circuit of the first valve. Series capacity values ranging from .0001 to .0005 mfd. are possible when occasion demands. L_1 is a standard split primary aerial coil, a popular and efficient method for improving the selectivity of the set, the tapping points 3 and 4 being joined to the lead from C_1 as desired. With the .0005 condenser C_2 tuning this coil, the wave-length range of 250 to 550 metres is covered, while on substituting the standard coil of larger inductance a band of 1,000 to 2,000 metres is available for reception.

A Double Tapped Coil.

By the inclusion of a radio-frequency choke, L_2 , in the plate circuit of the H.F. valve V_1 , the H.F. impulses are forced to take the low impedance path provided by C_3 , shown as .0001 in the diagram. The coil L_3 is a special double tapped one made up by Burne-Jones & Co., Ltd., at my

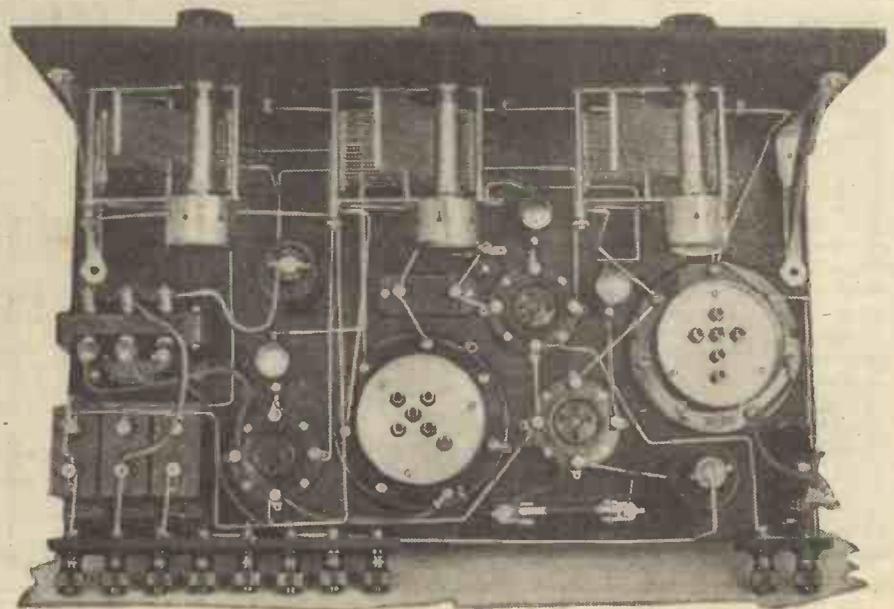
completed via the tapping taken to terminals 5 or 6. In practice this method was found to work exceedingly well, giving a smooth control of reaction when the adjustments to be indicated later had been effected.

L_4 in the plate circuit of V_2 is the usual radio-frequency choke to allow the Reinartz reaction to operate, while in this same plate circuit we have the primary T_1 of an R.I. multi-ratio transformer. The remainder of the L.F. side is quite straightforward, the insertion of the loud-speaker plug in the jack, J_1 , switching on the valve filament supply. Fixed resistors are included, and the suitable resistance values will depend upon the valve combination chosen.

Screened Condensers.

The photographs accompanying the article indicate that the component spacing on the baseboard has not been cramped, while on the front panel we find disposed the two tuning condensers and one reaction condenser, together with the jack. The aluminium dual indicator dials of Ormond's that have been included will be found very useful. The upper half of the dial is marked with a double scale, 180 and 100 degrees, while the lower half is graduated for logging purposes, and the cursor and pointer permit accurate station loggings to be made on the dial itself if desired. In addition, advantage may be taken of the fact that the dial acts as an earthing shield since it is insulated from the condenser shaft. When housed in a good cabinet, such as the Pickett's De Luxe Model illustrated, the appearance of

(Continued on next page.)



A "bird's-eye" view behind the baseboard, which very clearly shows the disposition of the components.

THE "LOGSTATION" THREE.

(Continued from previous page.)

the finished receiver is pleasing to the eye, the double doors protecting the panel front when the set is switched off.

Component Mounting Details.

Attention must now be turned to details of construction, and the panel can be drilled in accordance with the diagram of Fig. 3. The holes for the bracket screws are best marked off with the panel and baseboard inside the cabinet, and since there are only six screw holes and four holes for component mounting, the task imposed is a particularly light one. Mount the con-

panying photographs will relieve the constructor of any fears as to ultimate success. When desired, the terminals on the components can be used for passing the wires under, this always being advisable when the operation of soldering appears fraught with any difficulties; but a good soldered joint may be effected at the necessary points by those readers capable of using a soldering iron efficiently. It will be gathered from the illustrations that a mixture of soldered and screwed joints have been made, and the scheme was found to work well. Keep all the leads as short and straight as possible, removing the Glazite insulation with care, and always bearing in mind that one of the secrets of satisfactory receiver performance is good, workmanlike wiring. All the flexible leads should be just long enough to reach any of the alternative positions that may be desired, and if small spade tags are not to hand for screwing

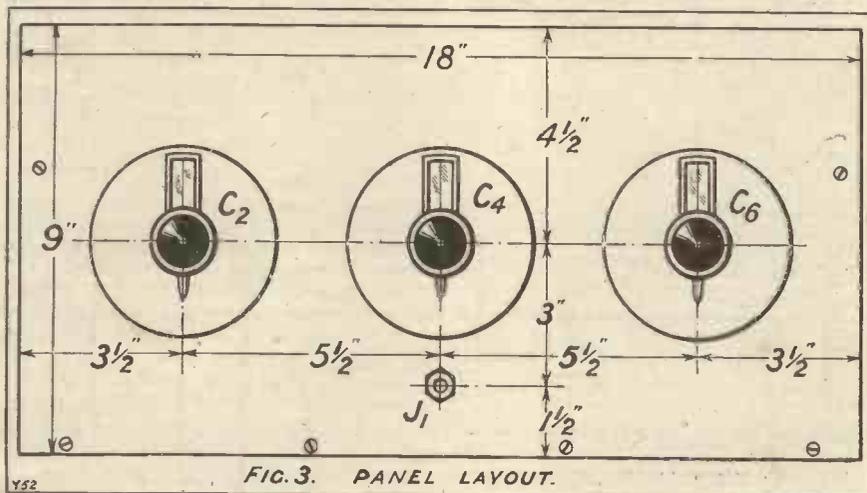
or a thin file, trim up the edges, and solder the lead to the tag end. To ensure that all is in order check over your handiwork with the diagram of Fig. 4, and, once satisfied that no mistakes have occurred, proceed to the last and perhaps most interesting stage—the aerial test.

Aerial Test Preparations.

The first point that arises in this connection is the right type of valves, and there is a wide range open to choice. For the H.F. and detector stages I have made a practice of using valves with a high impedance, and particularly good results were secured with P.M.1 H.F. (Mullard), H.310 (Burndept), 210 H.F. (Cossor), D.E.2 H.F. (Osram), H.408 (Octron), and similar types, the 2-, 4-, or 6-volt classes giving equally good signal reception. On the L.F. side we have: L.525 (Burndept), the Stentor range (Cossor), P.M.1A, 4 or 6 (Mullard), D.E.5 (Osram), L.P.240 (Octron), etc. Where possible, it is distinctly advantageous to try out as many valve combinations as the personal valve stock permits, for too often it is found that little heed is paid to the necessity for using the right valve in the right place. A little time spent in the study of valve charts, with their attendant details, will be amply repaid by the resulting improved signal reception. The correct fixed resistors must be incorporated according to the L.T. voltage supply and the filament voltage and current of the valves, but this presents no difficulty. With valves, coils, and screens in position, and a .0001 condenser inserted into the C_3 clips, connect up the L.T. accumulator to the appropriate terminals and insert the plug into its jack. Now apply the H.T. voltage. No hard-and-fast rules should be adhered to, but for V_1 a pressure of about 80 to 90 volts, for V_2 60 to 70 volts, and for V_3 100 to 120 volts generally will be found satisfactory.

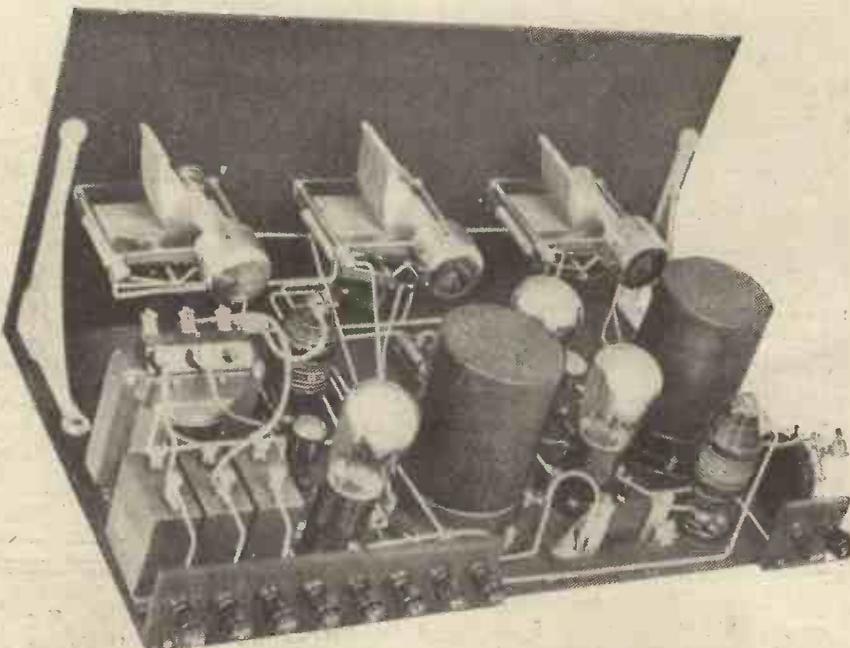
Now connect up the aerial and earth to the terminals so marked and adjust the grid bias voltage according to the plate voltage applied to the last valve, say $4\frac{1}{2}$ to 6 volts. Remove the plug and join to it

(Continued on next page.)



densers and jack in position and attach the panel to the baseboard, paying particular attention to alignment. The terminal strips can also be screwed into place on the rear edge of the baseboard and reference made to the wiring diagram of Fig. 4, and the photographs for the positions suggested as suitable for screwing the components to the baseboard surface. Elsewhere in the article will be found a complete list of the components and materials required for the construction of this set, together with the makers' names of those components actually used, but it will be appreciated that in many cases equally efficient substitutes may be included without detriment in any way to the performance of the receiver. When other components are decided upon, however, attention must be directed to any consequent slight alteration in lay-out so as to prevent fouling of one component with another and permit straightforward wiring. The proper orientation of the valve holders and six-pin bases for the screened coils must be noted to facilitate the subsequent work of wiring, but apart from these little details the constructor will find everything perfectly normal and he can proceed to the next stage, viz., the wiring.

under the numbered terminals of the screened coil bases, the soldering tags supplied with the unit will make good substitutes. Just remove the shaded portion shown in Fig. 5 with a pair of cutting pliers



The valves and coil screens are here shown in position.

Wiring the Receiver.

It is of material advantage to make all the connections in the order shown in the point-to-point wiring list, and the wiring diagram of Fig. 4 and the accom-

THE "LOGSTATION" THREE.

(Continued from previous page.)

the pair of loud-speaker leads. For the first trial, attach the flexible lead from C to No. 4 terminal of L, making C .0002 mfd., while the lead from C₃ can join to No. 3 and the flex from L.T. - to No. 6 of the terminals on the L₃ base. A word must also be said about the R.I. multi-rat-ion trans-

former which gives the benefit of seven ratios and three different impedances, according to the terminals joined in circuit. To start with, a 3 to 1 ratio is suggested with a 60,000 ohm impedance, and this is effected by joining to terminals PO, P2, SO, and S2.

Signal Reception.

Now insert the loud-speaker plug into the jack, having C₆ set at zero, and tune in the local station on C₃ and C₄. It will be found that the dial readings match reasonably well, which of course is of great assistance when searching for distant transmis-

sions. To increase the strength of the local transmission, if such a course is necessary, move the C₆ condenser slowly from its zero position; but be careful not to cause the set to oscillate by having the condenser plates too much in mesh, or a certain amount of neighbouring interference will occur, quite apart from the marring of one's own programme. Now tune in a more distant station by rotating slowly the two left-hand condensers in the same direction a degree at a time, and by so doing learn to get the "feel" of the set. When the transmission is heard and the station accurately

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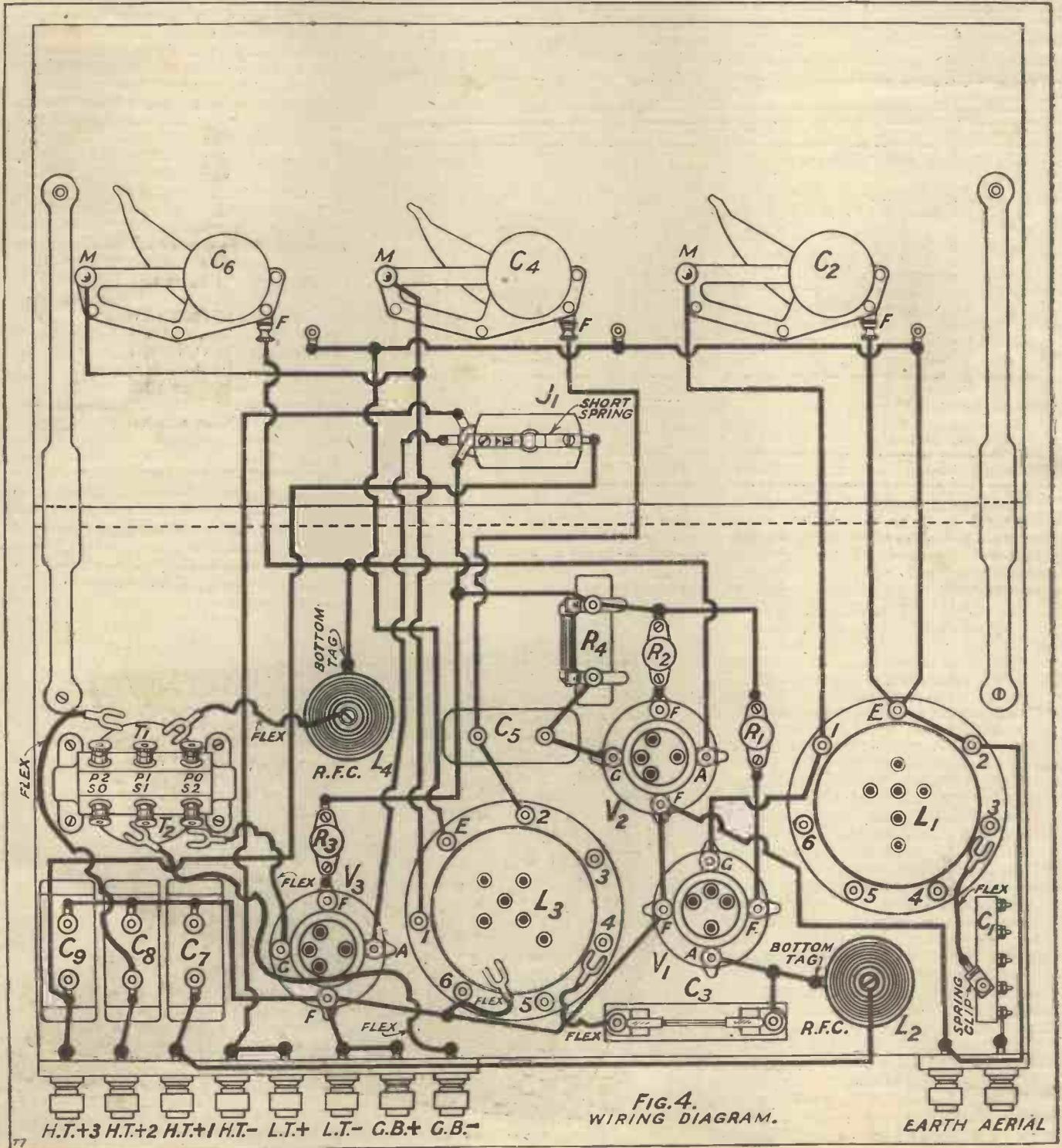


FIG. 4.
WIRING DIAGRAM.

THE "LOGSTATION" THREE.

(Continued from previous page.)

tuned, together with the reaction condenser suitably adjusted, try the effect of moving the feed of C_3 from No. 3 to No. 4 terminal and of altering the value of this feed condenser to .0002 or .0003. Also, the reaction may be increased by joining the lead from

POINT-TO-POINT CONNECTIONS.

Join aerial terminal to end of C_1 . Join earth terminal to No. 2 terminal on L_1 base, thence to E on base, continuing to fixed plates of C_2 and the three earth shield terminals for C_2 , C_4 and C_6 and E terminal on L_2 base.

Join G.B. + terminal to L.T. - terminal to one terminal on each of C_7 , C_8 and C_9 , to one filament terminal on each of V_3 , V_2 and V_1 , thence to earth terminal.

Join moving plates on C_2 to No. 1 terminal of L_1 base, thence to grid terminal of V_1 .

Join anode terminal of V_1 to bottom of R.F.C. L_2 , thence to one side of C_5 clip. Join top of R.F.C. L_2 to H.T.+1 and remaining terminal of C_7 .

Join remaining filament terminals on V_1 , V_2 and V_3 to one side of R_1 , R_2 and R_3 respectively.

Join together remaining sides of R_1 , R_2 and R_3 , thence to one side of J_4 and to one "filament spring" of J_1 . Join remaining filament spring of J_1 to L.T.+ and thence to H.T.-.

Join grid terminal of V_2 to one side of C_5 , thence to remaining side of R_4 .

Join remaining side of C_5 to No. 2 terminal of L_3 base and to fixed plates of C_4 .

Join anode terminal of V_2 to bottom of R.F.C. L_4 , thence to fixed plates of C_6 .

Join moving plates of C_6 to moving plates of C_1 and thence to No. 1 terminal of L_2 base.

Join anode terminal of V_3 to long spring of J_1 , the short spring of J_1 being joined to H.T.+3 and remaining terminal of C_9 .

Join H.T.+2 to remaining terminal of C_8 .

Join a spring clip to one end of a short flex, the other end terminating in a spade tag for attaching to terminal 3 or 4 of L_1 base.

Join remaining side of C_3 to a flex lead, the other end terminating in a spade tag for attaching to terminal 3 or 4 of L_2 base.

Join L.T. - lead to a flex lead, the other end terminating in a spade tag for attaching to terminal 5 or 6 of L_3 base.

Join G.B. - and grid terminal of V_3 respectively to two flex leads terminating in spade tags for connecting to secondary terminals on T_2 .

Join top of R.F.C. L_3 and H.T.+2 terminal respectively to two flex leads terminating in spade tags for connecting to primary terminals on T_1 .

L.T. - to terminal No. 5 in lieu of No. 6. Make one adjustment at a time, and note whether your station reception is improved, while the effect of different series capacities for C_1 merit a trial, or it may be wholly cut out of circuit. The aerial tuning of C_2 is generally sharper with the lead from C_1 joined to the terminal No. 3 on L_1 , and interesting conclusions can be formed by

tabulating and comparing the effects noticed with each alteration that is possible with the receiver.

