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Popular Wireless

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No. 199. Vol. IX.

and Wireless Review
Scientific Adviser: SIR OLIVER LODGE, F.R.S., D.Sc.

March 20th, 1926.



FEATURES IN THIS ISSUE.

The "P.W." "Resistapure Loud-speaker Set. Those Pedal Notes.
 The "P.W." Continental Broadcasting Timetable. Is Your Aerial Safe?

HOW TO MAKE THE "P.W." "STAR" CRYSTAL SET.

Our cover photograph this week shows Mr. Arthur Burrows listening to British broadcasting in his Geneva home.

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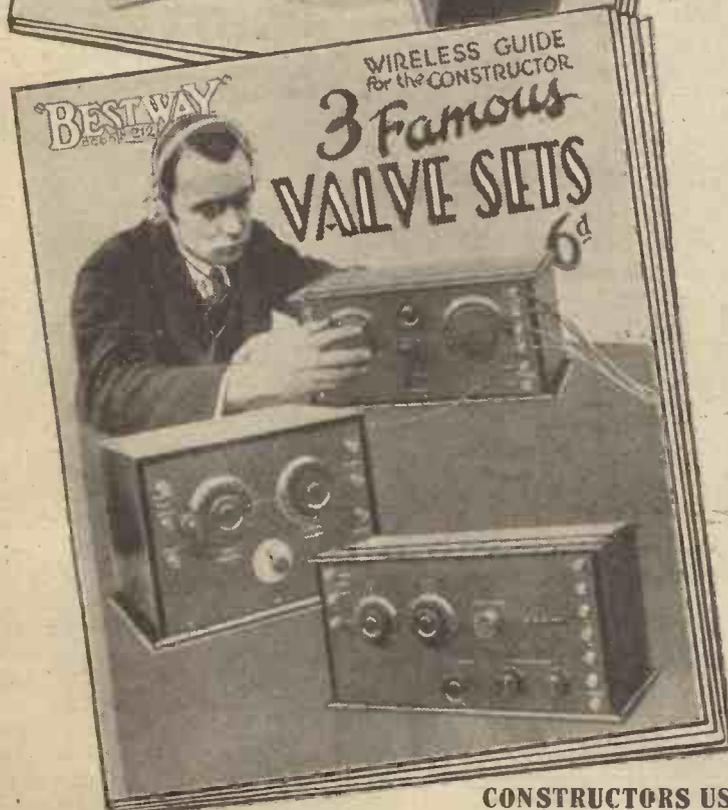
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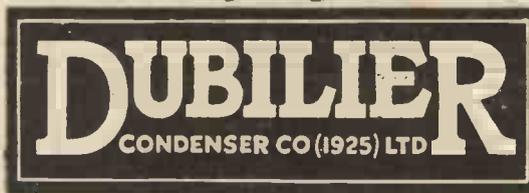
0.00025 mfd. . . 17/6

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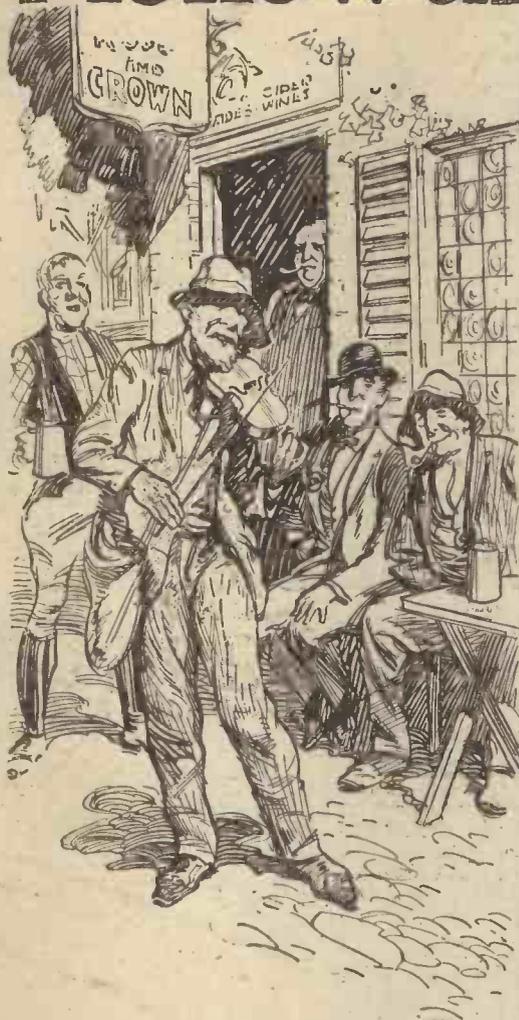
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P.1213