Of course, the opportunity of being able to try out different ratios and impedances with the L.F. transformer must not be overlooked, and it is recommended that after the selection of any ratio both primary and secondary leads should be reversed to ascertain which way round gives the best results.

Stations Heard.

In a very short time the constructor will be quite at home with his set, and the log-

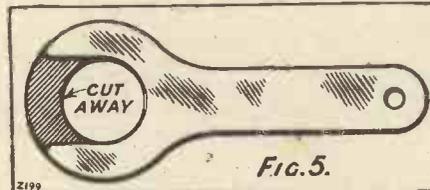


FIG. 5.

ging of British and continental transmissions will add to his joy. When tested on an aerial erected under rather adverse conditions about ten miles north-west of 2 L O, good results were secured. Amongst the stations heard from time to time at varying strengths on the loud speaker and telephones were: Bournemouth, Belfast, Aberdeen, Birmingham, London, Dublin, Langenberg, Voxhaus, École Supérieure, etc. Several others were heard on both the 'phones and loud speaker, but at the time of writing were unidentified. By changing the two screened coils for those of the larger inductance the long-wave stations can be received—Daventry, Hilversum, Radio-Paris, and Königswusterhausen.

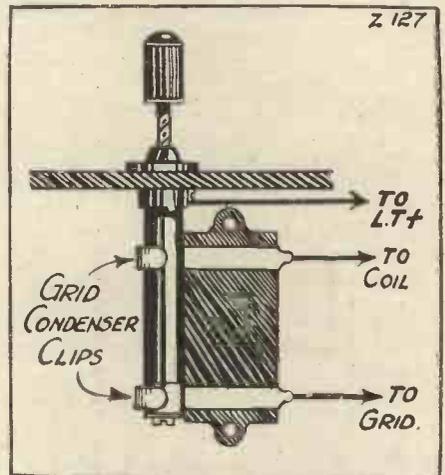
It is thus seen that with the receiver just described several alternatives are provided in lieu of the local programme when that is not desired. In addition, the set is not difficult to handle, and yet for the constructor who likes to be able to experiment with certain adjustments there is reasonable scope in this direction with the possible ones that have been enumerated earlier in the article.

A SIMPLIFIED CONNECTION.

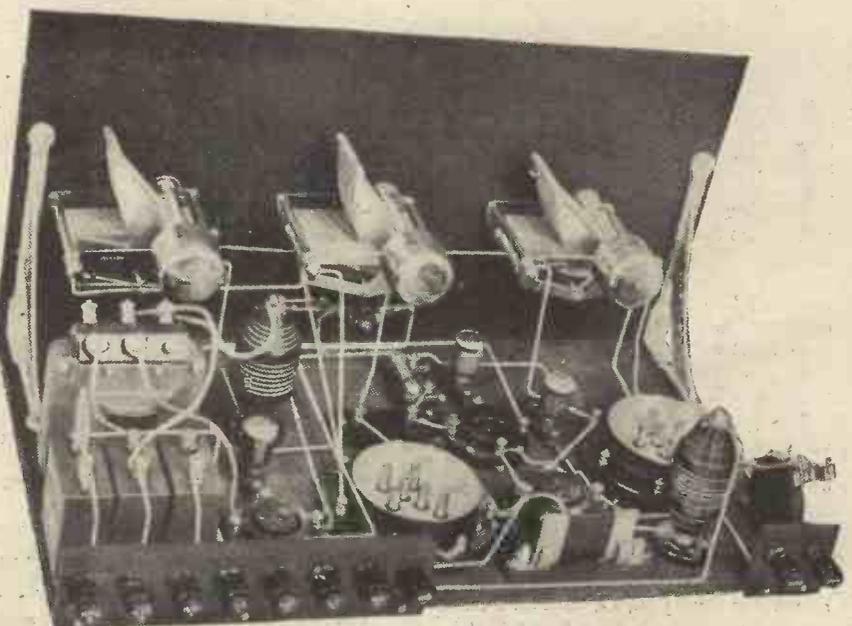
WHEN using a variable grid leak with the detector valve of a receiving set, many amateurs will have noticed that it entails rather lengthy leads in making the connection to the grid of the valve and to the grid condenser.

It is a rule in wireless construction that the leads to the grid from the aerial circuit should be as short as possible, and the diagram shows a neat method of observing this rule even when a variable leak is used.

The majority of detector valve circuits now prescribe that the grid leak should be connected between the grid and filament of the valve, instead of in parallel with the grid condenser as heretofore.



The fixed leak clips attached to the grid condenser have therefore become something of an unnecessary elaboration, but the method of fixing illustrated proves them still serviceable, one of them being used to make connection with the grid leak via the metal cap at the end.



Another back-of-panel view of the "Logstation" Three receiver.

SO much has been written of late in the daily newspapers about television, that it is not to be wondered at if the general public believe that seeing by wireless is now a full-blown fact and that the great problem has been satisfactorily solved. It hasn't.

Successful experiments in television have certainly been made and much excellent pioneer work has been done.

Mr. Baird, in this country, and Mr. Jenkins, in America, have both accomplished a good deal, but they are still a very long way from reaching that point where television becomes of practical importance and utility.

We find that many people are under the impression that, because television receivers are shortly to be placed on the market, and because a television company has been formed, that a great boom in television is shortly due, and that the B.B.C. will have to supplement their broadcast programmes with broadcast moving pictures.

We give it as our opinion that nothing of the sort is likely to happen.

It is possible that those who purchase television receivers will "pick-up" television transmissions from Mr. Baird's experimental station, but what sort of pictures they will receive we do not know. So far we have not had an opportunity of testing one of these receivers, nor have we been able to discover exactly how the purchaser will be able to use a television receiver with any degree of satisfaction, unless a powerful transmitting station is devoted to the needs of those possessing television receivers.

Even then we doubt whether television, in its present state of development, would appeal to more than a few experimenters.

So many exaggerated accounts of television experiments have appeared in print lately, that many people seem to think that the day has dawned when a clear moving picture—equal to a cinema picture—can be broadcast by wireless. It can't.

Still a Long Way Off.

Demonstrations recently have shown that it is possible to transmit a recognisable human face and reproduce it at the transmitting end on a small fluorescent screen. At present there is a very big gap between the experimental transmission of a human face by wireless and its reproduction on a small screen—and by no means a perfectly clear and detailed reproduction—and the reproduction in detail of, say, the Cup Final.

Whether Mr. Baird, or any other inventor, will bridge that gap in our lifetime, it is not possible to say. The problem is still a big and difficult one. And the danger lies in ignoring this so that the public receives exaggerated ideas of the degree of progress made. It would be more sensible to cut out the "stunting" and give the plain, unvarnished facts.

The television set recently demonstrated in New York seems to be of exceptional interest. In its present form, says "The Times," it is adapted to obtaining for one participant in a telephone conversation a continuous view of the face of the other participant. Such a view the receiving apparatus recreates on a picture plane about 2 in. by 2½ in., or, with an alternative form of equipment, on a plane about 2 ft. square for observation by more than a single person.

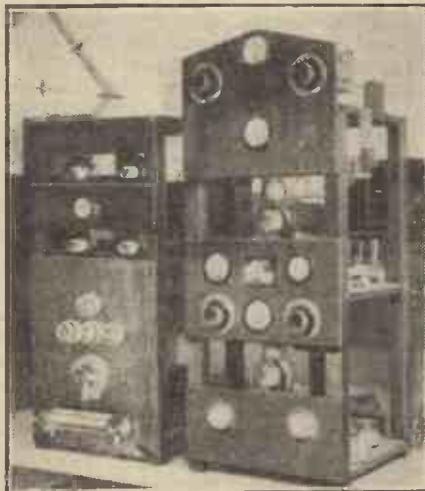
CURRENT TOPICS.

By THE EDITOR.

Recent Television Developments—
An Interesting American Invention.

A brief explanation of this television "outfit" may interest readers.

At the sending station there is, in addition to the usual telephone desk-stand, the special equipment for transmission in television. There is, first of all, a photo-electric cell or eye, which placidly views the scene before it, but receives no appreciable stimulus unless the scene is strongly illuminated. The second portion of the equipment includes a powerful light, the rays from which are not allowed to flood the scene and dazzle the actor, but are reduced to a narrow beam illuminating on the face of the actor a spot not more than a quarter of an inch square. This beam, guided by the



Short-wave transmitting apparatus used by an Australian experimenter for round-the-world radio.

so-called "scanning disc," never pauses, but sweeps the entire scene in less than a fifteenth of a second.

The Transmitter.

As each detail is illuminated the photo-electric cell instantly responds, initiating a current proportional to the light reflected to it, and hence proportional to the light and shade of the particular detail. As the beam of light swings across the scene, working its way from top to bottom, the current from the cell varies correspondingly. So swiftly does the beam sweep the scene that the current variations are wide and rapid—sometimes corresponding to a change from a maximum current to a minimum and back to a maximum in a twenty-thousandth of a second. These variations, the so-called alternating current components are transmitted by wire or radio to the receiving equipment, where they are effective in reproducing the scene.

The beam which assists the photo-electric eye to scan the scene before it is actually a succession of beams. In front of the source of light revolves a disc, the

'scanning disc,' in which is a series of holes through which flashes of light escape to illuminate, successively, narrow horizontal strips of the scene. This disc is driven by a combination of two electric motors.

Identical motors operate at the receiving station to ensure to the flashes of light the orderly succession necessary to re-create the image. Exact synchronism at the two ends of the system is accomplished by using at each two 'synchronous' alternating-current motors. At each end one motor, the main one, operates at a frequency with which complete images of the scene can be formed. To prevent this motor from "hunting"—that is, from small variations in speed alternately above and below that corresponding to 18 cycles per second, a second and smaller motor assists the drive. This synchronous motor, operated at 2,000 cycles, in the range of telephonic rather than power frequencies, ensures that the rotating mechanisms at the two ends of the system shall not be out of step with each other by more than the amount represented by half of one of the small holes in the disc.

At the Receiving End.

At the receiving station there is, first of all, a source of light which responds with a brilliancy corresponding to the current which is received from the transmitting station. The source is a 'neon tube,' in which, when a high potential is applied to its electrodes, there takes place a glow discharge, the brilliancy of which is exactly proportional to the potential. To obtain sufficiently high potential from the distant photo-electric cell valve amplifiers are inserted in the circuit.

The remainder of the equipment, that for synchronisation, provides that the light shall appear to an observer at each instant in the same position on a picture plane as that occupied by the beam-illuminated spot of the distant scene. For an individual observer this is accomplished by using a fairly large neon tube which glows as a whole, according to the current it receives, and revolving before it a disc similar in perforations to the scanning disc of the transmitting apparatus and in synchronism therewith. Although all portions of the tube have the same brilliancy at any instant, the observer sees only that portion exposed at the instant by the perforation in the synchronising disc.

In the production of an image on a larger picture plane, a different method must be employed. Instead of a relatively small tube, successive portions of which are viewed at successive intervals, there is a very long tube folded back and forth to form a grid. Instead of a single pair of electrodes, 2,500 pairs are placed along its length. To each electrode corresponds a single elemental area of the picture plane which is scanned by the photo-electric cell of the transmitting equipment. As the current corresponding to each area reaches the receiving station it is distributed through contacts controlled by the synchronised motors to the appropriate electrode, and so causes a flash of light similar in position and in intensity. The whole grid-like tube is observed either directly or through a translucent medium. Eighteen times a second each of its 2,500 areas shines forth with a brilliancy similar to that of a portion of the distant scene, but owing to the persistence of vision the observers apprehend not a series of discreet light flashes, but a picture as a whole.



By LAWRENCE W. CORBETT.
(Our New York Correspondent.)

WHAT was, without doubt, the most amazing demonstration of the practicability of simultaneous broadcasting took place on Washington's birthday (a national holiday in America), on February 22nd, when forty-two broadcasting stations scattered all over the United States were linked together to broadcast the presidential address delivered to Congress. Special circuits covering 10,000 miles were involved in this stupendous tie-up, and the services of some 400 telephone and radio specialists were required to see that nothing miscarried.

Distance was no handicap. The occasion, as far as New Yorkers will remember it, was a brisk, sunny morning with several inches of snow on the ground. Others who listened to the President's remarks may have paused from their swimming to do so. Those eastwards—in Europe or Africa—may have listened to the address via the short-wave channels of W G Y or K D K A, as evening shadows were falling.

The forty-two stations linked on this epoch-making occasion were scattered from coast to coast. Hardly anybody in the United States need have been out of range of one or other of the stations participating. All down the Atlantic coast, from Maine to Florida; as far north, in the central states, as St. Paul-Minneapolis; Tennessee, Georgia, Kentucky, Texas, in the south; through Denver, Colorado and Salt Lake City, Utah, to the Pacific Coast—to such well-known cities as Los Angeles, San Francisco, Portland, Spokane, and Seattle. What a tie-up! Do not forget that Los Angeles is as far from Washington, where the President spoke, as London is from Washington!

A Popular Station.

One of the most popular stations in America is W E A F, of New York City. The antenna of this station is located right

in the city, and, despite its five to ten kilowatts, W E A F is heard very poorly in some districts only a very few miles from New York City. The absorption due to massive steel-structure buildings in the neighbourhood of the transmitter is very large. Some of the best programmes

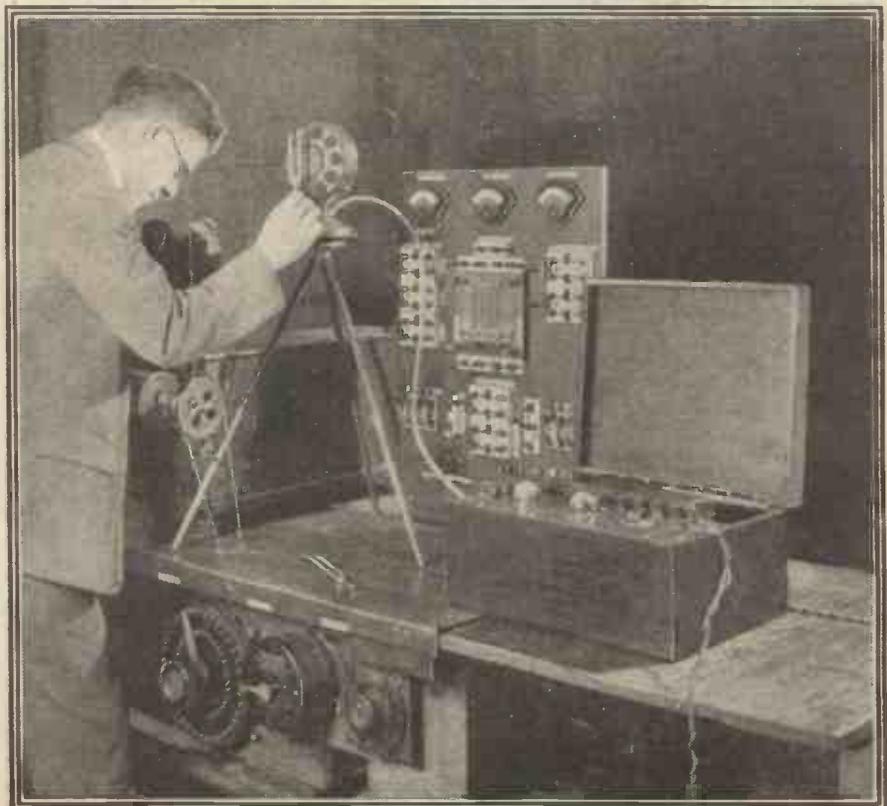
originate at W E A F, and although many of these are simultaneously broadcast, the engineers of the station see no reason why their station should be operating with such a poor radiating effect.

Another reason given why the present location of W E A F is unsatisfactory is that the transmitter above the Bell Telephone Laboratories is interfering with the research work of the American Telephone and Telegraph Company in that building. As a panacea for these two ills, it has been decided to move the transmitter to the country, the studios remaining in their old location at 195 Broadway, New York City. As yet no definite location has been decided upon for the new transmitter, although it has been announced that it will be a spot somewhere on Long Island, and that the new transmitter will go on the air early in the summer. One rumour has it that the spot likely to be chosen is in Mineola (pity the poor writer, who resides less than a mile from Mineola!). This despairing note is accentuated by the fact that another rumour states that W E A F will go to fifty kilowatts when it opens with its country location! Next winter will no doubt bring in reports innumerable from European listeners who hear W E A F.

New Short Waver.

Another note of interest regarding broadcasting stations, which will no doubt be appreciated by DX "fans" in Europe, relates to W R N Y, whose transmitter has often been illustrated in POPULAR WIRELESS. W R N Y has, as W E A F contemplates doing, already moved from its New York City location on the roof of the Roosevelt Hotel—a month or so ago—and the station now "gets out" much better. This week W R N Y announces that it will use a short-

(Continued on next page.)



Checking up sound-wave reproduction by means of an oscillograph in an American research laboratory.

AMERICA CALLING!

(Continued from previous page.)

wave channel, below fifty metres, in addition to its regular 375-metre wave-length, as soon as arrangements can be completed. W R N Y will be the first New York City

never before had such a tremendous audience. Fifteen microphones were used, for the pick-up. The distributing point for the two networks is in New York City, a distance of some six hundred miles from Chicago.

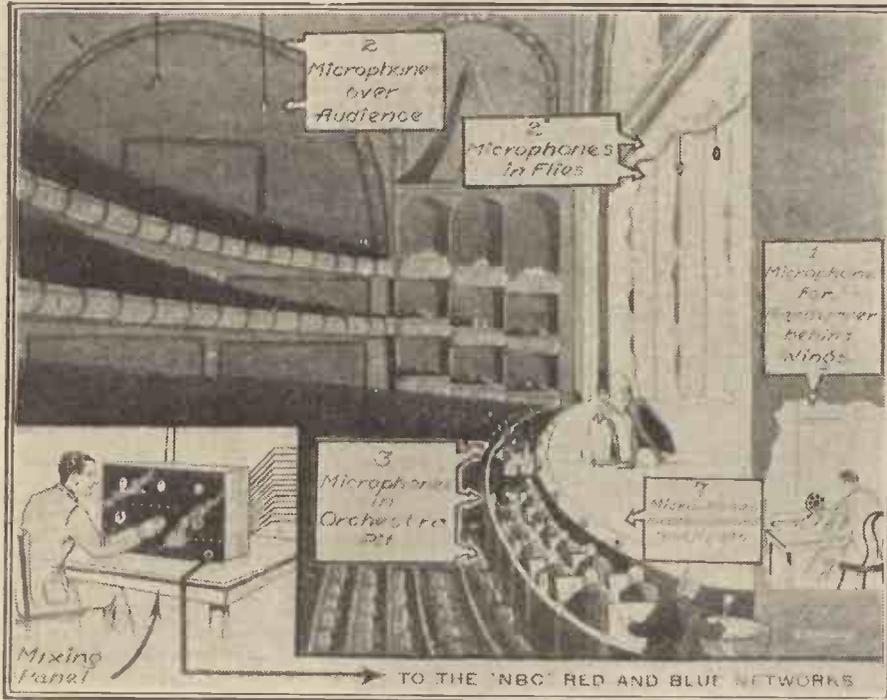
If, perhaps, you should hear the announcement that "this is W A B C, etc.," be informed that you are listening to an old friend, for W A B C (Atlantic Broadcasting



A new cone-type loud speaker now on the American market.