It must be Players

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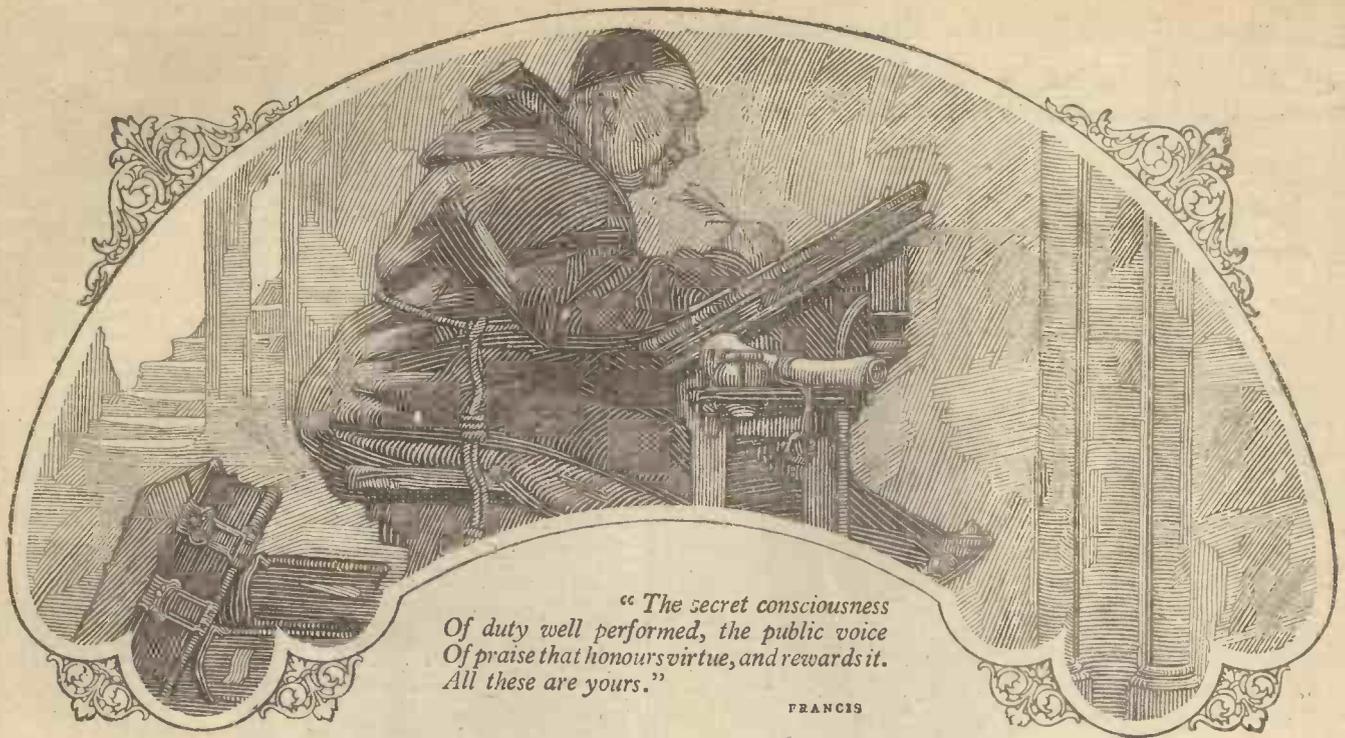
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RADIO NOTES AND NEWS.

Hotel Wireless—New Rome Station—World's Worst Place for Wireless—A Radio Preacher—European Broadcasting Conference—Short Wave Jottings—The Rugby Talks.

French Radio Compass Stations.

THE French Government has decided to erect a chain of wireless-compass stations round the coast for the benefit of ships approaching the French ports. The scheme as now planned provides for twenty direction-finding stations.

During fog or mist a ship can call up two or three of the stations, which are to be linked by landline, and each of them will be able to tell from which direction the ship's signals are coming. By comparing results the exact position of the ship can be determined, and for a small charge this information can be wireless to the blinded vessel.

Hotel Wireless.

I HEAR that in the main south block of the Hotel Cecil all the private sitting-rooms are being equipped for the reception of wireless programmes. The other rooms in the hotel will be fitted in the same way as soon as possible, so that guests will be able to plug in to wireless as easily as they now switch on the lights.

Technical Queries.

SOME important modifications of the rules regarding technical queries sent in by readers, are announced this week on page 178. In future, diagrams of crystal sets and one-valve sets will be drawn up for a nominal charge of sixpence per diagram. In addition to the diagrams specially drawn up in this way, there is a range of twenty different valve circuits, published in Blue Print form, each of which is obtainable from the Query Department at 6d. per blue print.

Revised Charges.

DIAGRAMS of two- and three-valve sets (and of one- or two-valves-and-crystal) can be specially drawn up for 1s. per diagram. One shilling and sixpence will be charged for multi-valve circuits of four or more valves, except in the case of super-heterodyne diagrams, which can only be supplied at 2s. 6d. per diagram.

It is hoped by graduating the charges in this way, according to the time involved, that delays will be obviated and all queries answered within a week. The full rules relating to readers' queries will be found

listeners was also rounded up, fines in these cases varying from 10s. to 20s.

A nineteen-year-old engineer in the employ of A. C. Cossor, Ltd., was found not guilty of stealing 117 wireless receiving valves, and was discharged.

5 X X Struck by Lightning.

DAVENTRY's breakdown at the beginning of the month was caused by lightning, according to the B.B.C.'s official explanation. It is rather early in the year for lightning troubles, but in this case the station was working again inside ten minutes.



FAMOUS ARTISTES AT 2 L.O.

Left to right. (Standing), Miss Fay Compton, Gladys Cooper, Gwen Frangcon-Davies, Lady Wyndham, Judith Cross. (Sitting), Sir Gerald du Maurier, Leslie Henson, Henry Ainley and Claude Hulbert.

South Africa and the Pirates.

A COMPREHENSIVE Bill, dealing with all phases of wireless, has recently been before the Union House of Assembly, at Cape Town. A feature of the Bill is the heavy penalties for radio law breakers. Obstructing wireless messages and the despatch of false radio communication are each punishable by a fine of £50 and three months' imprisonment, either with or without hard labour! Graduated broadcasting fees are provided for, according to the zone in which the receiver is situated.

under the heading "Radiotorial" on page 176.

Wireless in the Courts.

PLEADING that he did not know that a receiving licence was required for a crystal set, a Nunhead listener was fined a total of one pound at the Lambeth Police Court recently. A batch of Sheffield

New Rome Station.

THE power used at the Rome station has recently been doubled, and programmes are now sent out upon 12 instead of 6 kilowatts. This explains the improved reception which several readers have reported within the last few

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

weeks. I hear that the old transmitter will shortly be re-erected in another Italian city, probably Naples.

World's Worst Place for Wireless.

PROBABLY the worst place in the world for local interference and "mush" is Schenectady, New York State. Here the General Electric Co. have their experimental wireless plant, which includes no less than nine different radio transmitters, all working upon different wave-lengths. Sometimes seven of the stations are on the air at once, and as one or two of them are super-power stations employing up to 50 kilowatts, listeners in Schenectady have an exciting time if they try to cut out the locals.

British Empire's "Beam" System.

THE British Empire will soon be "beaming" for the Imperial Wireless Chain is at last nearing the stage of practical results. For years and years obstacles have arisen to prevent this country keeping in touch with our kin overseas by means of radio, but at last the stations are nearing completion. Sir William Thomson, Postmaster-General, said recently in the House of Commons that the contractors for Bodmin and Bridgwater stations hoped to complete them early next month. These two are for the Canadian and South African services, and in August, Grimsby and Skegness will be ready to talk to India and Australia.

A Radio Preacher.

MR. A. S. McPHERSON—the young American widow who recently visited London, en route to the Holy Land—is claimed to be the most eloquent broadcast preacher in the world. She is the founder of a great religious movement in the United States, where she broadcasts daily from the Angelus Temple, in Los Angeles. It is claimed that since she spoke "on the air," two thousand listeners have been converted.

Sir Harry Lauder.

WHY is it some people take to the microphone like a duck to water, whilst others sound uncomfortable all the time they are talking to it? Look at Sir Harry Lauder, for instance, as an example of perfect microphone personality. Left in the studio for an hour, he commences by boldly telling the "mike" that what it wants is imagination, and he laughed and chuckled so irresistibly at it that whole chunks of his delightful personality came over the ether to listeners.

Sir Harry is a born broadcaster, for it takes the efforts of a real artiste to sound so effortless.

Moving-Train Reception.

ONE of the best long-distance reception feats during the winter has fallen to the lot of an official upon a moving train. It is the policy of the Canadian National Railways to equip their passenger trains with wireless to keep in touch with the great North American cities, but in this instance a train passing through Jacobs-Ontario picked up broadcasting from Lima, in Peru.

Picking Up Peru.

IT transpired later that at the time all broadcasting stations in the U.S.A. and Canada were closed down, on account of the International Radio Tests. The reception was therefore carefully checked, and it was found that for nearly half-an-hour the moving train in Canada was undoubtedly picking up signals from O X A, the Lima, Peru, station.

French Parliament on the Air?

THERE is a proposal on foot to broadcast the French parliamentary debates. The question was put by a deputy to the Minister for Commerce, Posts and Telegraphs, as to whether it would not be desirable to let the public hear the debates via radio. The official reply was non-committal, of course, but it indicated that in high places there would be no objection at all if the scheme seemed practicable and in accordance with public wishes.

European Broadcasting Conference.

A EUROPEAN Conference on Broadcasting, to which all existing or projected radio authorities have been invited, is to be held at Geneva on March 25th. The various bodies will meet at the

SHORT WAVES.

"What is 2 L O?"—Mr. Justice Astbury.

"The dead hand of Whitehall must be avoided if broadcasting is to fulfil its possibilities as a social amenity."—Westminster Gazette.

"Broadcasting, says a music publisher, has a tendency to kill new songs before they are really born. Is not this one of the best things which could be said in defence of broadcasting?"—The Star.

"A scientist has discovered how to distribute heat by radio. It is expected that the day is not far distant when ladies will be able to dry their hair in the hot air broadcast from Parliament."—Passing Show.

Palais des Nations, and proposals for wave-length changes, limitation of stations, and other important aspects of international broadcasting, will be examined. It is anticipated that the conference will last for several days.

Amateur Makes Broadcasting Station.

A POWERFUL broadcasting station is being made by a London amateur to enable a British missionary in Iceland to preach to his "parishioners." The station is to be established at Akureiri, Iceland, and it is hoped to relay British and American programmes when conditions are favourable. Its wave-length will be about 200 metres, and it is being constructed by Mr. F. L. Hogg, of Bishop's Road, Highgate, who is himself the son of a missionary.

Radio Conference at Bournemouth.

BOURNEMOUTH and District Radio and Electrical Society is promoting a Conference of Radio Societies, to be held in that town on 26th or 28th of April. A visit to 6 B M is planned, and an attractive programme concluding with a popular address is being drawn up. Those interested should communicate with the hon. sec., Mr. H. J. Bliss, 140, Old Christchurch Road, Bournemouth.

Short-wave Jottings.

MR. E. J. SIMMONDS (2 O D) tells me that there has been very little doing on the ether this week—in fact, not enough to "jot" about!

In the circumstances, the Editor is omitting "Short-Wave Jottings," by 2 O D, this week, but this popular feature will appear in "P.W." next week, as usual.

The Broadcasting Report.

THE Government's Broadcasting Committee has duly presented its report, and truth to tell its arrival was something of an anti-climax. It seems to have been just about what everybody had expected, the least pleasing feature to most of us being that no reduction in licence fee was recommended. Everyone, on the other hand, was pleased with the proposal to exempt blinded listeners from any fees, and all clearly recognise that the chief interest is to get the right men as Commissioners.

On the whole, it seems a great pity that Government control is inevitable; but most of us will be lazily glad that the familiar initials, B.B.C., still hold good for the British Broadcasting Commission!