Company) is the call signal of erstwhile W A H G. This station has often been heard in Europe, and was even reported in Australia when using only about 1 kilowatt. The power was recently increased to 5 kilowatts.

A man who was leaving in a few hours to serve five years in a penitentiary was permitted to call up W L W, Cincinnati, and ask for his favourite number to be played. Much to the studio manager's surprise, he did not ask for the "Prisoner's Song," but, instead, requested that "Roses of Picardy" be played. The organist obliged with the selection, thus granting the last request the man would be able to make for five years.



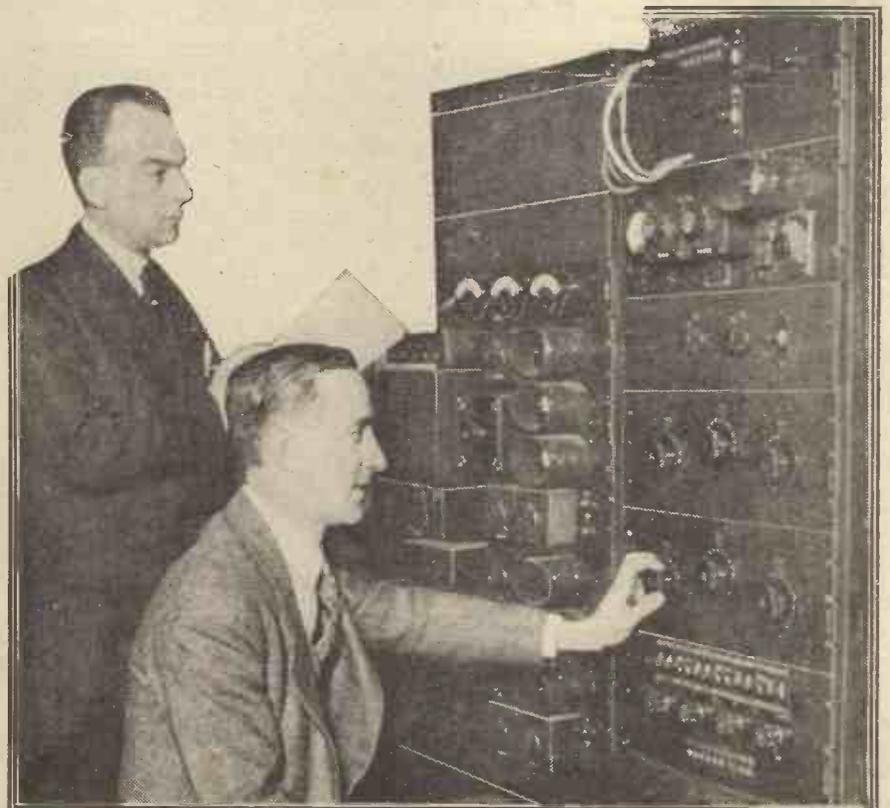
Showing the disposition of the 15 microphones in a Chicago theatre when an opera was broadcast.

district station then to operate on short waves, as W G Y and K D K A have been doing for some time now. W R N Y also announces that they are going to use an underground aerial patterned after the suggestions of Professor James H. Rogers, who has pioneered in this work.

Unrehearsed Incident.

In addition to the above announcements, W R N Y has been getting into the news more frequently than any other broadcasting station of late. Last week their station director resigned, to command another broadcaster. And then there is the story of the smashing of W R N Y's microphone by a youth during a broadcast from a remote point. On this occasion, W R N Y had just started to broadcast a programme from the Rosemont Dancing Academy in Brooklyn. A few bars of the French National Anthem were used by the orchestra to introduce their programme. As the music sounded, a youth named Salle rushed up, shouted something about "desecration," and, upon no notice being taken of his demands that the music be stopped, lunged at the microphone, and dashed it to the ground.

The National Broadcasting Company (N.B.C.) did a good job when they broadcast excerpts from the operas "Faust" and "Il Trovatore" from the stage of the Chicago Civic Opera Company. Both the W J Z group (the blue network) and the W E A F group (red network) were linked for this event, and it was suggested that opera had



The apparatus installed underneath the stage of the Auditorium Theatre, Chicago, in connection with the broadcasting of an opera production.

IS IT REALLY BETTER?

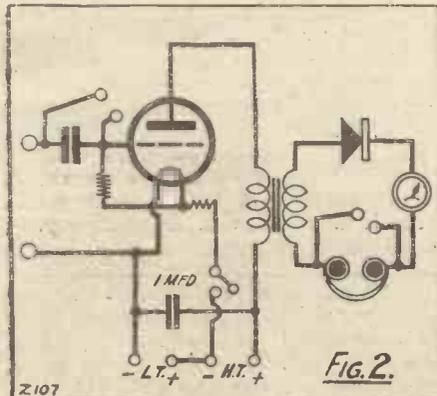
DIRECTLY one attempts to do any serious experimental work, the problem of how to eliminate the personal element in measurement stares one in the face. Some firm may produce a new valve; a novel crystal circuit may appear; big claims are made for a new circuit. Are they really better than the old arrangements? Just how can we find out?

The most expensive part of my laboratory equipment is designed for the determination of quite simple facts—at least they appear to be simple! Almost daily I receive new apparatus and components for test, and the measurements taken in trying them constitute some of the most interesting work I do.

Let us take the case of a crystal detector. "That's simple," you say. "All you have to do is to compare it with one you know, by means of a change-over switch. Listen!"

Testing Crystal Detectors.

For a rough-and-ready test this method is permissible, but you will realise its disadvantages when you consider the following facts.



1. One crystal detector can be easily fifteen or twenty per cent. better than another without the human ear being able to detect the difference.

2. The best circuit arrangement for one detector may not necessarily be the best for another.

3. Constant changes in the nature of the transmission from a broadcasting station (the transition from a talk to jazz music, for example) may make comparisons of this kind very difficult.

Whenever possible the human element should be cut out in radio measurements, and the methods I adopt for testing crystal detectors include the following:

1. The production of a uniform signal from an oscillator, modulated by the uniform note.

2. The production of an induced current in a circuit, consisting of a coil of low H.F. resistance, shunted by a variable condenser, so as to tune it to the frequency of the oscillator.

An article of interest to the experimenter.

By
P. W. HARRIS,
M.I.R.E.



3. The connection of a known crystal detector across this in series with a sensitive microammeter.

The detector to be tested can be substituted for this known detector in a moment by means of a change-over switch.

4. The testing of the crystal in various types of circuit.

First of all, the circuit with the known crystal detector is tuned in to the oscillator, and its rectified current measured. The strength of the oscillation is adjusted so as to bring the reading to some convenient spot on the scale.

The reading given on the microammeter is now noted, and the change-over made to the crystal to be tested, and a note also made of the reading obtained with this. It should be mentioned that high-resistance telephones are connected in series with the microammeter, although they are not used for actually measuring the signal strength.

"Astonishingly Little Variation."

After a note has been made of the new reading, a change-back is made to the known detector by the switch, to make sure that the oscillator has remained constant.

The next test is made with much reduced

coupling between the oscillator and the coil, so as to test the rectifier on weak signals, and a further test is later made with very strong signals. These tests are most necessary, as detectors differ quite considerably in their sensitivity to very weak and very strong signals. The microammeter used is sufficiently sensitive to give a reading on signals so weak that they would not be considered of much value in broadcast reception.

I can tell you definitely that practically all the well-known brands of crystals sold are good, and so far as the cat's-whisker type is concerned, there is astonishingly little variation between them, provided care is taken in finding a good spot on each crystal. The so-called permanent detectors do, however, vary a great deal, and it is not unusual to find one 300 per cent. better than another.

Under Working Conditions.

An extension of the same method is used in conjunction with a valve detector to try out various coils under actual working conditions.

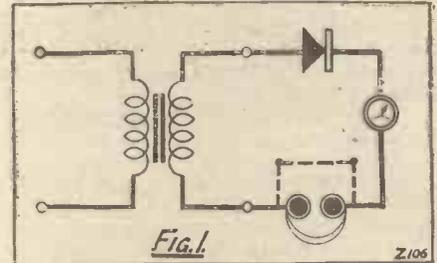
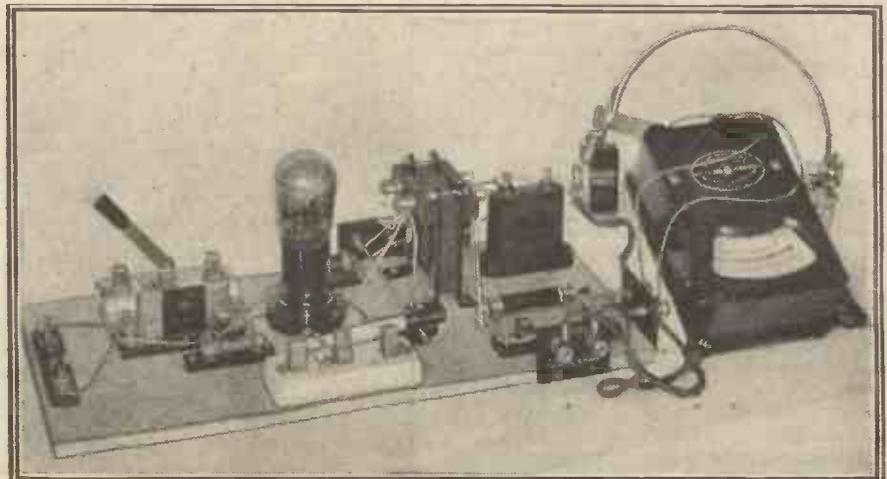


Fig. 1 shows a telephone transformer, to the secondary of which is connected a crystal detector in series with a sensitive microammeter. Now, if the primary winding is connected in the plate circuit of the detector valve, the rectified current

(Continued on next page.)



Apparatus used by the author in the measurement and comparison of circuit efficiencies. The output of the rectifying valve is measured by the microammeter.

IS IT REALLY BETTER ?

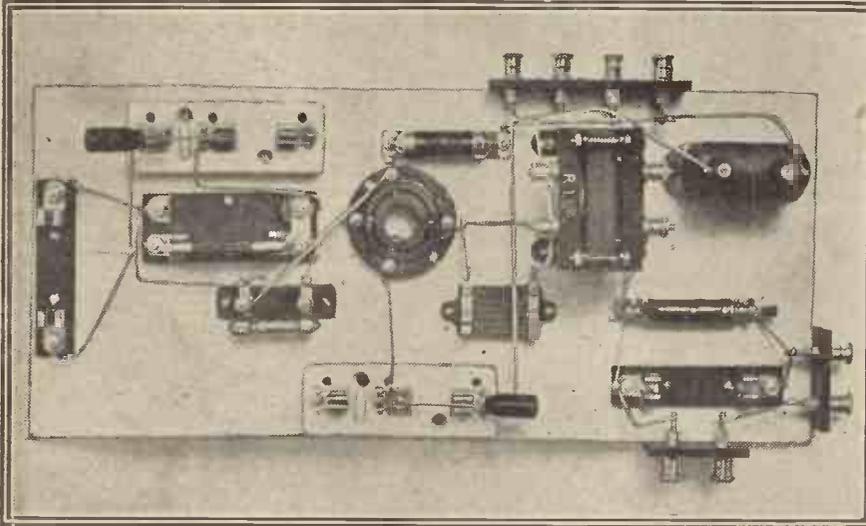
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thereupon passes through its windings, inducing an L.F. alternating current in the secondary winding. This L.F. alternating current (the frequency of which corresponds to the modulation frequency of the C.W.

coupled or a tapped circuit, the relative efficiencies will show up more clearly, and still more so if the crystal detector is shunted across only a part of the tuned circuit.

How important it is to eliminate the human element in testing, and to make actual measurements before forming actual conclusions, is demonstrated by a quite sensational test I conducted on a "low-loss" variable condenser recently submitted for test. It had all appearances of being

that all was well. A further test again showed very high losses, and these were also given by three other specimens of the same make. Puzzled as to the cause, I stripped the condenser, and found that what appeared to be solid insulation was but a tube through which a metal rod passed. The only insulation between this metal rod (which was connected to the moving plates) and the fixed plates, was one layer of untreated brown paper! As a matter of fact the component has been withdrawn from the market and replaced by another, similar in appearance but, electrically, fundamentally different. In this the losses are as low as can be reasonably expected.



Portion of the apparatus employed by Mr. Harris in testing components. In this case a valve detector passes its rectified current through the primary of a telephone transformer, and the current in the secondary is rectified by a crystal and finally passed to a microammeter.

oscillation) is rectified by the crystal detector and directly measured by the microammeter.

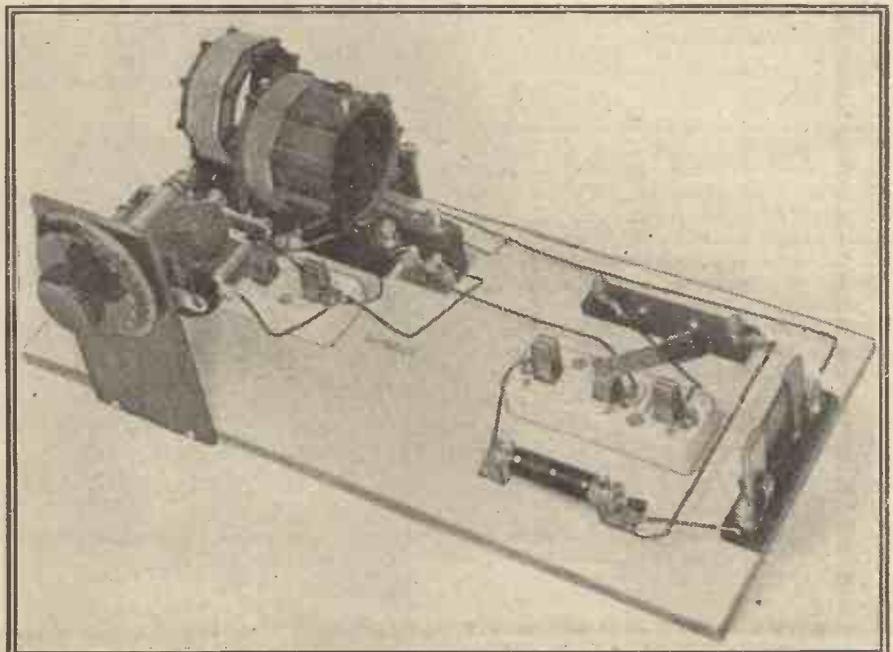
Fig. 2 shows the circuit of a test-board, consisting of a valve detector with the transformer and crystal-measuring circuit. The grid condenser can be short-circuited, when desired, by a switch, and the leak removed, so as to use the valve after an L.F. transformer. Comparisons of coils can readily be made with this arrangement.

After H.F. measurements have been effected on the coil itself (one of the methods used has already been described in these columns), a measurement of the wavelength band covered with a given condenser is then made. One of the most interesting tests made by means of this apparatus in conjunction with other devices specially designed for this purpose has been the measurement of signal losses under practical conditions introduced by the screens themselves in the screened types of coil.

An Interesting Test.

A fact easily demonstrable with the apparatus previously described is that when a circuit is used consisting of the aerial directly coupled to the grid of the first valve with a crystal detector shunted across the whole of this coil, the damping introduced by the aerial and the crystal detector is sufficient to mask very considerable differences between coils. For example, the substitution of a really low-resistance coil for one of comparatively high resistance will make so small an alteration of current in the microammeter circuit, that the alteration of sound strength cannot be detected in the telephones. If, however, a coil is used in an inductively

an excellent instrument. It was well finished with a smooth movement; the insulating material and its disposition suggested sound design, and, in fact, it could easily have been passed as a good condenser by visual inspection. Tested for H.F. losses, however, it immediately showed up so badly that I stopped the test, and re-tested my own instruments to see



Part of the apparatus used in the testing of various types of crystals.

CONDENSER CALCULATIONS.

A ROUGH-AND-READY method of calculating the capacity of a home-made condenser, when .002 mica is used, is to reckon that each overlap of metal sheets equal to an area of one square inch gives a capacity of .0003. Thus, if there are only two metal sheets overlapping (with mica between) to the extent of $\frac{1}{2}$ in. \times $\frac{1}{2}$ in., the capacity will be about $\frac{1}{4} \times .0003$, or approximately .0001. Seven metal sheets, three connected to one terminal and four to the other terminal, will give an average overlap of $\frac{1}{2}$ in. \times $\frac{1}{2}$ in., will give a condenser of about .001.

If it is desired to test the capacity of a condenser made in this way, a simple method is to insert it first in series with the tuning circuit of a receiver, and then in parallel, and to note the difference in tuning on a given station. The differences thus noted should be compared with the differences caused by using a commercial fixed condenser of known capacity and reliable manufacture in the same way.



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Advertising manufacturers expect their products to be used and mentioned regularly in the circuits and articles appearing in any periodical. Each manufacturer is given a turn, including LISSEN. But users have long since understood this, and know that when certain makes of radio parts are specified it does not necessarily mean that they are the best for their purpose—the corresponding LISSEN parts can be used instead with a gain in clarity and volume of signals—at no increased cost.

LISSEN parts use all the available energy and build up signals strongly. There are no losses and no leakages to be overcome in the parts themselves. The LISSEN direct-to-dealer policy of distribution cuts out big wholesale profits and passes the saving on to the users.

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LISSEN fixed condensers are accurate to within 5 per cent. of their marked capacities. They never leak, they never vary. You can't buy a finer condenser.