The Rugby Talks.

RUGBY'S results with telephony to New York have been exceptionally good lately. Several readers overheard the British and American newspaper reporters gossiping across the Atlantic a Sunday or two ago. In most cases the two stations were picked up on the intermediate amplifiers of super-het. receivers, Rugby being about twice as loud as New York. The first report of this kind was from a "P.W." reader living in Hillsleigh Road, London, W.8, who states that every word could be heard when the amplifier was oscillating.

Unidyne in South Africa.

THE 1926 Unidyne is making a great name for itself in South Africa. Already one enthusiast has succeeded in picking up Bournemouth's carrier wave upon the one-valve set, distance approximately 6,000 miles!

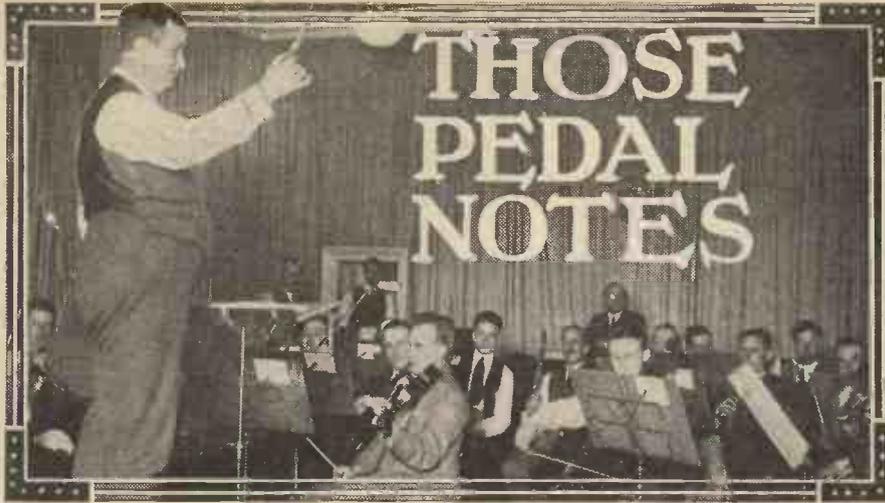
In a letter just received, Mr. Raymond Coombes, the Editor of "Radio" (South Africa's leading wireless journal), informs me that another reader living about 100 miles north of Delagoa Bay is able to pick up the Cape Town programmes on the one-valve Unidyne. All the reports agree that the absence of the unnecessary H.T. battery means better and clearer reception.

Presentation by Radio.

SIR HENRY THORNTON, lately General Manager of the Great Eastern Railway, and now President of the Canadian National Railways, has just presented the first medal ever officially awarded by wireless. The recipient was Mrs. Polybank, living in the village of O'Brien, Quebec, and the medal was the Canadian Humane Society's Bronze Medal for Life-saving.

As Sir Henry's words of presentation came from Ottawa by wireless, and issued from the loud speaker, an official of the railway company handed the medal to the heroine. Thousands of listeners in Canada shared the thrill of the first medal ever presented by radio.

ARIEL.

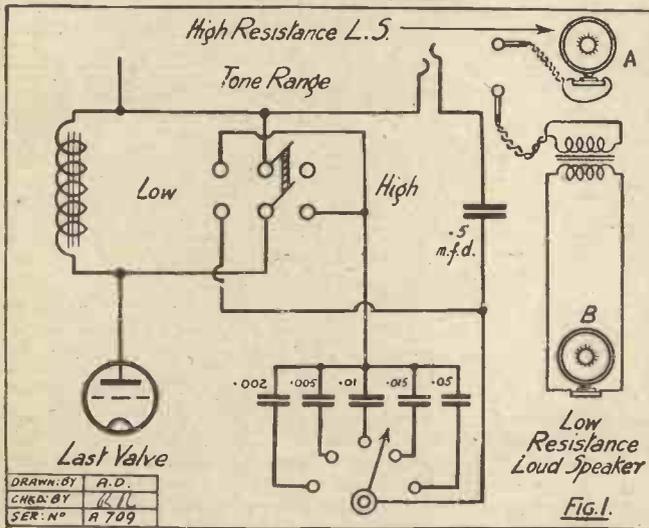


By **B. HONRI.**
(B.B.C. Research Staff.)

The many thousands of "P.W." readers who appreciated Mr. Honri's article, "Cutting Out Noise," will find even more to interest them in this exclusive contribution.

"YES, sir," said a wireless salesman to me the other day, "this set is remarkable for its purity of tone." "But," I protested, "what do you mean by purity of tone?" He explained to me that the "clearness" of reception on the set was

receiver was quite good on one or two of the speakers, but when he tried one of the new hornless types on it, the results were poor. "This new loud speaker —'s have just put out is a wash-out," he said. That was all. Because the loud speaker did not sound as well as the older types on his particular set, he condemned it.



DRAWN BY A.D.
CHECKED BY R.L.
SER. NO. A 709

much above the average. Whether he referred to the absence of "blasting" on the set or the way it reproduced the musical scale, I do not know.

Thereupon he began to demonstrate the set, connecting in turn a number of loud speakers which he had in the shop. The

designers had possibly intended that resonance to be there, expecting the loud speaker to be worked off an L.F. amplifier having cheap transformers. Such a loud speaker on a well-designed resistance-coupled amplifier would give "wuffy" tone. The remedy in this case would be to lessen the value of

the L.F. coupling condensers or to raise the tone by means of the tone circuit given in Fig. 1.

The ideal loud speaker is one which is equally sensitive to all audible frequencies. Consequently, when a good loud speaker is connected to a poor L.F. amplifier, the results are usually thin and high-pitched. The loud speaker is usually blamed for the distortion, whereas it is actually accurately reproducing the distortion of the L.F. amplifier.

The Two Extremes.

But how are we to reproduce the extreme high notes of the piccolo and the pedal notes of the organ with equal accuracy? It is all a question of impedance in our L.F. circuits. Firstly, we must have a good amplifier, in which the impedances of the transformer primaries are at least equal to the impedances of the preceding valves, or a resistance-coupled amplifier with high insulation coupling condensers of not less than .01 mfd. capacity.

Secondly, the output impedance of the amplifier should suit the impedance of the

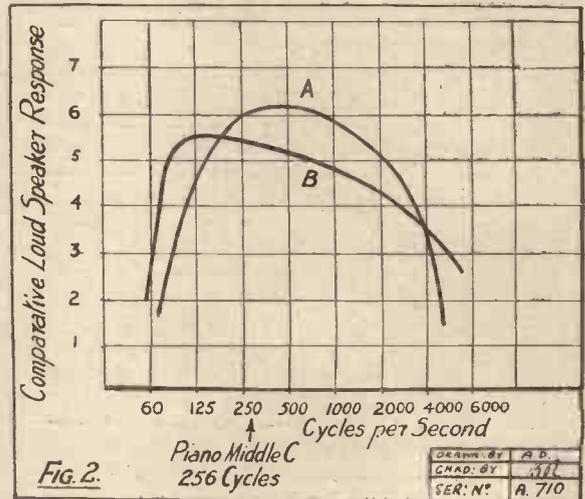


Fig. 2.

loud speaker. In the case of most of the 2,000 ohm resistance loud speakers, the impedance is about 10,000 and 12,000 ohms, and the output valve should have an impedance of about 6,000 to 10,000 ohms. Choke coupling the output valve to the loud speaker, as in Fig. 1, improves matters still more, but it is important that the choke should have an inductance of at least 50 henrys with a low D.C. resistance.

L.R. Loud Speakers.

The makers of one of the new types of 650 ohm resistance hornless loud speakers recommend an output impedance of 2,000 ohms. It is therefore necessary to use an output transformer stepping down from, say, 6,000 ohms to 2,000 ohms, or else to use a very low impedance valve in the last stage. The former method is the more economical, and in the case of the "Kone" loud speaker, the makers sell suitable output transformers which may be fitted in the loud speaker base, the terminals 1 and 2 being connected to the loud speaker.

This is, of course, not required when the loud speaker is worked off a "Kone" amplifier. When strong signals are expected the very best output connection would be that of Fig. 1 B. In this arrange-

(Continued on next page.)

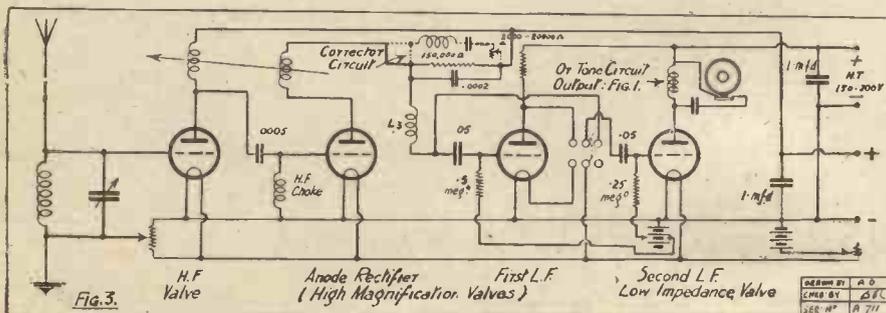


Fig. 3.

DRAWN BY A.D.
CHECKED BY R.L.
SER. NO. A 711

THOSE PEDAL NOTES.

(Continued from previous page.)

ment, the D.C. current of the valve does not go through the primary winding of the transformer.

A bad loud speaker often sounds quite pleasant on a bad set. It is, of course, a roundabout-swings situation, in which the L.F. amplifier deals out strong high notes while the loud speaker is more sensitive to the fairly low notes. The result is pleasant but not accurate, for it lacks the very low notes and the very high ones too. The curve A in Fig. 2 gives some idea of what is

C variable from about .002 to .04. Variation in the value of the resistance, R, flattens the "chunk" taken out of the curve of the amplifier by the acceptor. (See Fig. 4.)

Grid Bias.

When considering the value of the grid negative to be put on the first L.F. valves of a resistance amplifier, it is important to consider the dynamic characteristic of the valve. Referring to Fig. 5, it will be seen that the effect of putting 100,000 ohms resistance in the plate circuit of a D.E.5 B. or D.F.A.4 alters the characteristic curve considerably, and under actual working conditions the curve B must be read.

The reason for this flattening of the curve is that as the grid becomes more positive the anode current increases, and there is more voltage drop across the resistance. The curves show that the valve should have 2 volts negative grid bias with the resistance in circuit and 1½ volts negative without the resistance, exactly the reverse of what would be expected. In actual practice, the presence of the anode resistance may be neglected when estimating the correct grid bias, in spite of the flattening out of the characteristic curve.

Choke Coupling.