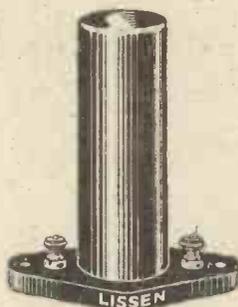


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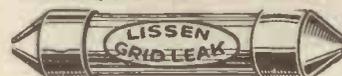
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LOW LOSS, LOW CAPACITY



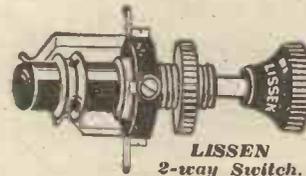
There is not a square inch of superfluous ebonite in this LISSEN Valve Holder. That means low capacity and low loss, and therefore stronger, clearer signals. Shown ready for baseboard mounting, but can also be used for panel mounting by bending springs straight. Patented. Previously 1/8. NOW 1/-

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L.319



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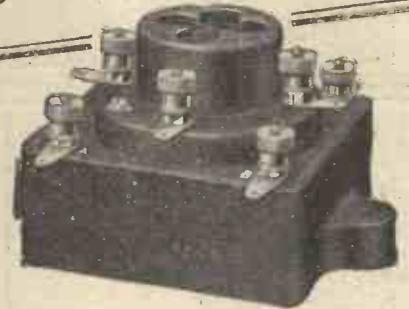
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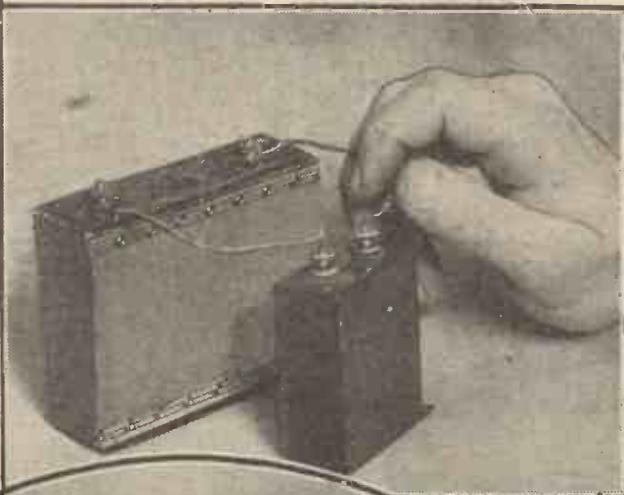
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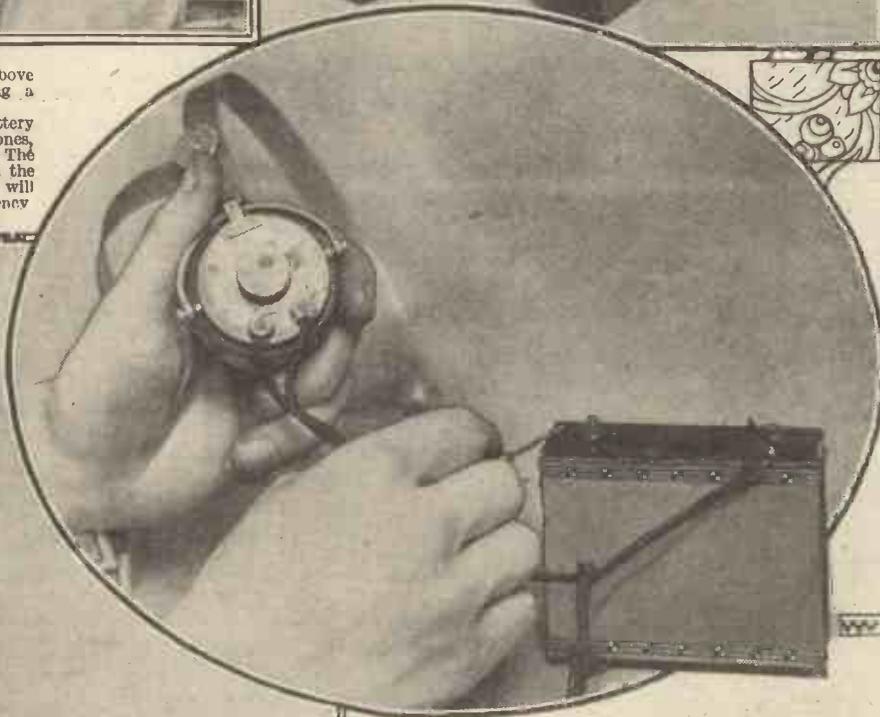
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P69

TRACKING TROUBLE!



The two photographs above show a method of testing a fixed condenser.

It is first charged from a battery and then discharged through 'phones, when a click will be heard. The length of time during which the condenser can be left charged will indicate its insulation efficiency



If one of the 'phone ear-pieces seems faulty, it can be shorted as shown above and the remaining one can then be tested.

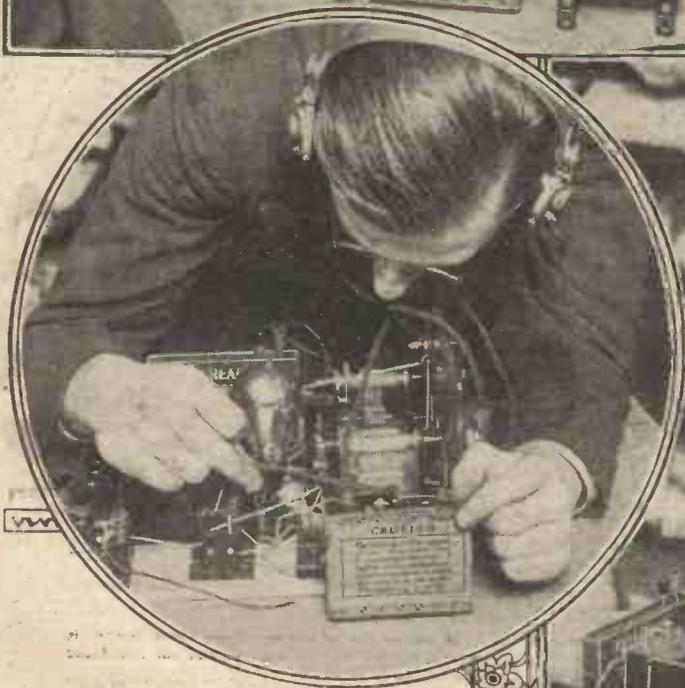
To find if the 'phones are O.K. all that is necessary is to connect them momentarily across a low-voltage battery, when continuity is indicated by a very loud click.

(Continued on next page.)



(Above.) If 'phones are connected across one winding of an L.F. transformer, and a battery is "tapped" across the other winding, corresponding loud clicks will be heard if the component is O.K.

Connect one 'phone-tag to one terminal of a battery and a wire to its other terminal. Then the remaining 'phone-tag can be used with the wire to test any coil or winding between the two. (Left) A transformer primary being tested.



The test made with a battery and 'phones connected in series can be applied not only to one coil or winding, but to a whole scheme of connections.

Above is shown a test of this nature, continuity being indicated by a loud click when the connection is made.



Another continuity test is shown above, where one side of the battery is joined to the aerial terminal.

Then by joining the other side of the battery to the other side of the coil, both the coil and its wiring can be tested.

How to get those Low Notes



An article of vital interest to the loud-speaker enthusiast.

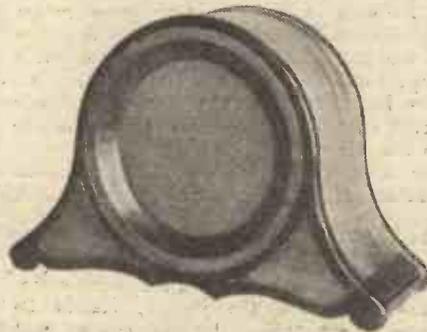
By G. P. KENDALL, B.Sc.
(Chief of "P.W.'s" Queries Dept.)

THE human ear, provided that it has not been too highly trained in musical matters, is extraordinarily adaptable and seems able to accustom itself to almost any standard of reproduction and find it good; probably a very fortunate fact for the success of broadcasting. I know that this sounds like the beginning of one of Sir Thomas Beecham's denunciations of broadcasting and all its works, but my object is different from that of that redoubtable musician, in that I know that almost perfect reproduction is possible, and I wish to deal practically with a certain special aspect of the problem.

Mere Noise!

Now, although nearly perfect reproduction is certainly obtainable, it is, unfortunately, only too true that very few people get it, and, worse still, that very many are quite satisfied with the inferior reproduction which they do obtain. Of course, there

the mere fact that it is wireless, and that therefore it is rather wonderful to be able to hear broadcasting at all, is rather liable at



In some open-diaphragm loud speakers the back of the instrument is completely closed in.

times to make us less critical than we should be. So long as the reproduction is reasonably pure and not noticeably distorted we are apt to be satisfied, and I want to try and make my readers discontented with such an easily-achieved ideal, because something better is most certainly available to them.

to which I have referred, but that merely means that the music is reproduced without any noticeable additions or alterations, and what is further required is that there shall be no serious subtractions either.

Omissions.

This last, which is not nearly so easy to guarantee, simply means that every note, whether high or low, must be reproduced at the correct volume and none omitted.

This may seem rather a strange stipulation to readers who have not previously realised that the sins of the modern L.F. amplifier and loud speaker are sins rather of omission than commission, but it is, nevertheless, a very important one.

It is a fact that at the present time it is quite an easy matter to get reproduction which sounds pure and without any noticeable distortion, all that is needed being a reasonably good loud speaker, and similar L.F. transformer, suitable valves, and proper H.T. and grid bias. To obtain really faithful reproduction, however, something more is needed, and in my experience such

(Continued on next page.)



One of the easiest ways to secure better reproduction of the low notes is to use resistance coupling.

will always be the type of listener to whom wireless is a source of wonder and interest rather than musical entertainment, and to a certain proportion of these mere noise is more impressive than anything else, and so long as they can "hear it at the end of the garden with all the windows shut" they do not care how bad the quality is.

With this type of listener we are not here concerned; his numbers are, fortunately, small, and tend to grow smaller. Rather do I wish to appeal to that very large army of listeners who appreciate good quality but who are too easily satisfied. Now, I think

my mind, very misleading, and its common employment is probably responsible, to a considerable extent, for the low ideal which I am trying to upset. "Pure," in the sense in which it is usually employed, merely means that the music and speech are free from any obvious jarring notes and discordant sounds, and that each note is clear and reasonably like the original sound produced in the studio. Something very much more than this is needed before really good reproduction is obtained, such as would satisfy a person of musical tastes. Of course, it must be "pure" in the sense



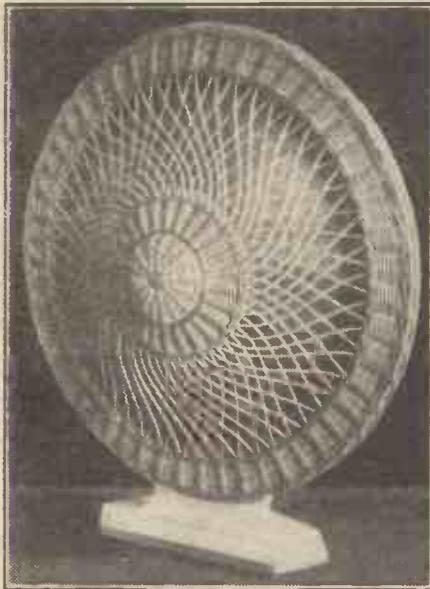
Open-diaphragm loud speakers are becoming very popular in America, where some very ornate specimens have been produced.

HOW TO GET THOSE LOW NOTES.

(Continued from previous page.)

reproduction is so rare as to make me fear that there is more than is pleasant to admit in Sir Thomas Beecham's denunciation of broadcasting.

At this point I can imagine that you, my reader, may feel a strong desire to ask why all this concern about faithful reproduction? You may consider that your set and loud speaker give music which sounds perfectly pure and undistorted, and that you are,



An ingenious American scheme for protecting the "works" of a cone-type loud speaker.

therefore, justified in being satisfied with what you have and disregarding the urgings of people like myself who try to make you discontented in favour of what you have not.

Naturalness.

The answer to that question is simply this: If you will endeavour to obtain real faithfulness instead of being content with the lower standard of absence of obvious distortion, you will find before long that you are getting reproduction of a *naturalness* that you previously thought impossible, and that your pleasure in listening has been enormously increased. Moreover, you will be spared the humiliating experience which so often befalls those who invite some person of musical tastes to listen. What happens is something like this: you possess a set which gives particularly "pure" results without the slightest sign of discordant sounds, and you have listened to it long enough to have got so used to it that you do not notice that it completely fails to reproduce one range of notes and over-emphasises another.

All your wireless friends praise it, and the natural result is that you ask some musician of your acquaintance to come and listen and be converted to broadcasting. He arrives, listens for a while without comment, and then makes some tactful but non-committal remark to the effect that wireless

is a very wonderful invention; and you will probably get no more out of him unless you ask some very direct questions (assuming, of course, that he does regard you as a friend, although wireless-mad!). If you can persuade him to tell you what he thinks without fear of hurting your feelings, he will probably start by saying, "Well, in the first place, it's really not music," and then you will learn a heap of valuable things that you never suspected.

The Bass Notes.

Chiefly, you will find, he has been outraged by the fact that your set is practically suppressing a certain range of notes altogether, so that it may completely spoil the character of a piece of music, if those notes chance to play a large part in it. Now these notes are those of the lower register—i.e. the bass notes, in practically every case, and their omission by so very many sets seems to me so crying a defect that this article is being devoted entirely to trying to give my readers a correct insight into the matter, and to show how it may be remedied. Let me emphasise this last point; it is possible to reproduce the low notes, and when this is done the increase in naturalness in all music, but more particularly in orchestral pieces, is positively startling, even to a non-musical listener.

To some readers it may seem rather startling to be told that the great majority of sets and loud speakers almost completely omit the low notes, and the fact that we can listen to such reproduction without being offended by its shortcomings is due to the curious power of the human ear of becoming accustomed to such imperfections and ceasing to notice them.

The Proof.

If you find this hard to believe, just listen to a dance orchestra rendering something in which the rhythm should be strongly emphasised by the drums, and notice whether those drums can be more than faintly heard somewhere in the background. On the average set and horn loud speaker that is about all you will hear, and if you will listen carefully to any orchestra you will discover that the deep notes of all the instruments are so weakly rendered that they cannot bear their part properly in the way the composer intended. There, has that infected you with some of my dissatisfaction with the ordinary standard of reproduction?

In the past this feeble reproduction of the bass notes has been due to two things: first, the inability of the ordinary horn loud speaker to render the lower musical frequencies at their true volume, and secondly, the corresponding inability of the average transformer-coupled L.F. amplifier to magnify them except weakly. Progress has been slow because these two factors reacted one upon the other, and there was a tendency for the designer of amplifiers and the manufacturer of L.F. transformers to assume that it was useless to worry about musical frequencies below about 200 per second, because they would not be reproduced by the average loud speaker in any case.

Similarly, the loud-speaker manufacturer might be forgiven for declining to incur much expense and trouble in producing an instrument capable of rendering the low notes properly when he knew that the vast majority of sets would not provide those

notes in sufficient strength to be worth troubling about.

Comparatively recently, however, a reaction has set in. The greater popularity of resistance-capacity coupling opened up possibilities of more even amplification over the scale of musical frequencies and led many people to adopt a higher standard. Simultaneously, loud speakers began to appear which were capable of reproducing the bass notes at something like their correct volume, and certain transformer manufacturers designed transformers which permitted good amplification to be obtained much further down the scale. The position now is that it is definitely possible to secure full and satisfying reproduction of the more important part of the bass end of the scale, provided that certain rules are observed.

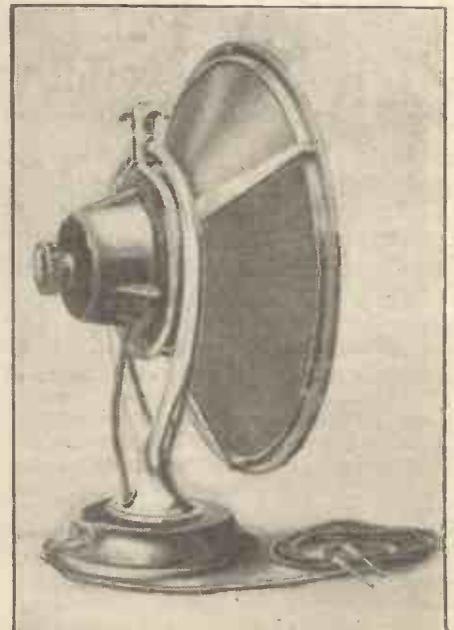
Practical Points.

And so we come to the practical side of the question. I make no apology for the amount of time I have devoted to preliminary explanations, because it seems to me that the whole subject is a vital one to the continued success of broadcasting as a means of musical entertainment rather than a mere scientific toy. It is an obligation which falls upon every one of us to do what we can to remove any justification from the allegations of imperfect reproduction so often levelled at broadcasting by musical folk.

Let us take first the L.F. amplifying circuits. Here the first point to be decided concerns the method of coupling to be used. Now, the easiest way to be sure that your set is capable of reproducing the low notes is to use resistance-capacity, and if you use the latest special valves and the correct anode resistances you need not be afraid of a loss of volume as compared with other methods. Make sure that your grid condensers are large enough (.01 mfd. is a convenient size), and do not use too low a value of grid leak, and with adequate H.T. voltage you will not go far wrong.

Choke coupling is also capable of giving the desired results if the chokes are large

(Continued on page 423)



One of the earlier B.T.H. conical diaphragm speakers.

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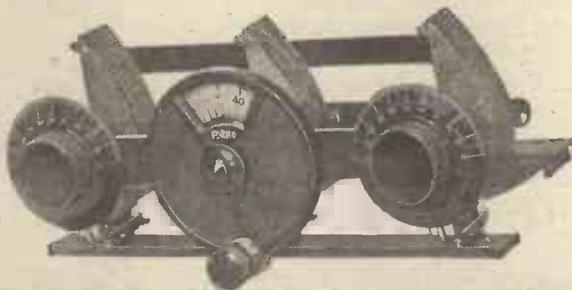
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Now on Sale.

ONE SHILLING.

AN AUTOMATIC EARTH PLATE.

Describing a novel and efficient earthing device.

By O. J. RANKIN.

MAKING good electrical contact with ordinary earth is often an extremely difficult matter; we cannot make a mechanical joint, and so we have to merely bury the metal conductor, or otherwise place it *against* the earth, which amounts to practically the same thing as leaving all the connecting wires in the receiver lying *against* terminals, etc., instead of securing them firmly under the terminal nuts. How often do we go over all connecting points, tightening a terminal here, and a nut there, and how often do we think of the importance of "tightening" our earth connection also?

the case, and the result is that the earth contact is not always efficient. The efficiency of an earthing system depends mainly upon its resistance, which, of course, must be cut down to a minimum by providing a good contact.

The simple idea outlined in the accompanying sketch may be of interest to experimenters who are striving for the perfect earth. This has been devised by the writer, and used with great success over a long period of changeable weather. The device consists of two small tinned iron pans, as used in kitchens, etc., and a large strong

spring as used by manufacturers of easy chairs. A hole is drilled in the centre of each pan, so that when the pans are placed over the ends of the spring, the latter may be held in compression by means of a piece of cord arranged as shown. If the large spring cannot be obtained, then three or four smaller springs might be used. The earth lead is divided and soldered to the rims of both pans.

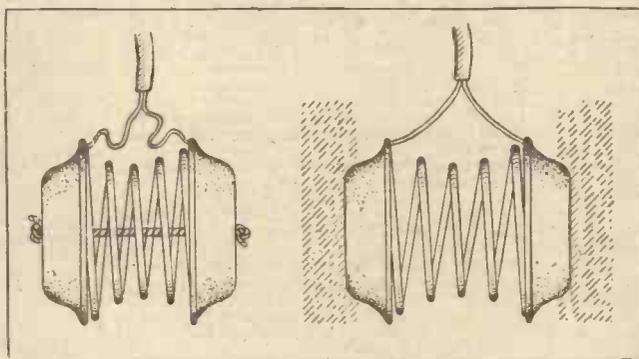
Releasing the Spring.

The device, with the spring compressed as shown in the left-hand figure, should fit nicely into the prepared hole in the ground, so that the bases of the pans make a reasonably good contact with the sides of the hole. If the cord is then cut the spring will force the pans against the sides of the hole in the manner shown on the right, and hold them in good contact for quite a long period. If the device is buried fairly deeply the cord may be cut by means of a safety-razor blade screwed to the end of a thin lath. The hole may be filled in, as usual, or left open.

Only pans of the best quality (heavily-tinned pans) should be used, those obtained from iron-mongers being suitable. Stout zinc plates would, of course, constitute a great improvement; these might be round, square, or hexagonal, and attached to the ends of the spring in any suitable manner. The idea, even in its most simple and convenient form, will be well worth trying.

Good Contact Essential.

A poor earth contact often means the difference between success and failure. Ordinary earth tubes, spikes, etc., can never be efficient in the true sense because climatic conditions influence the expanding and contracting properties of the earth, while the metal conductor remains unaffected. If the earth and the conductor expanded and contracted at the same rate, all would be well, but unfortunately this is not



HOW TO GET THOSE LOW NOTES.

(Continued from page 420.)

enough. Unfortunately, some of the L.F. chokes on the market are definitely of too low an inductance value to give the required amplification of low notes unless rather low impedance valves are used, in which case the amplification per stage is reduced. It is safest only to use those chokes of which the makers actually publish the inductance (it should be 100 henries at least, and more if possible, to enable really high impedance, high amplification factor valves to be used).

Transformer Coupling.

When we come to consider transformer coupling, we reach the rock on which so many are shipwrecked, and it must be definitely stated that the average L.F. transformer does *not* permit the low notes to be amplified at anything like their true volume. Only the really first-class instruments, usually of comparatively recent design, are capable of doing it to a reasonably satisfactory degree, and even with these I prefer to use only one stage and employ resistance coupling for the other (assuming an amplifier of two stages for loud speaker work).

It must not be forgotten that the type of valve in use affects the evenness of amplification over the range of frequencies. To obtain proper reproduction of the desired low notes the impedance of each valve in

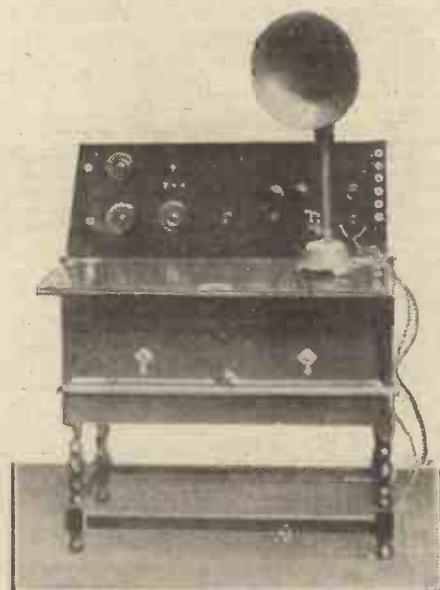
the amplifier must be less in a certain ratio than the impedance in the anode circuit of that valve. What this means in practice is that it is very desirable in the case of transformer coupling to use power valves throughout and not merely in the last stage. It also means that the transformer following the detector valve, that is, coupling the detector to the first L.F. valve, should be of *low* ratio, since a detector valve is commonly of high impedance, and the only way to get the desired ratio of impedances is to use a large primary on the transformer. This naturally means a low-ratio transformer for this stage.

The Final Link.

In the last stage, of course, a power valve is essential, not merely to secure the desired ratio of impedances (valve to loud speaker in this case), but also for the usual reason of avoiding over-loading. This brings us to the end of the more important points in the amplifier which govern the reproduction of our much-desired bass notes, and we can turn to the loud speaker, which is the final link in the chain. Here I must make another very positive statement: the ordinary horned loud speaker will *not* reproduce the lower frequencies properly, and nothing that you can do will make it. The majority of them do not adequately go below perhaps 150 or even 200 per second, and some begin to cut off even higher than this.

To reproduce the bass with something like the natural effect one of the modern open-diaphragm or "cone" types is needed, but I must be careful not to give the impression that *all* open-diaphragm loud

speakers will do it, because there are one or two on the market which are little if any better than a horned instrument in this respect. In general, however, "cone"



With a large set of this type it is very easy to overload a small loud speaker.

types will serve the purpose, and so complete the chain which ends in the rendering in your room of a version of the transmission which you may safely allow your musical friends to hear!

A TWO-FOLD TWO-VALVER.

The Editor, POPULAR WIRELESS.

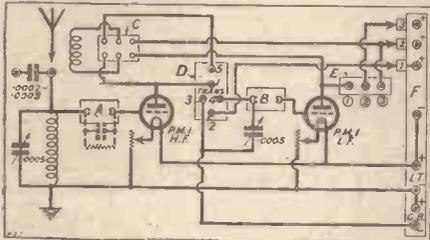
Dear Sir,—I was very interested in "H.F. or L.F.'s" query and your answer in "P.W." recently. May I suggest that the enclosed diagram of circuit and lay-out would meet the case without complicating the wiring or making the size of panel too large, and the change-over would take very little longer than with switches?

Yours faithfully,
A. H. ABEL.

93, Harberton Road,
Highgate, N.19.

The lettering on the diagrams has the following significance:

- A. Ebonite strip to hold two clips (or plug) for clip in G.L. and condenser (or shorting strip), according to whether H.F. or Det.
- B. Ebonite strip to hold two clips (or plug) for clip in G.L. and condenser (or shorting strip), according to whether Det. or L.F.
- C. D.P.D.T. to change re-action coil from 1st to 2nd valve.



- D. Ebonite strip to hold five valve sockets. 1-4 being for H.F. trans. + 2-5 for L.F. trans. The L.F. trans. should be mounted on ebonite strip with connections to four valve logs (thus making it a plug-in unit) (primary 2 and 5, secondary 3 and 4).
- E. Terminal strip for 'phones: 1-2, 2nd valve L.F.; 2-3, 2nd valve Det.
- F. Terminal strip for H.T., L.T., and G.B.: 1, H.T. for 1st valve; + 2, H.T. when using 2nd valve as Det.; 3, H.T. when using 2nd valve as L.F.

FAIR PLAY FOR THE "HALE!"

The Editor, POPULAR WIRELESS.

Dear Sir,—I have been reading "Notes on the Hale," by Captain Round, in the December 11th, 1926, number of your publication, POPULAR WIRELESS, and I was struck with a familiar look about the circuit. Therefore I went through my book of cuttings from various wireless publications, and sure enough found one describing a circuit called the "Old Dobbin," which appeared in an article by Mr. Joseph Riley in the American magazine "Radio News," for March, 1925, page 1,075.

I enclose the diagram of this circuit and you will see that this circuit is fundamentally the same as that "invented" by Mr. Hale.

In his article on the "Old Dobbin" Mr. Riley says "If the set is to operate in an open district (so far as radio is concerned) the crystal may be operated from the grid lead" (i.e. the top of the tuner secondary). This would make the circuit nearly exactly the same as the Hale, except that in the latter the crystal is placed on the filament side of the transformer primary and in the Dobbin it is on the tuner or grid side.

I think Mr. Hale would be interested to know that the circuit which, according to another issue of your magazine, was the result of much experimenting on his part, was published nearly two years ago, and incidentally was built by the writer and found O.K. on a trip across the Pacific?

While wishing Mr. Hale all the best, and believing that the statement in POPULAR WIRELESS that Mr. Hale invented this circuit is quite sincere, I think Mr. Hale would like to "play fair" and give Mr. Riley credit for being first in the field with the circuit.

I should like to see such an acknowledgment published in your magazine, which I receive regularly from home, and to which may I be permitted to wish every success.

Yours faithfully,
J. GIBBS.

Wireless Operator, S.S. Ampullaria,
S.S. Ampullaria,
C/o. Anglo-Saxon Petroleum Co.,
St. Helen's Court,
Leadenhall, Street, E.C.3.

The above letter has been submitted to Mr. Percy W. Harris, who writes as follows:

Mr. Gibbs has assumed quite erroneously that the Hale circuit is a product of the last few months. Patent for this circuit is dated 1924, a whole year before the publication of the "Old Dobbin." The full patent was published early in 1925, as Mr. Gibbs can ascertain for himself on inquiry at the Patent Office. Mr. Gibbs may care to ask Mr. Riley to "play fair." — P. W. H.

RESISTANCE v. TRANSFORMER COUPLING.

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to Mr. Hardingham's letter in your paper of April 14th, I wish to correct a slight misunderstanding. Though in a previous

CORRESPONDENCE.

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.

letter Mr. Hardingham asked "Maltese Cross" for a circuit, it was I who wrote him and who had the pleasure of demonstrating my set to him, and it was my set that accounted for his enthusiasm for R.C. coupling. I have written Mr. Hardingham, and he will no doubt be writing you in the matter.

The set is perfectly simple, easy to construct, and has the advantage of being extremely economical to construct and to maintain. Though at my place it is run entirely off the A.C. mains, the basic circuit remains the same, whether mains or batteries are used, and will be supplied to those interested (stamp). It is a combination of crystal and two or three valves R.C. coupled, with optional reaction. At six miles 2 L.O. is full loud-speaker strength on two valves without reaction, and as Mr. Hardingham said, "could not be approached for purity coupled with very great volume." No transformers are employed.

Anybody caring to hear this set, which is laid out only in experimental fashion, can do so, if he will drop me a line beforehand. I have also piles of "P.W.'s" and other wireless magazines which may be obtained by callers free of charge. I cannot guarantee specific numbers as some have already been taken.

In closing, I can wish your paper no greater success than it has achieved in the past.

Yours faithfully,
HERBERT J. DYKES.

"Matlock," 69, Holmdene Avenue,
Horne Hill, S.E.24.

[Editor's Note.—We have had a letter from Mr. C. Hardingham explaining that by a curious mistake he confused "Maltese Cross" with Mr. Dykes owing to this latter gentleman writing him immediately subsequently to the publication of the enquiry directed to "Maltese Cross."]

To the Editor, POPULAR WIRELESS.

Dear Sir,—May I be permitted a further incursion into your valuable space on the subject of faithful reproduction? The trouble is that the human ear is so easily deceived. As one who has made twenty-five years' study of musical tone and written three standard works on the organ, perhaps it may interest your readers to know that there was a time when I, along with many others, imagined that I was listening to fundamental tones 250 cycles from a horn type of speaker. The only true method of testing such phenomena is to switch from one type of speaker to another, the one having a high cut-off, the other a low, and to note the difference in the reception of the lower frequencies. Better still, listen to the lowest notes of the piano on your speaker and then actually play them on your own piano. With a horn type of speaker (unless the horn is at least seven feet long) the difference is laughable. Even a thirty feet horn will not secure a perfect reproduction, because the diaphragm itself is incapable of the degree of motion required. Your correspondent, A. C. R., will, in due course, discover how little his speaker is capable of reproducing the lowest tones of the grand organ and the orchestra.

I am very interested in the crystal and R.C. amplifier circuit mentioned by Mr. Hardingham. The tonal results of such a receiver are undoubtedly very satisfying, but I do not think that it is the last word. To begin with, the crystal, despite the assertions of experts, is not the ideal detector, since it cannot pass the lowest frequencies with equal amplitude. I have made several careful tests with crystal and valve detection, and am able to state that the detector valve working on an anode bend is supreme. When purity of signals is considered there is not much to choose between crystal and valve, but for equal amplification of all musical frequencies the valve wins the day. Moreover, the amount of amplification required to work a coil-driven cone places crystal detection at a discount.

If anyone wants to know what wireless can accomplish in faithful reproduction, I advise him to try anode bend detection followed by battery coupling to the first L.F. stage, followed by the older form of R.C. coupling. Of course, the right valves must be used, and the right voltages. And the right speaker, please!

NOEL BONAVIA-HUNT.

96, Broadhurst Gardens,
Hampstead, London, N.W.6.

The Editor, POPULAR WIRELESS.

Dear Sir,—There has been a great deal of very interesting correspondence in your columns recently in regard to purity of reproduction and the vexing question of Transformer v. R.C.C., but there are several points which very definitely require to be cleared up before we can even start to think about natural reproduction. The fact that the actual

B.B.C. transmissions are not perfect is more or less generally known, but it does not seem to be taken into consideration. By not perfect I mean that the B.B.C. engineers purposely make it so by including in the transmission more bass than would be the case in an ordinary concert hall. At the Royal Albert Hall, for instance, there are usually twice as many double basses than would be used if the concert was not being radiated. This, of course, assumes that listeners' receivers are not perfect, and that, as a rule, the frequencies below 200 are very imperfectly, if at all, reproduced.

This is quite a good idea on the part of the B.B.C., but what of those who are able to get absolutely pure reproduction with the aid of R.C. amplifiers and Kone or R.K. speakers? They will probably think that something is wrong with the receiver, in view of the preponderance of bass. This, though, could be very easily remedied by decreasing the value of the coupling condenser in the resistance-coupled stages.

It will be obvious, therefore, that we do not want a perfect receiver to receive the B.B.C. transmissions perfectly, but a receiver which suppresses the low frequencies to a certain extent.

Another point in the battle between transformers and resistance coupling, if as several correspondents have stated, transformers do not pass the very low frequencies well, there would be no object in taking elaborate measures with the B.B.C. transmissions. This is because the B.B.C. speech amplifiers incorporate about 5 L.F. transformers of a well-known make.

The above statements are, of course, open to correction, and I should be glad to hear what your other readers have to say on this subject.

Yours very truly,
2 A D G.

THE MYSTERY SOLVED.

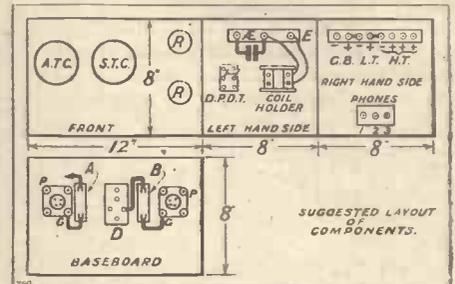
The Editor, POPULAR WIRELESS.

Dear Sir,—On glancing through the copy of "P.W." No. 250, of March 19th, I noticed a letter from Mr. F. Griffiths, of Small Heath, headed "A Singing Set." I have a 3-valve set, using Telsco transformers for coupling the L.F. stages, and some time ago was surprised to hear the set reproducing, but took no more notice of same until I rebuilt it about three weeks ago, and on going over the transformers found that the bolts binding the core of one of them were loose. On tightening them the set was silent again. This, I should imagine, was what was happening in your other correspondents' cases.

Yours faithfully,
L. J. COLLINS.

Denbigh Lodge, 75, Wheeley's Road,
Edgbaston.

P.S.—The set is in another room to which the loud speaker is used, being connected by lines.



This and the other diagram accompany Mr. A. H. Abel's letter published on this page.

THE INEXPENSIVE ONE-VALVER.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have pleasure in letting you know of the results obtained from "An Inexpensive One-Valve Set," which was described in "P.W." a few weeks ago. I can receive fifty broadcasting stations, including all B.B.C. main and four relays. All B.B.C. stations can be received in daylight. These results have been obtained consistently for the past fortnight. This is the seventh set I have built, including two containing one stage of H.F.; but for sheer range this has beaten the lot. I have a 2-valve L.F. amplifier, and with this combination practically every station comes in on the speaker, one note magnifier being sufficient to bring in six or seven. After this, me for the straight circuit.

Yours truly,
D. HEBB.

Plumtree, Notts.

"FINISHING FLEX."

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to your article in to-day's issue of "P.W." on "Finishing Off Flex," I find that, by merely passing a small piece of rubber sleeving, as used when wiring a set, over the cotton before fixing to spade terminal, makes a very neat job and saves winding with silk or cotton.

This idea may be useful to your readers if published.

Yours faithfully,
L. E. BRIGNALL.

43, Loxley Road, S.W.18.

BROADCAST NOTES.

By OUR BROADCASTING CORRESPONDENTS.

Princess Mary to Broadcast—Irving Berlin's Music—French President's Arrival—Wanderings Through Europe—"The Huguenots"—"The Magic Flute"—Schneevoight for London—Raiding B.B.C. Revenue—A Derby Lunch Broadcast—Regional High-Power Doubts—B.B.C. and Television.

Princess Mary to Broadcast.

H. R. H. PRINCESS MARY is visiting Manchester on Saturday, May 14th, to perform the ceremony of laying the foundation stone of the new Nurses' Home attached to the Manchester Royal Infirmary. Manchester Station, which recently broadcast an appeal for this extension, will relay the speech of the Princess. There will also be a running commentary of the proceedings.

Irving Berlin's Music.

On Wednesday, May 18th, the London Radio Dance Band will give a special programme of Irving Berlin, famous for his dance music triumphs since the days of "Alexander's Ragtime Band."

French President's Arrival.

The arrival of the President of the French Republic on a State Visit to this country will be the subject of a broadcast narrative on May 16th at 11 a.m. The narrative will include a description of the reception by the King at Victoria, as well as a broadcast of the music played by the military band in attendance, the inspection of the Guard of Honour, and so forth.

Wanderings Through Europe.

Mr. E. V. Lucas, whose travel books have such a tremendous vogue, will, on Thursday, May 12th, give the first of a series of talks on the capitals of Europe. He will start appropriately with Paris.

"The Huguenots."

Act III. of Meyerbeer's "The Huguenots" will be relayed from Covent Garden Opera House between 9.45 and 10.30 on Monday, May 30th.

"The Magic Flute."

The next of the series of operas for which the B.B.C. prepares special libretti will be given on Thursday, May 26th, between 8 and 9, and between 9.35 and 10.0. It is Mozart's "The Magic Flute." It is reported from Savoy Hill that the "potted operas" of the studio are much more popular with listeners than relays of outside unadapted operas.

Schneevoight for London.

Schneevoight, the eminent Finnish conductor, will open his forthcoming visit to this country with a special concert in a London studio, on Wednesday, May 25th. Sibelius will be included.

Raiding B.B.C. Revenue.

Mr. Charles Gulliver's announcement that he would not decline £10,000 a year from the B.B.C. was quickly followed by other acceptances of more substantial amounts, reaching in the aggregate something between £300,000 and £350,000 within a week. Great joy was reported in the camps of the music-hall managements at the prospect of such easy money.

Curiously enough, there was equal joy at Savoy Hill. Once again, the enemies of the B.B.C. had fallen into a publicity trap, and had made their case ridiculous. The artistes had become annoyed and alarmed at the disregard of their interests.

It was easy for the B.B.C. to say "negotiate" with its tongue in its cheek. But it was perfectly obvious that the B.B.C. could never agree to subsidise competitive managements in the way suggested. George Grossmith's solution of payments both to manager and artiste in individual cases held the only practicable basis of negotiation. The truth is that the Savoy Hill people are in a much stronger position with regard to light entertainment than they have ever been before. Mr. R. E. Jeffrey, the Productions Director, is now surrounded by an able and enterprising staff. Mr. Jack de Freese, the latest recruit to join, has



Some of the home-made receiving apparatus used by Mr. W. Blackledge of 321, Tonge Moor Road, Bolton.

already brought a lot of valuable new material into the programmes. Even if Mr. Gulliver's proposal were adopted only a few artistes would be concerned, and these Savoy Hill can well afford to do without.

And on the top of the kindly efforts of the entertainment industry to relieve the B.B.C. of financial responsibility comes a renewal of a demand for a subsidy of opera from licence revenue. Interested quarters have suggested that the B.B.C. policy of studio production is killing opera. But the Savoy Hill people have had a good answer in the Committee they set up to recommend how best they could help opera in this country. Sir Hugh Allen is chairman, and it is perhaps a sign of the complexity of the subject that after months of deliberation they are still without an agreed conclusion. The problem bristles with difficulties and the B.B.C. are extremely well-advised to move with care, and to avoid all commitment until they are sure of their ground. Helping opera must not be confused with subsidising inefficiency.

A Derby Lunch Broadcast.

Every year, on the Monday preceding Derby Day, the "gentlemen of Fleet Street" entertain at lunch certain illustrious personages connected with the Turf, who are expected by reason of their tremendous knowledge of things appertaining to The Matter of the Moment to propound prophetic forecasts concerning what generally proves to be a particularly perplexing problem. Lord Derby is, of course, always present at these functions, and though his "tip" for the winner may not, and does not usually coincide with the opinions of other race-horse owners present, the Press Club Derby Lunch is nevertheless of considerable importance to scores of thousands of once-a-year backers, who otherwise would be unable to decide on which horse to place their modest "bob."