In conclusion, the writer strongly advises those who dabble in circuits to construct a good-quality amplifier which may be "hitched" on to them. If L.F. transformers are used in this amplifier, let them be the very best obtainable. If resistance coupling is used, let the connection be something like that in Fig. 6. If choke coupling is used, let the chokes have an inductance of at least 50 hys. (For choke coupling, substitute L.F. chokes for the anode resistances in Fig. 6.) By paying attention to detail it is perfectly

Curve A = Corrector with no Resistance.
Curve B = Corrector with 2000Ω "
Curve C = Corrector with 5000Ω "

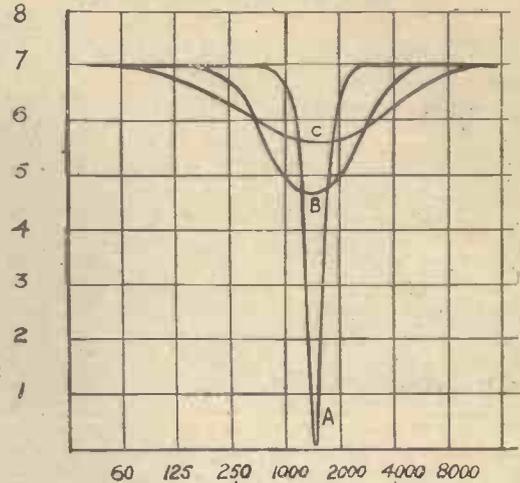
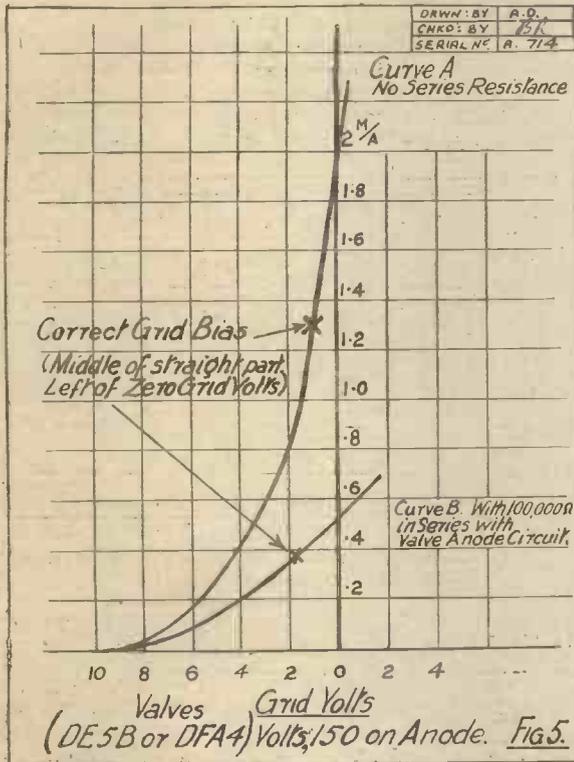


FIG. 4. Circuit tuned to 16,000 Cycles.

DRWN: BY A.D.
CHKD: BY B.K.
SER. NO. A. 713



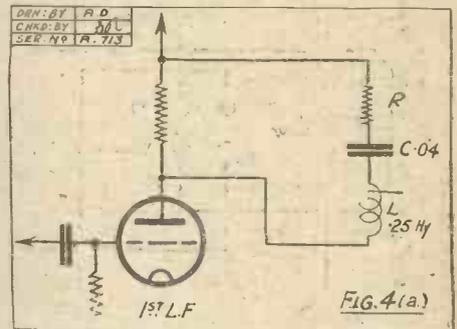
happening. If the same loud speaker is worked off a good L.F. amplifier, the curve B would be expected; so that a known good set shows up a bad loud speaker in its true colours.

Further Precautions.

There are still some further precautions to be taken by those who are endeavouring to obtain equal loud-speaker audibility for all notes. Firstly, it is an advantage to connect an H.F. choke in the first amplifier circuit (L3 in Fig. 3). This prevents any H.F. currents getting on to the first amplifier grid. It is, of course, unnecessary if transformer coupling is used. It is possible to eliminate any very prominent loud-speaker resonance by means of an acceptor circuit across the first anode resistance (see Fig. 4). This circuit should be tuned to accept the particular note or band of notes which is undesirably loud, and must be adjusted by experiment. A useful band of frequencies may be covered by making the value of the coil L, ¼ henry, and (by means of combinations of fixed condensers) the condenser

possible to do justice even to those elusive organ pedal notes.

The designing of L.F. amplifiers is an exceedingly interesting branch of the science of radio and one that fully repays any trouble that is incurred. The satisfaction obtained from listening to a good loud



speaker attached to a good amplifier and pushing out undistorted music is a very real one, and with a little experimenting one that can be reached by all who will take the trouble to study the whys and wherefores of audio-frequency amplification.

It is hoped that this little article and those on "Cutting Out Noise" that have preceded it will assist many constructors to get the most and also the best out of their receivers.