It is therefore of particular interest that the speeches from this year's Press Club Derby Lunch on Monday, May 30th, will be broadcast. The proceedings begin approximately at 2 p.m. and Mr. Edgar Wallace will preside. The function should prove a fascinating prelude to the broadcast narrative of the great race which takes place two days later.

Regional High-Power Doubts.

The approach of the era of redistribution naturally focuses attention on the B.B.C. plans and expectations in this connection. It is understood that the basis now accepted as probable is five transmitters, each working a double wave-length. Some of those who have studied the problem most carefully are dubious as to the desirability of as many as five main transmitters. The view held by this school is that it would be much better to reduce the number to two, allowing each to work two wave-lengths, and using such power as would guarantee satisfactory service conditions in all parts of

England, Wales, Scotland, and Northern Ireland for all four programmes. They point out that such a contraction would make possible much better programmes by concentrating resources. It would also enable staff to be cut down by more than fifty per cent., thereby again releasing more money for programmes. Presumably, however, there would be difficulty in getting international agreement to the very high power which this contracted scheme would demand. Nevertheless, it is certainly worthy of serious consideration at Savoy Hill while there is still time to change.

B.B.C. and Television.

There are renewed complaints at B.B.C. "stonewalling" against television. Those engaged in developing the new invention on both sides of the Atlantic complain that they receive nothing but ridicule at Savoy Hill. Such an impression does the B.B.C. harm. If it is unfounded there should be some clear statement on the subject by the B.B.C. without delay.

Internal Resistance.

A POINT worth bearing in mind is that although the internal resistance of a voltmeter is (or should be) fairly high, it is not necessarily extremely high, and, consequently, if the instrument is used for reading the voltage across (say) a battery or more particularly across the ends of a very high resistance, it may give an incorrect reading; this is due to the fact that the connecting of the voltmeter into the circuit upsets the conditions, so that the conditions with the voltmeter in circuit are not the same as they were before. A simple way to illustrate this is as follows: Suppose two resistances in series, each of 10,000 ohms, are connected across a 100-volt electric light mains and it is desired to measure the voltage at the ends of one of these two resistances. Of course, we know that it will be half the total voltage, that is 50 volts, but we are supposing for the moment that we do not know the value of the resistances accurately. If now the 2,000-ohm voltmeter be connected across resistance in circuit, instead of being 20,000 the ends of one of the resistances, the total ohms, will be 10,000 plus 10,000 in parallel with 2,000, which is equal to approximately 1,700, so that the total resistance in circuit is now only about 11,700. The current flowing from the mains will be different from what it was before, and the voltage will be proportional to the resistances, so that the voltage at the terminals of the voltmeter will be approximately 1,700 divided by 11,700 of the total voltage of the mains, which, of course, is very different from what it was before the voltmeter was connected into circuit.

Electro-static or Electro-magnetic?

To put the matter briefly, the voltmeter, since it is an electro-magnetic and not an electro-static instrument (that is to say, since it consumes a certain amount of current) must be assumed to have an internal resistance which is large compared with the resistance of the part of the circuit across which it is connected, so that the voltage conditions in that circuit are not appreciably affected by connecting in the voltmeter.

Four Electrodes.

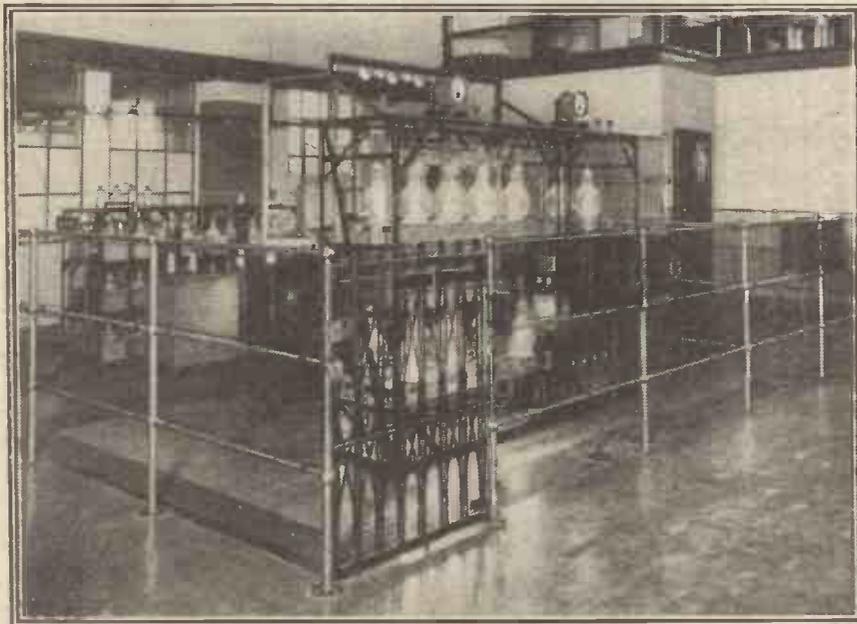
There seems to be a reviving interest in 4-electrode valves. I notice many references to the advantage of these valves not only in the United States journals but also in foreign journals from many other parts of the world. It is well known that if a valve, instead of being of the conventional 3-electrode type, has a fourth electrode in the shape of an extra grid introduced between the filament and the conventional grid, this extra grid, with a very few positive volts applied to it, has a considerable influence in dispersing the "space charge" which tends to accumulate in the region of

TECHNICAL NOTES.

A Weekly Feature
Conducted by

Dr. J. H. T. ROBERTS, F.Inst.P.
(Staff Consultant.)

the filament: in other words, the impedance of the valve is considerably reduced and, consequently, a very much lower value of H.T. is required. In some cases the same amplification is obtained, with, say, 10 or 20 volts as would be obtained with 100 volts applied to the plate if the extra



The rectifier plant at the Grimsby "Beam" radio station, which works with Anstralia.

grid were not present. There are important indications that the value of this principle has not hitherto been fully recognised, and that in the near future much more extensive use will be made of 4-electrode valves.

A Time-Saving Hint.

Experimenters will often find that a good deal of time is wasted in bothering with pieces of connecting wire which are of the wrong length or type for the purpose. It is a good plan to have a number of what may be called "connecting pieces" of various lengths, on hand the two ends of each piece having been carefully bared and preferably tipped with solder. It may seem a little trouble to prepare these connecting pieces, but it will be found well worth while. It is also a good plan to have them always laid out straight in a box or drawer, so that their length can be at once seen and any desired piece picked out. If they are all in a hopeless tangle (as they so frequently are in an experimenter's workshop) it is not only difficult to decide which is the required piece, but still more difficult to extricate any piece. The plaited silk or cotton sleeve of flexible wire should be removed in the case of short pieces, as it is apt to slip over the end and become an inconvenience.

"Indirectly Heated" Valves.

There is a very pronounced tendency, both here and in the United States—particularly the latter—towards the adoption of various means for overcoming the battery inconvenience, and in the United States (according to some figures which were sent to me recently) close upon 1,000,000 various battery eliminators or equivalent devices are in use.

Of course, one of the ways of getting over the nuisance of having the battery recharged is to use a valve which is operated direct from the electric-light mains. Various attempts have been made during the past two or three years to produce such a valve in a successful commercial form, but until comparatively recently valves of this kind did not seem very practical.

The Radio Corporation of America about three years ago produced a valve designed to work direct from the electric-light mains, which had a central heater imparting heat to the cathode; the latter was thus "indirectly heated," as it is called, and gave off the necessary supply of electrons. Quite recently the Marconi Company have put on the market a valve operating on a somewhat similar principle.

A New Valve.

I hear from America that the Radio Corporation have now brought out another valve which is designed for the same purpose. In this valve the grid and plate are circular, and the heater element is about the size of a lead pencil. The filament connection is made at the top of the bulb by means of a metallic contact. A standard American

base with four prongs is used, so that the valve will fit into the standard socket. A slight alteration in the wiring of the filament circuit of the set is necessary in order that this valve may be used and batteries dispensed with. The heater element is replaceable and the glass bulb is arranged in such a way that the heater element may readily be inserted into a glass tunnel which extends right through the arrangement of grid and plate. Thus the removal and replacement of the heater do not involve gaining access to the evacuated part of the bulb at all.

Interference.

A considerable number of readers have asked my advice from time to time in connection with various forms of interference which they have experienced. Interference is often due to electrical mains, particularly alternating-current mains, or in special cases may be due to a nearby electric tram or train service, or may proceed from electrical machinery in the building, or high-frequency electro-medical apparatus or a great variety of other causes.

It is sometimes quite easy to obviate the effects of such interference whilst, on the

(Continued on page 436.)

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- 2, 0.001 mfd. Condensers, Type 610 with series clips.*
- 4, 2MΩ Dumetohm Leaks.
- 1, Dumetohm Holder.
- 1, Duvarileak, 0 to 5MΩ.
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Other features are (1) Single Hole panel fixing or base-board mount. (2) Entirely enclosed, freedom from dust and damp, etc. (3) Push-pull and turning motion, giving coarse and fine adjustment. (4) It is fitted with a lock nut so that a fine setting can be protected against possibility of disturbance.

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A. & P.S.



Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Dept. for test. All tests are carried out with strict impartiality in the "P.W." test-room under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

A HIGH-RESISTANCE POTENTIOMETER.

AS you will all know, a potentiometer is a device which enables close variations of voltage to be obtained. It does not step up voltage in the manner of a transformer, but, placed across the terminals of a supply of current, it provides an adjustment from between zero and the maximum available volts. It is used, for instance, in some anode bend rectifying circuits in order to supply a controllable variation of voltage to the grid of the detecting valve. A potentiometer has three terminals, two of which are situated at the extreme and opposite ends of a resistance element. The third terminal is connected to a moving contact arm which runs up and down the resistance element from end to end. Now as the resistance element is joined right across the battery to which the potentiometer is attached, it will be obvious that a flow of current passes through the device the whole time it is in use.

In many cases this current is so much waste, for it is purely a voltage that is required. Therefore, the higher resistance the potentiometer has the less current will flow and be wasted. Burndept Wireless, Ltd., have produced a potentiometer having a resistance of 2,000 ohms. Connected across a 6-volt accumulator this instrument would pass but 3 milliamps.—quite a negligible current in the circumstances. A high-resistance potentiometer of this nature has many uses. In battery eliminators it should prove invaluable, for it can take up to 50 milliamps. As a two terminal variable resistance it will have its uses, too, as a volume control and in other capacities.

This latest Burndept component is very well made and its winding is by no means fragile despite its high ohmic resistance. It sells at 8s.—a very moderate figure in our opinion. A 1,200 ohm potentiometer is available at 7s.

A NON-MICROPHONIC VALVE.

A sample of a very interesting new valve has recently reached us from The Electron Co., Ltd. It is known as the S.S.9 Type T. It is an S.S.9 which has been made absolutely non-microphonic in a novel manner. The valve itself is contained within a glass casing and is supported in this by shock-absorbing material. Additionally, the space between the outer glass envelope and the glass bulb of the valve proper is evacuated so that no air remains through which vibrations could pass to the valve. This is, of course, a very important part of the design, for it prevents the transmission of vibrations to the elements of the valve through the operation of a loud speaker—the majority of amateurs will have experienced that annoying howl which builds up through this happening. It is a howl that seems so difficult to subdue, too, in many cases.

By the way, the "Six Sixty" people say, in a letter, "It is impossible to make these valves howl even after five or six stages of L.F. amplification, which is solving one of the most difficult problems of the present day receivers." We know what they mean, of course, but a "present day" set which employed six stages of L.F. amplification would tend to do some howling on other counts, wouldn't it?

However, seriously speaking, this S.S.9 "T" would seem to us to represent a very worthy development. Probably very few amateurs realise the distortion and "raggedness" that is due to microphonic causes in the cases of powerful loud speaker installations and a ready means of diminishing or eliminating such deserves commendation.

(Continued on page 430.)

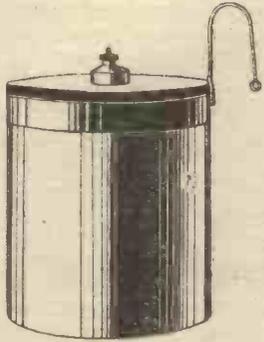


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WHEN REPLYING TO ADVERTISEMENTS.

APPARATUS TESTED.

(Continued from page 428.)

The S.S.9 "T" is a rather weird-looking device, but it is not over bulky, and as our tests proved, it accomplishes its object admirably, and this is all that really matters after all.

THREE NEW VALVES.

Well known for some time now as repairers of valves, the North London Valve Co., Ltd., of 22½, Cazenove Road, Stoke Newington, London, N.16, recently turned their attention to the production of valves carrying the name of "Leo" for direct sale to the public. Three types are available, all at the standard and low price of 10s. each. The following are their characteristics.

- (1) 2 volts; 0.3 amps.; 15,000 ohms impedance; amp. factor 6.5.
- (2) 4 volts; 0.06 amps.; 15,000 ohms impedance; amp. factor 6.5.
- (3) 4 volts; 0.1 amps.; 14,000 ohms impedance; amp. factor 7.5.

As will be observed this trio of tubes are all more or less of the general purpose type, the third showing a trifle of a bias towards L.F. and transformer coupled detector work. We must say right away that we feel kindly disposed towards these Leos inasmuch as they operate rather effectively in Filadyne circuits—and there are not too many valves on the market which do this! But in other circuits, too, they work quite well. The two-volter is a bit of a current eater for these days, but it is a lively little valve and sizes up well in several positions, although it is somewhat microphonic.

The 4-volters are quieter in this respect,

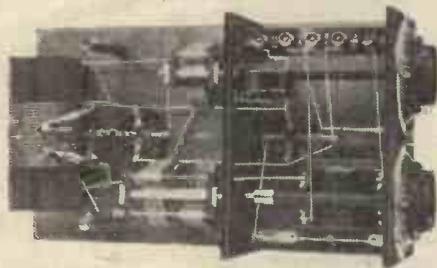
but, comparatively speaking, they operate just as efficiently. We prefer these Leos in detector positions to any others, but perhaps their makers are going to extend their range in order to cater for other purposes.

MAGNUM CALIBRATED FILAMENT RESISTANCES.

It is very comforting to know that your valves are receiving approximately the current specified by the makers and with a voltmeter and a little calculation this is now quite easy using the new filament resistances due to Messrs. Burne-Jones & Co., Ltd. One of these will take the place of several fixed resistors. The device is designed for baseboard mounting, and consists of a small resistance winding, along which passes a contact slider. The little knob of this latter runs along a horizontal scale which is marked in ohms. The 6-ohm type, for instance, has steps of 1 ohm and the 30-ohm type, steps of 5 ohms. This may be rather crude marking, but it should be remembered that the resistance of the resistance element will be directly proportional with its length. On test we found the component operated smoothly and gave resistances closely corresponding to the markings. The Zero 6-ohms type and the Zero 30-ohms both retail at 3s. each.

R.N.B. WIRELESS CONSTRUCTOR'S ENVELOPE.

The Radio News Bureau, Ltd., of 50-51, High Holborn, W.C.1, recently sent us one of their latest Constructor's Envelopes. It is very well produced and includes everything necessary in the way of photographs, blue prints, etc., for the successful guidance of constructors.



Explore the Ether on Short Waves

The New Short-Wave Receiver (20 to 200 metres), designed by Bowyer-Lowe for compactness, ease of operation, and stability, is without equal.

This remarkable production is another instance of the advancement of Radio by Bowyer-Lowe. The name guarantees its quality and perfect operation, and its price is low because production is simplified and each component is standard. Send 1s. now for your copy of booklet with constructional details and blue print—and explore the ether from your armchair.

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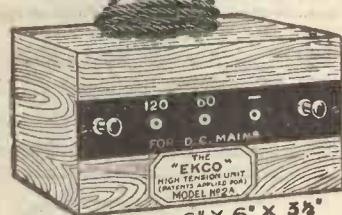


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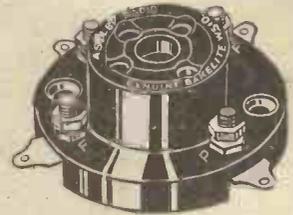
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50,000 ohms to 1 megohm.

Exhaustive tests by the National Physical and other world famous laboratories have produced highly satisfactory reports. Each Resistance on completion is subjected to a prolonged ordeal during which it is under pressure at a minimum of 230 volts.

Guaranteed accurate within ten per cent. Superior to wire wound. Differs in construction from all others.

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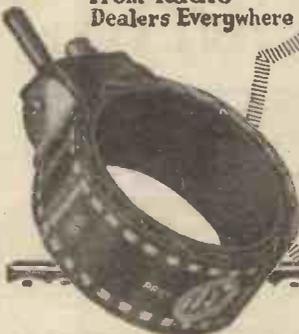
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The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All enquiries concerning advertising rates, etc. to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. 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.

Readers' letters dealing with patent questions, if sent to the Editor, will be forwarded to our own patent advisers, where every facility and help will be afforded to readers. The envelope should be clearly marked: "Patent advice."



RULE FOR GRID BIAS.

T. S. (Fallowfield, Manchester).—"What is the rule for telling grid-bias values by the amplification factor of the valve concerned, and is this rule accurate enough for general purposes?"

The rule referred to is quite accurate enough to form a good guide, though it does not give absolute accuracy.

To find the required grid bias by it, double the amplification factor of the valve, and divide by this figure the H.T. voltage applied.

BATTERY WASTAGE.

G. N. (Littlehampton, Sussex).—"I am trying a carborundum crystal, and get very good results when the potentiometer is adjusted carefully. But as the dry cell supplying the current is always connected across the potentiometer, I think there must be a battery-wastage. Is this so, or is the resistance so high that the loss is negligible?"

The loss is very slight but we should not call it negligible, under ordinary circumstances, so it would be advantageous to switch off the battery when the set is not in use.

A push-pull switch, in series with one of the "outside" leads to the potentiometer, is probably the easiest method of switching off, but unscrewing one of the battery connections when closing down would have the same effect.

CONDENSER ACROSS PRIMARY.

L. A. (Tottenham, London, N.).—"Is it a fact that if I take the .0005 fixed condenser from across the primary of my L.F. transformer and place it instead between reaction coil and L.T. neg., the quality of reception will be improved?"

The alteration will probably have no effect at all, as far as the ear can tell; but theoretically it is better to place the by-pass condenser between the L.T. and reaction coil to provide the shortest possible path for H.F. impulses.

DISTORTION AND GRID BIAS.

D. S. F. (Trowbridge, Wilts).—"Is it possible to get distortion from too much grid bias, as well as from too little?"

Yes. Excessive grid bias will give rise to distortion, just as insufficient bias will, but in this latter case there is a heavy wastage of H.T. current in addition.

RESISTANCE CONTROL OF REACTION.

J. E. (Ross-on-Wye).—"On a friend's set I saw the other day, oscillation control was exceptionally smooth, and it appeared to be carried out by means of an ordinary variable resistance. How would this be connected to control oscillation?"

There are several methods of connecting such a resistance, according to the circuit. In some multi-valve sets the resistance is simply placed in series with the H.T. neg. lead; but where a reaction-coupling is used, the resistance is sometimes placed in series or in parallel with this.

CRYSTAL SET CONNECTIONS.