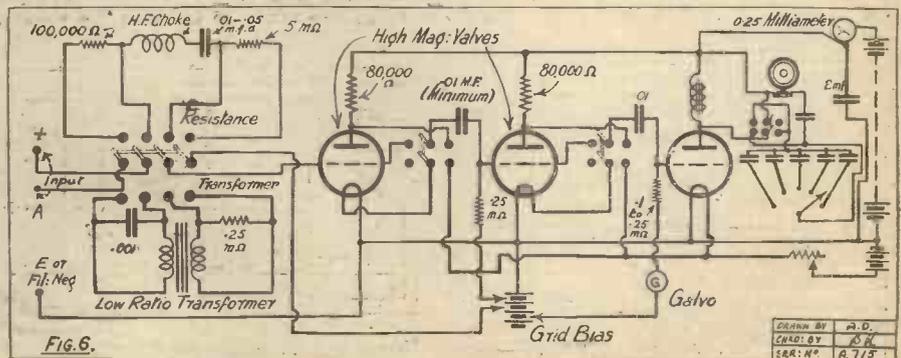
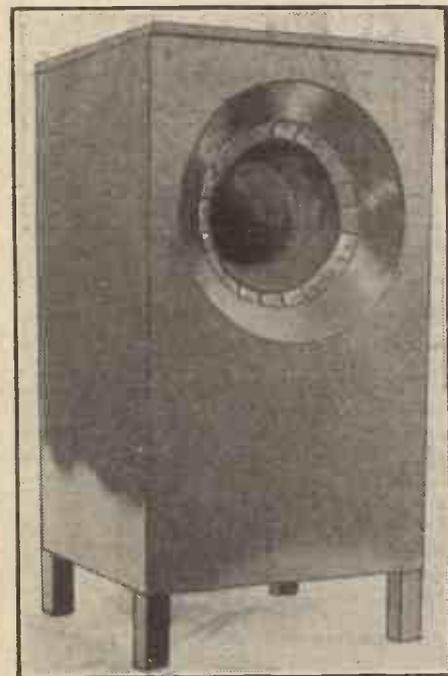


FIG. 6.

DRWN: BY A.D.
CHKD: BY B.K.
SER. NO. A. 715

FROM the amateur's point of view, listening to broadcast programmes as a source of entertainment and the pursuit of long-distance reception are entirely different, so much so that ardent experimenters are apt to regard the former with disdain.

However, the possession of a good loud speaker, used in conjunction with a receiver and amplifier reasonably free from distortion, can be a source of much pleasure to one's friends, especially during winter evenings; but the success of "radio parties" depends



The complete instrument built into a cabinet.

largely upon the loud speaker, which may well be the best obtainable. The cost of such an instrument, however, is a very considerable proportion of the total outlay on the receiving system, and may even equal the cost of the latter when home constructed.

Now, for the benefit of those who quite rightly pride themselves upon having con-

HOW TO MAKE A LOUD SPEAKER.

By J. ENGLISH.

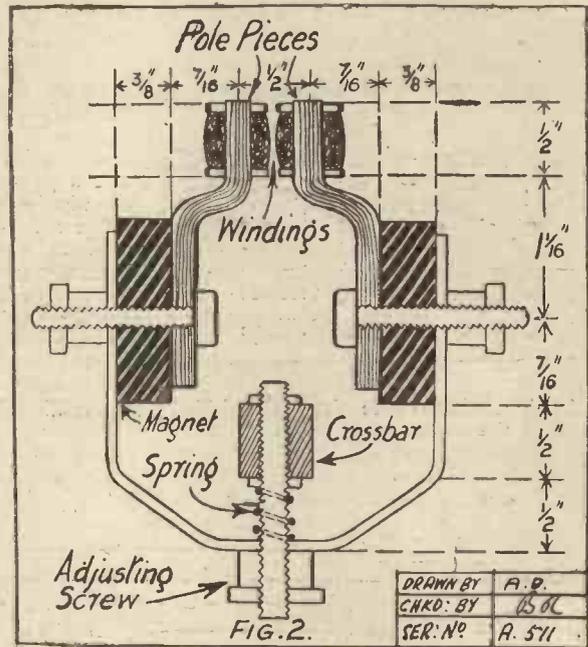
The construction of a loud speaker is not so difficult as many amateurs imagine. In this article a well-known "P.W." contributor gives constructional details which can very easily be carried out and with interesting results.

constructed the bulk of their apparatus, I propose to outline the construction of a cabinet loud speaker which compares very favourably in operation with the best commercial types, and one that is capable of handling a large input, yet sufficiently sensitive to give good volume with a moderate input power.

Comparisons.

Tested against smaller types of commercial loud speakers, the superiority of the home-made instrument was very apparent, there being an entire absence of shallowness of tone, while the cost of this instrument is but a few shillings. Many experimenters will, perhaps, find the necessary component parts in their junk boxes, and the construction can be undertaken by anyone possessing the usual tools and a little mechanical skill.

The appearance of the instrument is apparent from the photographs, and it will be seen that no attempt has been made to produce an elaborate cabinet; but there is no reason why anyone gifted as a cabinet-maker should not turn out an ornamental and useful piece of furniture.

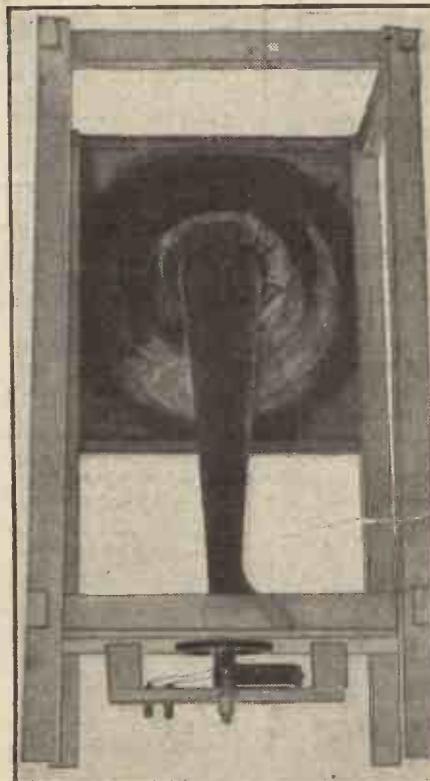


We will first consider the electro-magnetic system, which is the most important part of the loud speaker, and upon the construction of this depends the efficiency of the instrument. The exact dimensions of the original loud speaker are given here as a guide, but a certain degree of latitude is possible without prejudice to the final result.