R. B. E. (Bournemouth).—"How is it that a crystal set will often give better results if the lead from the crystal to the aerial coil is connected about half-way along the coil, instead of to the aerial end of the coil?"

Better results with the intermediate connection are generally due to the fact that the aerial damping losses due to the crystal circuit are greatly reduced by this method.

By connecting the crystal and 'phones across the whole of the aerial coil, the aerial circuit is heavily damped, and consequently the effective energy flowing there may not be very great, though it is all applied direct to the detector.

On the other hand, an intermediate tapping for the crystal connection allows a good "build-up" in the aerial coil; and though the detector is applied across only a part of the coil, the effective energy may exceed the whole of that available in the more heavily-damped circuit.

AUSTRALIAN BEAM SERVICE.

"COLONIAL" (Oxford Street, London, W.).—"How much power is used for the new beam wireless service to Australia, and what is the wave-length and call-sign?"

The power employed is twenty kilowatts, which is not much more than Daventry uses for broadcasting. The call sign of the Grimsby station, that transmits to Australia, is G.B.H., and the wave-length employed is about 26 metres.

REACTION ON SHORT WAVES.

J. F. (Princes Risborough, Bucks).—"Experimenting with a short-wave set, I find that in order to get oscillation effects the aerial coil

(Continued on page 434.)

Cabinets of distinction

The "Solodyne" Cabinet and "Solostand" illustrated here are fine examples of the cabinet-maker's craft. In common with other cabinets of our design and construction they are unequalled for price and quality. Cabinets of similar quality are made to customers own designs in a special section of our works at moderate prices. An illustrated folder of specimen cabinets and prices will be gladly sent on application.



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VARIABLE CONDENSERS S.L.F.
 Igranite Pac., .0005, 18/6; .00035, 14/6. G.E.C. Slow Motion, .0003, 24/-.; .0005, 27/6. Brandes S.L.F. Friction, 4 in. Dial, Ratio 80-1, .0005, 18/6; .0003, 15/-. Cylidon S.L.F., .0005, 15/6; .00035, 15/-.
MARCONI Special Potential Divider, 7/-. Power Choke, 50 henries M.O. 80 milliamps. Res., 450 ohms, each 25/-. Power Transformers, type C 200/240, type D 100/120, each 37/6. Ditto type A, to use with U.5 Rectifying Valve, 35/- each.

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STANDARD WET H.T. BATTERIES, economical, no charging, permanent, silent in action. Size 11 in. by 18 in. 84 volt, 60 cell battery. Complete sets of components, 21/-. A standard wander plug can be plugged in every cell. Jars, 1/3 per doz., Sacs No. 1, 1/6 per doz.; Sacs No. 2, 3/- per doz.; Sacs No. 2, with Terminals, 3/6 per doz.; Jars (new model), 1/- per doz.; Rubber Bands for insulating 12 No. 1 Sacs, 6d. box; Ditto, 12 No. 2 Sacs, 6d. box; Electrolyte, sufficient for 20 cells, 9d. Carriage forward.
 Send 1d. stamp for new illustrated list, giving full details, prices of batteries for various voltages, maintenance hints, and useful information.

SOLID OAK CABINET (12 x 8 panel), with room underneath for batteries, opens at back, all parts enclosed, doors at front, 17/6. By post, 20/-. Send for new lists.
WATES MICROSTAT, 2/9.
BELLING - LEE TERMINALS stocked, 4 1/2d., 6d. and 9d. (only sent by post value over 3/-).
COIL STANDS, Ebonite, 2-way geared, 2/6, 3/-, 3/6. Panel or Baseboard models. Back of panel geared, 3/6, 3/11, 4/6 ea. Lotus, geared, 7/- (8/- L.H.); 3-way, 10/6 (L.H., 12/-), all best quality, post free U.K.
MULLARD, COSMOS, EDISWAN, COSSOR always in stock.
LEADING WEST-END DISTRIBUTORS OF ORMOND, Square Law Low Loss. .0005, 9/6; .0003, 8/6; 1/16 each less no corners, Friction Geared, .0005, 15/-; .0003, 14/6; .00025, 13/6. Single Line Frequency Friction Geared .0005, 20/-; .00035, 19/6. S.L.F. .0005, 12/-; .00035, 11/-. **SQ. LAW LOW LOSS DUAL** .0005, 16/- each Ormond Friction Dial 10/-; Filament Rheostats, Dual, 2/6; 6 ohms of 3 ohms, 2/-; Potentiometer, 400 ohms, 2/6 Standard, .0005, 5/-; .0001, Reaction, 4/-; Air Dielectric, 2/-; Neutralising, 4/-; Neutrodyne, 2/-; Twin Gang, .0005, 32/-; Triple, 40/-

FORMO OR FINSTON S.L.F. CONDENSERS
 With handsome TRIOLITE 7/6 dial and knob By Post 7/11.
LOW LOSS SQUARE LAW
 .0003 and .0005 4/11 each. By Post 5/11. With Vernier 1/- extra.
ACCUMULATORS
 2-v. 40, 7/11; 2-v. 60, 9/6; 2-v. 80, 12/6; 2-v. 100, 14/6; 4-v. 40, 13/11; 4-v. 60, 17/11; 4-v. 80, 23/6; 6-v. 60, 28/6; 6-v. 80, 35/6. ALSO another good make, 1/6 extra on each of above Post 1/- each.
SPECIAL OFFER. X COILS.
 60X 2/11; 250X, 4/3. Can be used in all circuits where X Coils needed.

POTENTIOMETERS, Patent, 400 ohms, 2/6. Precision, 3/9. 300 ohms Peerless, 4/6. Lissen, 2/6 (B.B., 1/6).
World's Most Wonderful Crystal "WYRAY" 1/6
MAGNUM
 Neutralising Condenser, 5/- Single Coil Mount on Base, 1/9. Aperiodic H.F. 10/-
GAMBRELL CENTRE TAPPED COILS
 B.B.C. 6/-; 5XX 8/3 60X, 6/9; 250X, 8/9. B.B.C. or 5XX H.F. Transformers, 7/- each.
ALL PARTS STOCKED. MARCONI, S.T.H. VALVES. The latest always in stock.

CRYSTALS, Supercite, 1/6; Shav's sealed Supercite, 8d., 1/-; Wyray, 1/6.
HEADPHONE CORDS, Good quality, 1/3. 1/6. Loud Speaker Cords, 1/9. 4-way Battery Leads, 2/-; 7-way, 3/6.
GEARED COIL STANDS 2-way, 2/3, 2/6, 2/11 up. 3-way, grand value, 5/11. Back of panel front 2/11. All ebonite and best quality.
FLASH LAMP BATTERIES, No cheap and nasty batteries sold here. Adico, 4 1/2d. each, 4/3 dozen. British 6d. line, 3 for 1/3.
SOLDER, with Resin, 2d. foot, 1/16 sq. Bus Bar, 2 ft. 1d. tinned copper, 16 and 18 gauge, round, 9d. per lb. D.C.C., 1-lb. 20 gauge, 8d.; 22 gauge, 9d.; 24 gauge, 10d.; 26 gauge, 11d.; 28 gauge, 1/-; 30 gauge, 1/2.
MANSBRIDGE CONDENSERS, "Hydra" 1 mfd., 2/9. 2 mfd., 3/9. 0-1, 1/9; .24 and .5, 2/3 ea. Cast on Hydra, finest made, all tested on 500 volts.
SWITCHES on Porcelain, D.P.D.T., 1/3; S.P.D.T., 8d. and 10d. Sound quality. Panel switches with Ebonite handle, worth double. S.P.D.T., 1/-; D.P.D.T., 1/6.
NAMED TERMINALS, Red or Black, 2 1/2d. each, usual wordings. Insulating, 4 1/2d. Copperfoil, 4d. foot (6 in. wide). Grid Bias Ohms, 6d. Panel Brackets, 9 1/2d., 1/- pr. Shorting Plug, 3d.

WATER VALVES
 2-v. 40, 7/11; 2-v. 60, 9/6; 2-v. 80, 12/6; 2-v. 100, 14/6; 4-v. 40, 13/11; 4-v. 60, 17/11; 4-v. 80, 23/6; 6-v. 60, 28/6; 6-v. 80, 35/6. ALSO another good make, 1/6 extra on each of above Post 1/- each.
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GEARED COIL STANDS 2-way, 2/3, 2/6, 2/11 up. 3-way, grand value, 5/11. Back of panel front 2/11. All ebonite and best quality.
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ALL PARTS STOCKED. MARCONI, S.T.H. VALVES. The latest always in stock.

CALLER'S COLUMN

NOT SENT BY POST.

AERIALS.—100 ft. 7/22 Hard drawn, 1/11. Extra heavy, 2/2. Phosphor 49 strands, 1/-. Electron stocked. Special INDOOR Aerials, special, with ebonite separators and rubber rings (12 ft. x 8 strands), total 100 ft. 4/6. O.V., 2/6. Rubber Lead-in, highest quality, 10 yds. 1/-; 10 yds. 1/3; 10 yds. 1/6. Extra heavy, 2d. and 3d. yd. B. & B. Twin Flex (best), 6 yds. 10d.; 12 yds. 1/6; 36 yds. 4/-; Ins. Hooks, 2 for 1d. Egg Insulators for 1 1/2 ins. Staples, 4 a 1d. Earth Tubes. Copper, extra value, 2/3. Climax, 5/- (also at 2/6). **EASY FIX AERIALS**, with 2 insulators and lead-in, 1/3.

TERMINALS, Nickel W.O. Pillar, Phone, 1-doz. (3 for 4d. with N. and W.); Brass do., 10d. doz., (1d. each with N. and W.), all high quality. Valve Pins, with nuts, 2 a 1d. Ormond Screws, 6 or 4 B.A., 6d. dozen with nuts, washers 12 a 1d. Red and Black Spades, screw at side, 3 1/2d. pr. Plug and Socket, Red or Black, 3 1/2d. Wander Plug, Red or Black, 3 1/2d. pr. (Large, good). Phone Connectors, 1d. Flush panel sockets and nuts, 4 for 4d., 10d. dozen. Brass Spade Tags, 6 a 1d. Nickel Solder Tags, 4 a 1d. 2 and 4 B.A. Rod, 3d. foot. Nickel Valve Legs and Nuts, 1d.; 8d. dozen. Stop Pins, 2 a 1d.

EBONITE GRADE A Stock sizes, 6 x 6 and 7 x 5, 1/2; 8 x 6, 1/6; 9 x 6, 1/9; 10 x 8, 2/9; 12 x 6, 2/9; 12 x 8, 3/6; 12 x 9, 4/-; 13 x 7, 4/6. ALSO CUT TO SIZE while you wait at 1d. per sq. inch 3/16th and 3d. sq. inch for 1 in. Special cheap panels for Crystal Sets.

R.T. BATTERIES, No cheap and nasty batteries sold here; only highest quality at lowest prices. Adico (Trade test award best given) 60-v., 6/11; 100-v., 12/11 nett; the new 66-v. Eveready, 9/6; Crown "Polo", 6/3; 100-v., 10/11; good quality "K", 60-v., 5/11; 100-v., 9/6; 1-5 L.T. Hellenes's, 2/6; Adico, 1/8, 2/-; B.T.H. 2/-; Flac, 2/-; **COIL PLUGS**.—Ebonite on Base, 6d., 7d. Lotus, 8d. Burne-Jones, 1/9. Lov Loss, 8d. Panel, 6d. Various stocked.

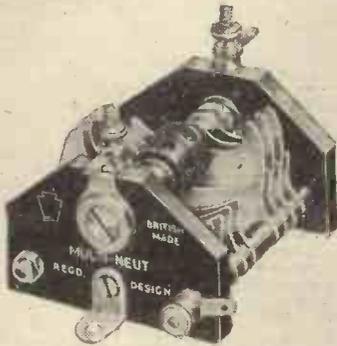
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ALL PARTS STOCKED. MARCONI, S.T.H. VALVES. The latest always in stock.

BE SURE YOU ARE AT RAYMOND'S!

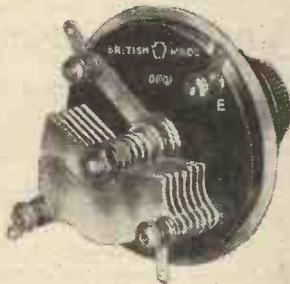
A NEW "KEYSTONE" COMPONENT THE "MULTI-NEUT" CONDENSER



THIS condenser has been designed to meet the need for a twin neutralising condenser as used in Mr. Percy Harris' "SIGNAL BOX" and "BLACK PRINCE" Receivers, but it can also be used for balancing out stray capacities, as a "trimmer" between gang condensers, and in endless other ways. Its many applications are dealt with in the Keystone Folder now in course of preparation. "Multi-Neut" Condenser. Send for your copy to-day.

Price **6/6**

KEYSTONE "MIDGET" CONDENSER



Ideal for the many positions where a small capacity condenser is required. An aluminium shield prevents hand-capacity effects, and a special taper bearing gives a beautifully smooth movement. Accurately designed and rigidly constructed, this Keystone condenser is backed by the usual Keystone guarantee of efficiency. Capacity .0001 mfd.

Price **5/6**



Keystone Fixed Resistors. No. 4 for .25 amp. valves with 6-volt accumulator. No. 17 for .06 amp. valves with 4-volt accumulator. And in many other values. Price **2/6** Resistor only 1/9. Base, 9d.



Special Six-pin Base. To replace the more expensive standard screened coil base in sets where the actual screen is not required. Standard spacing with terminals arranged for easy accessibility. Price **2/9**

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 432.)

has to be kept away from the grid and reaction coils. If it is brought within about two inches of them I cannot get reaction. The coils are 4 turns for aerial, 8 for grid-coil, and 9 for reaction. What causes the set to stop oscillating when the coils are brought near together?"

This effect is not an uncommon one, and is due to the extra damping introduced when the coils are near together. When close-coupled, not only does the aerial coil introduce energy into the grid circuit, but the grid coil loses some of its energy to the aerial circuit. In many cases the loss of power due to the close proximity of the aerial coil is sufficient to prevent oscillation.

HIGHEST BROADCAST WAVE-LENGTH.

S. M. (Framlingham, Suffolk).—"What is the highest wave-length used for broadcasting in Europe?"

Four thousand metres is the highest wave-length in use at present. (This is one of several wave-lengths upon which the Berlin [Königswusterhausen] station transmits.)

THE TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

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

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

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," 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 completely to solve your problems.

IRON MASTS.

G. N. T. (Derby).—"Is not a wooden mast better than one made of iron, in view of the fact that wood is an insulator whilst iron is a conductor?"

The question of insulation hardly affects the mast, as in a properly designed aerial system there is no tendency for the leakage from the aerial to earth via the mast—the aerial insulators see to that.

In any case, a wooden mast can hardly be considered an insulator when it is coated with rain, snow, etc., and it is only at such times that there would be a likelihood of leakage.

HOW MANY TURNS?

A. M. P. (Christchurch, Hants).—"How many turns of No. 22 D.S.C. wire should be wound (unspaced) upon a 4-in. diameter tube to cover wave-lengths up to 600 metres? (No tuning condenser to be used but all tappings to be taken to a switch.)"

Seventy turns will be required.

STEADY KNOCKING NOISE.

E. J. E. (Frinton-on-Sea).—"My set is a straightforward detector and two L.F. amplifiers, the latter being resistance coupled.

(Continued on next page.)

Cybernet

LOUD SPEAKER

FREE DEMONSTRATIONS MAY 7th-14th at any of the Stores listed below.

Allen Bros., London Road, MITCHAM, S.W.16; Angel Wireless Co., 371, Upper St., ISLINGTON, N.1; Arding & Hobbs, CLAPHAM JUNCTION, S.W.11; Arthurs, 110, Charing Cross Road, W.C.2; Arthur's Wireless Stores, Arcade, Victoria Station, S.W.1; J. Ashley, 37, Bedon Street, HAMMER-SMITH, W.6; J. Ashley, 1, Chapel Street, Edgware Road, W.2; Bakers Wireless Stores, 395, St. John Street, E.C.4; A. Bedford & Sons, 11, High Road, LEE, S.E.13; H. J. Bond, 766, Harrow Road, W.9; Brecknock Wireless Stores, 177, York Road, HOLLOWAY, N.7; B.B.H. Wireless, 29, Farringdon Street, E.C.4; F. V. Collins & Co., 155, Kingston Road, WIMBLEDON, S.W.19; The Darex Radio Co., Waldram Road, FOREST HILL, S.E.25; F. Dove & Sons, 77, Pimlico Road, S.W.1; F. J. Durrant, Tanners Hill, LEWISHAM, S.E.13; Edwards Accessories Stores, 142, St. John's Hill, CLAPHAM JUNCTION, S.W.; Electron Wireless Co., 234a, Seven Sisters Road, FINSBURY PARK, N.4; A. & F. Garnett, 29, New Kent Road, S.E.1; G. W. Geere, 116, High Street, ISLINGTON, N.1; Gibrico Electrical Co., 179, Hampstead Road, N.W.1; E. Girdler, 131b, Streatham Road, MITCHAM, S.W.16; H. C. Gray, 6, Sutherland Avenue, Harrow Road, E.9; Hartland, Hays & Co., 629, Holloway Road, N.7; Hendrick & Durck, 92, Park Street, CAMDEN TOWN, N.W.1; W. J. Higgins, 1, Railway Approach, BROCKLEY, S.E.4; Highbury Engineering Works, 287, Upper Street, ISLINGTON, N.1; Hill & Co., 856, Old Kent Road, S.E.15; Holdrons Limited, Rye Lane, PECKHAM, S.E.15; Ideal Radio Stores, 1, Clarendon Road, HARROW-ON-THE-HILL; Jobco Fittings, 24a, Florian Road, PUTNEY, S.W.15; Kinetic Wireless Supply, 80, High Street, COLLIER'S WOOD, S.W.19; D. Levy, 390, Old Kent Road, S.E.15; Malabar Radio Supplies, 20a, St. James Street, WALTHAMSTOW, E.17; C. H. Marshall, 227, Holloway Road, N.7; Metron Electrical Co., 143, High Street, COLLIER'S WOOD, S.W.19; Miscellaneous Trading Co., Ltd., 143, High Holborn, W.C.1; C. E. Morris, 553, Holloway Road, N.19; My Fancy Shop, 80, London Road, ELEPHANT & CASTLE, S.E.11; C. H. P. Nutter, 243, Selhurst Road, S.E.25; Omnora Limited, 258, New Cross Road, S.E.14; Peckham Radio Supplies, 152a, Rye Lane, PECKHAM, S.E.15; L. R. Pilbeam, 507, Lordship Lane, EAST DULWICH S.E.22; W. J. Powell & Son, 1a, The Parade, Stroud Green Road, N.4; Radiant Motor & Cycle Co., 268, Hornsey Road, HOLLOWAY, N.7; Radioco Limited, 91, High Holborn, W.C.1; Raie Studios, 7, Fulham Palace Road, HAMMER-SMITH, W.6; J. Rodway, 876, Garratt Lane, TOOTING, S.W.17; H. W. Ryan, 301, High Street, LEWISHAM, S.E.13; R. F. Sadler, 26, King Street, RICHMOND; R. Scruby, 9, Ct. Newport Street, W.C.2; South-Western Electric Co., 9, Merton Park Parade, S.W.19; Sparks Radio Stores, 398, Lillie Road, Fulham Palace Road, W.6; Sports and Wireless Stores, 232, High Road, KILBURN, N.W.6; Swan Radio Co., 97, London Road, MITCHAM, S.W.16; Templeman's Stores, 193, Worpole Road, RAYNES PARK, S.W.19; W. Thomas, 286, Caledonian Road, N.1; W. Western & Co., 72, Elthorne Park Road, EALING, W.5; M. Wolridge, 39, Lisle Street, W.C.2.

Special demonstrations also being held at: Beasleys Ltd., 95, High Street, WHITSTABLE; Messrs. Alexander & Mann (Harrow) Ltd., 150, Pinner Road, HARROW; J. W. Rogers, Stanley Road, WELLINGBOROUGH; L. J. Ives, 11, The Parade, and 7, Clarendon Corner, WATFORD; A. L. Dell, 60, Rosemary Road, CLACTON-ON-SEA; E. B. Burbridge, "Highgate," HAWKHURST, Kent; Messrs. Shelley Bros., 37, Parsons Street, BANBURY, Oxon; E. H. Beauchamp, 1a, Church Street, EPSOM; Messrs. Jennings Bros., Loudwater and Flackwell Heath, near HIGH WYCOMBE, Bucks; The Ore Petrol Service Station, 393, Old London Road, ORE, Hastings.

Stocked by all the best Dealers. MAKE SURE YOU HEAR ONE!

Tested and unanimously approved by "Popular Wireless," "Wireless World," "Wireless Trader," "Amateur Wireless," "Broadcaster." Sole Makers: LONDON RADIO MFG. CO., LTD., Station Road, Merton, London, S.W.19.

EVERYTHING WIRELESS On Easy Payment Terms.

SEND LIST OF YOUR REQUIREMENTS QUOTATIONS BY RETURN POST.

THE P.D.P. COMPANY, 41, Great Tower St., E.C.3. 'Phone: Royal 4479.

The New "PILOT" Manual

Containing details and prices of the most modern and efficient receivers. Much useful constructional information also included. Post Free 3d.

PETO-SCOTT Co., Ltd., Regd. Office: 77, CITY ROAD, LONDON, E.C.1

Branches: LONDON—82, High Holborn, W.C.1. WALTHAMSTOW—230, Wood Street. PLYMOUTH—4, Bank of England Place. LIVERPOOL—4, Manchester Street. P.S. 8806

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

It has given very pure results, but not long ago I tried to increase the volume a little by using one of the new valves with a high amplification factor.

"It seems a better valve, as far as power goes, but I cannot use it, because as soon as it is plugged in, the set starts a "knocking" or thumping noise. What is the cause of this, and can I stop the thumping when using the new valve, without altering the set much?"

In all probability you will find that the thumping noise can be cured completely by attention to the grid leak. Take out the present grid leak (the "first" one—i.e. the one that is connected to the aerial coil via grid condenser) and replace it by another leak having a somewhat lower resistance value. This should be all that is necessary to put the set right for the new valve.

PROVIDING SEPARATE H.T.

J. R. A. (Plymouth).—"I am going to build a four-valve set into a cabinet I have on hand. There is hardly room on the panel for separate H.T. terminals without spoiling the layout, and I wish to have as few leads as possible, so would it be advisable to have one H.T. + terminal for all the valves instead of two or more terminals for separate H.T.?"

Whether you can do this will depend upon the valves to be employed, but the probability is that the use of only one H.T. + terminal will cause distortion. This might be very bad and harsh, so we advise you to provide for separate H.T. This will almost certainly be necessary for the last valve, and possibly for the others, so we should make provision by bringing out each H.T. + lead to a separate H.T. + plug of its own. (It is not essential to have a terminal on the face of the panel for each lead. Strong flex leads coming from terminals inside the set will be quite O.K.)

If the valves used happen to allow of common H.T. for several valves, the corresponding points can easily be joined inside the set, and only one long lead to the battery will then be required for these valves.

CARE OF ACCUMULATORS.

"CELL" (Stoke-on-Trent).—"I am informed that my accumulator is injured because it has been discharged at a rate greater than the maximum rate of discharge as stated by the makers. How does this happen?"

The transformation of chemical energy into electrical energy—which is the principle upon which your accumulator works—can only take place with safety at a definite rate; and this rate depends upon the type of accumulator, its size, shape of plates, etc. When the maximum discharge rate is exceeded and a very heavy current is taken—as, for instance, when the accumulator is shorted—the chemical action is correspondingly violent, and is accompanied by heat, loosening of the paste that forms a part of the plates, sulphating, buckling of the plates, etc.

There is no more certain way of ruining such an accumulator than by exceeding the normal charging rate, or discharging rate, so great care should be taken to follow the makers' recommendations upon these points.

H.F. AND L.F. TRANSFORMERS.

"PERPLEX" (Glasgow).—"Why does an L.F. transformer have an iron core, and an H.F. transformer not?"

Because the effect of the iron core is essentially different at different frequencies. The L.F. transformer deals only with alterations of a few thousands per second, and the corresponding magnetic variations are assisted by the presence of iron in the core of the transformer. The H.F. transformer, on the other hand, deals with radio-frequencies—when, for instance, tuned to a 300-metre wavelength the frequency is one million per second—and the iron core is useless at these phenomenally high frequencies, being unable to follow the magnetising changes with sufficient rapidity and accuracy.

ACCESSORIES FOR THE CHITOS ONE-VALVER.

C. F. G. (Vancouver, B.C.).—"Besides the set itself, what accessories are required to work the one-valve Chitos set?"

The accessories necessary are as follow: 1 100-turn coil; 1 45-turn coil; 1 pair of 'phones; 1 valve; 1 L.T. battery, and 1 H.T. battery to suit the valve chosen.

A NEW REPAIR SERVICE

Transformers, 5/-; 'Phones, 5/-; Speakers, 5/-. Re-magnetising and adjusting, 2/-. Postage extra. 1/6. brings list.—ETON REPAIR SERVICE, 46, St. Mary's Road, Leyton, E.10.

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THOUSANDS OF SATISFIED CUSTOMERS.

All Polished with new enamel that gives a glass hard surface that cannot be soiled or scratched. Ebonite or Radion Panels Supplied and Perfectly Fitted at low extra cost. SENT FREE—Catalogue of Standard Wireless Cabinets in various sizes and woods.

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Specially designed for this famous Radio Press Circuit. All details and dimensions conform to their specification, enabling constructors to follow the layout without difficulty.

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Prices include either "full front" with handsome solid raised panel, as illustrated, or beaded doors, allowing ample space for tuning controls, etc. Glass panelled doors can also be supplied at 3/- extra.

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Packing Case 5/- extra repaid if Case returned within 14 days Carriage paid to Works.

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NEW VALVES FOR OLD

To further popularise our celebrated GUARANTEED BRITISH-MADE VALVES we make the following exceptional offer for a limited period.

Send us your old valve, no matter what make and condition, and we will replace with a BRAND-NEW GUARANTEED VALVE AT HALF PRICE. Special

	List Price.	Offer Price.
BRIGHT EMITTER.		
L.F. or H.F. 3-4 v. .6 a.	7 6	3 9
DULL EMITTER.		
L.F. or H.F. 2 v. .25 a.	10 6	5 3
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2 or 4 v.	17-	8 6
2 or 6 v.	22-	11-

Above offer for CASH WITH ORDER only. Please include 6pence per valve for postage and packing.

Full particulars, curves, etc., on receipt of P.C. Satisfaction Guaranteed.

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WET H.T. POROUS POTS

Genuine miniature porous pots for Wet H.T. to fit 2 1/2 x 1 1/2 Jar, registering 1-4 volts; 3/- per doz. Non-conductive Glass Jars, 1/- doz. Waxed, 1/3 per doz. Sacs, 1/6 doz. Zincs, 1/- doz. Send 1/6 stamp for Price List and Instructions. Carriage and Packing extra.

Trade Inquiries: THE ETON GLASS BATTERY CO., (Dept. P.), 46, St. Mary's Road, E.10. "Primary Batteries." An excellent work on Wet Batteries published by Messrs. Cassell & Co., 1/6, post free 1/9.

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Buy your Wireless parts direct from the Warehouse at Warehouse prices.

Every known component in stock.

Write NOW for list.

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STANDARD WET H.T. BATTERIES

(Leclanche Type)

1 1/2 volts each cell.

Separate Parts	
Jars (waxed)	1/3 doz
Zincs	1/0 "
Sac No. 1	1/6 "
Do. with terminals	2/3 "
Sac No. 2	3/0 "
Do. with terminals	3 9 "
Electrolyte for 20 cells	9d.
Box Rubber Bands for 12 Sacs No. 1	6d.



60 cell, 90 volt battery—Price of complete set, £1 10. Varnished Mahogany Tray, 9/6 extra.

Each Cell comprises Jar (Waxed), Zinc, Sac Element with rubber insulating band and electrolyte

Separate Parts	
Box Rubber Bands for 12 Sacs No. 2	6d.
Shellac Varnish	6d.
Suitable oil for use on electrolyte for 60 cells	9d.
Sample doz. cells with No.1 Sac, Elect. and Rubber Bands.	4/6

NO CHARGING — ECONOMICAL — PERMANENT — SILENT

Send 1/6 stamp for illustrated list giving full particulars, maintenance hints and useful information. We shall be pleased to advise the best battery to suit your set on receipt of full details.

TRADE INQUIRIES INVITED.

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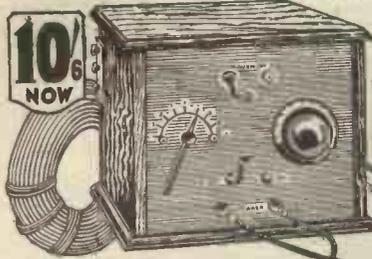
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LOUD SPEAKER BARGAIN.



10/6 NOW

This highly efficient 2-Valve Loud-Speaker Set is the finest wireless value ever offered.

It gives a volume and quality of tone unattained by any instrument of a similar price, and is the essence of simplicity. Fitted with coils covering all the British wave-lengths, including Daventry, THE CABINET is of beautifully polished Oak, & all components are of the highest quality. Dual Emitter Valves with patent valve holders, 4c, H.T. Battery, 2-volt accumulator and complete Aerial Outfit. **LOUD SPEAKER** of exclusive design with unique magnetic system and improved mica diaphragm. Price **£7:17:6**

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Rewound and re-magnetised 4/- per pair. Loud Speakers repaired 4/-; Transformers re-wound 6/- each. All work guaranteed and tested before delivery. Write for Trade Prices. Phone: Clerk. 1795. **MASON & CO., 44, East Rd., City Rd., N.1**

TECHNICAL NOTES.

(Continued from page 426.)

other hand, in certain cases it is very difficult to do so, and as really everything depends on the circumstances in a particular case, it is impossible to give any general rules for dealing with the trouble. If the cause is a local electric power line, or a tram or a train service, it is usual to arrange the aerial as nearly as possible at right-angles to the line carrying the electric power. In the case of the pick-up of the A.C. hum from the electric wiring in the house, care should be taken to avoid having the lead-in wire or any parts connected with the aerial or the high-frequency side of the set in too close proximity to (and especially parallel with) any parts of the electric wiring.

Suspect the Earth.

Contrary to the popular impression, interference is often picked up through the earth lead, and therefore it is always worth while in such cases to try using a different "earth": for example, if a buried-plate "earth" has been used it is always worth while trying a change-over to a waterpipe earth. Sometimes this simple change will completely cure the trouble.

Some kinds of circuits are much more liable to pick up interference of this kind than others. Reflex circuits in particular are very liable to troubles of this sort, and with any other kind of circuit a large amount of low-frequency amplification always increases the liability to power-line interference.

Shielding is very useful for preventing interference with the high-frequency part of the set, but it does not get over heavy interferences of the kind we have just been considering.

Underground Antenna.

I had some samples of underground aerials sent to me the other day for which great claims were made. These "aerials" consist briefly of lead covered cable loaded at intervals with special loading coils. The idea was to dig a hole in the ground, about three feet square and three feet deep, and to lay the "aerial" in successive flat coils at intervals of about nine inches upwards from the bottom of the trench, filling in, of course, with earth as the work proceeded. It was claimed for this "aerial" that it was very free from the usual kinds of transmission interference and that it gave great sensitivity and selectivity. According to the tests, however, it was found to be much inferior to an outdoor aerial of the usual dimensions as regards sensitivity, and as regards freedom from interference, it was difficult to judge of this in view of the low sensitivity.

BUY HYDRA CONDENSERS.

Here are a few reasons why you should:

- Because they operate perfectly at all voltages up to 600 D.C. without risk of breakdown.
- Because they are guaranteed precise within 5 or 10 per cent of their rated capacity.
- Because they absorb all crackling noises that arise from H.T. Battery when it is getting old.
- Because they are made by a firm who have been making the best condensers for 28 years.
- Because, although the standard of quality has been raised, prices are very reasonable.
- Because they are the only condensers to do justice to your skill as a constructor.



Obtainable in all capacities from .0011 mfd. to 10 mfd.; for instance, 1 mfd., 2/9; 2 mfd., 3/9; 4 mfd., 6/-, etc.

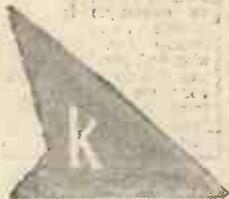
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THE WORLD'S BEST OSCILLATION DETECTOR
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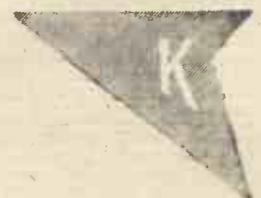
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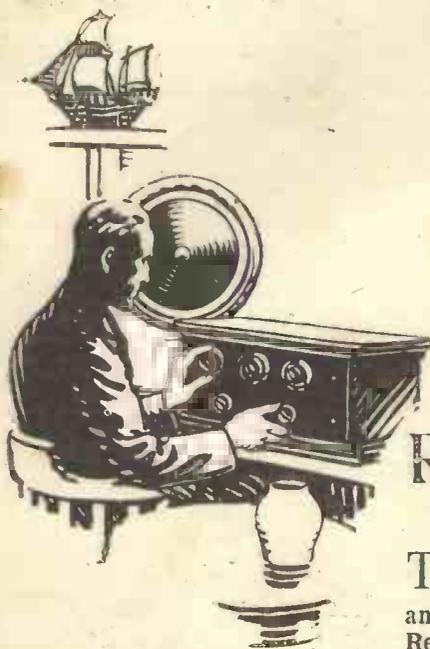


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All bother with coils is eliminated and a greater efficiency is gained, for the R.I. Retroactive Tuner secures the correct aerial reaction over the whole range of wave-lengths covered. In addition this tuner costs appreciably less than a set of coils with coil holder to cover the same range.

The R.I. Retroactive Tuner provides the easiest, most efficient and most economical method of tuning which you can incorporate in your set. Follow the lead of all the famous set designers and constructors and improve your tuning arrangements from to-day with the R.I. Retroactive Tuner.

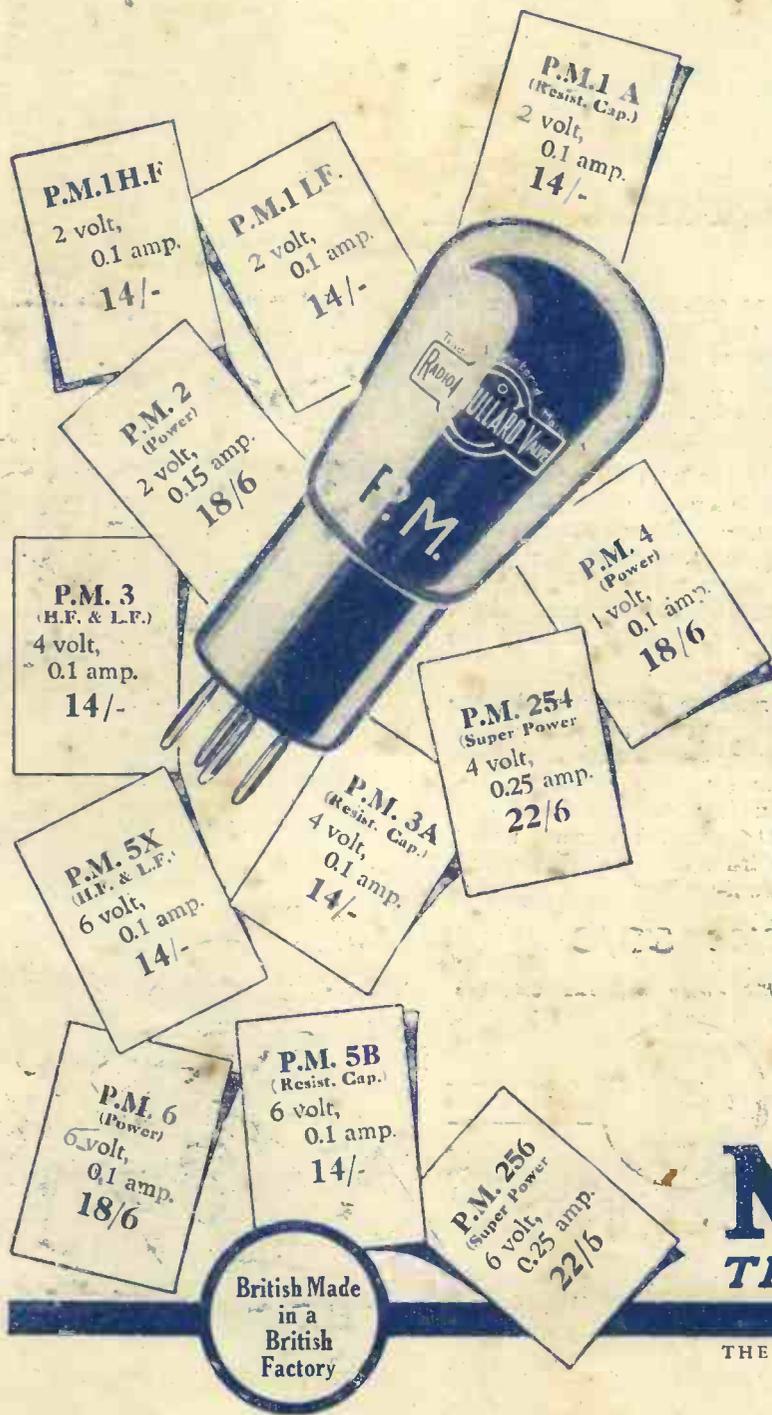
PRICE 39/6

Write for the R.I. Green and Gold Catalogue.



12 Master P.M. Valves

each with the wonderful P.M. Filament to improve definitely reception from every type of circuit



No matter what type of circuit you employ or whether your accumulator is 2 volts, 4 volts or 6 volts, you may now secure Mullard P.M. Valves from the P.M. Range specially designed to give the highest results from your particular circuit.

By the research-proved application of the wonderful P.M. Filament to the relative design of the grid and anode in each type of P.M. Valve, perfect operation is obtained for every individual circuit. This P.M. matched electrode design in itself gives assurance of better results, but positive improvement is made fact by the employment to the full extent of those vital advantages offered only by the wonderful P.M. Filament.

Long life, economy, greater and purer volume are secured with every Mullard P.M. Valve with the wonderful P.M. Filament.

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