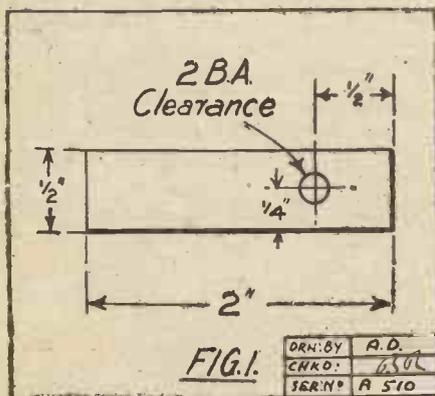
The Laminated Pole Pieces.

The first requirement is a horse-shoe magnet, which should be small and fairly strong, the one used by me having been obtained from an ex W.D. moving coil ammeter, and measures 3 1/2 in. long, 2 1/8 in. wide across the poles, the section of the magnet bar being 1/2 in. by 7/8 in. Magnets of approximately these dimensions may be obtained very cheaply from disposal dealers, but the magnet must be furnished with a hole through each pole, so that pole pieces may be bolted on, and preferably with a hole at the bend.

Laminated pole pieces are constructed from soft iron sheeting, which is easy to work, a suitable material being ferrotype sheets, which may be purchased for a few pence from any dealer in photographic sundries. From this sheet are cut twenty pieces, measuring 1/2 in. by 2 in., the enamel being burnt off in a fire or gas flame. When cold, the carbonised residue is rubbed off, but each piece is left unpolished, as the



The various parts are held together by a wooden framework.

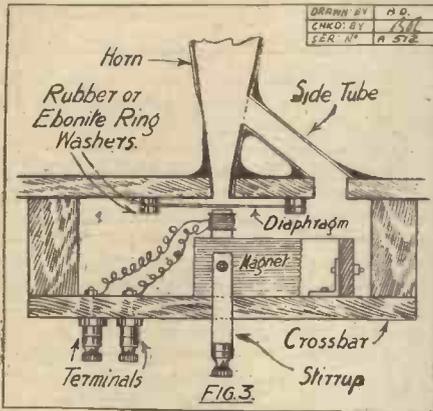


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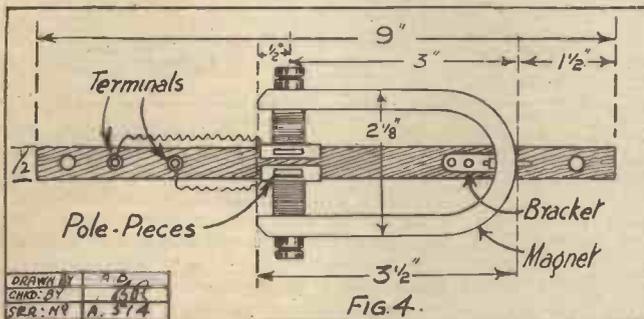
MAKING A LOUD SPEAKER.

(Continued from previous page.)

layer of oxide tends to reduce eddy currents in the pole pieces, such eddy currents being detrimental to a high efficiency. If the holes in the magnet poles are $\frac{1}{4}$ in. in diameter,

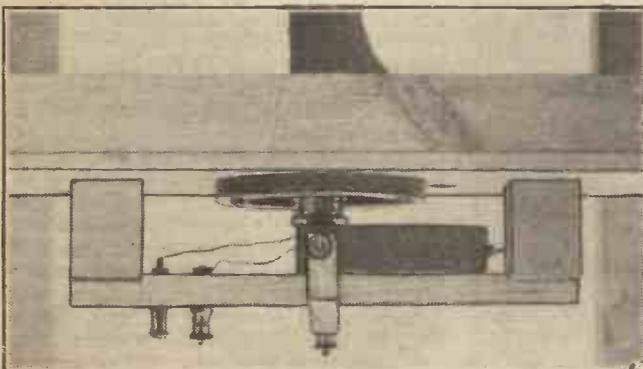


a 2 B.A. clearance hole should be drilled through the laminations, as indicated in Fig. 1, the twenty pieces being made up into two bundles of ten each, and roughly bound up with wire. Drilling is facilitated if each



bundle is clamped in a vice against a piece of wood.

When the holes are drilled, the binding wire is removed, and a bundle bolted to each pole of the magnet by means of a 2 B.A. nut and bolt, and large 2 B.A. terminals cut down to the shank make



A "close-up" of the electro-magnetic system in the base.

strong and useful bolts. The projecting portions of each bundle are now roughly bound up with wire, to prevent the laminations springing apart, and then bent into the position indicated in Fig. 2 with pliers.

As the sheeting is very soft, this is quite an easy operation. The bound pole pieces are then removed from the magnet, and the bolts put on them and tightened up to hold all the laminations in place for the next operation, which consist of trimming and filing down square the top end of each pole piece. Both these must be of equal height, and truly square when reassembled on the magnet.

Winding the Magnets.

The pole pieces are next prepared for winding by fitting stiff cardboard or fibre cheeks $\frac{1}{8}$ in. thick, measuring $\frac{1}{2}$ in. by 1 in., two to each pole, the slot in the centre being cut of such a size that the cheeks fit tightly on the pole-piece ends. Thus equipped, the pole pieces are dipped in hot paraffin wax, and two layers of thin waxed paper wound in the space between the winding cheeks over the laminations.

For a low-resistance loud speaker to be used in conjunction with a step-down transformer, wind on each pole piece, in the same direction, one thousand turns of No. 40 enamelled wire, and for a high-resistance winding put on as many turns as possible of No. 47 enamelled, the greater the number of turns, within limits, the higher the efficiency. The completed windings may be bound over with oiled silk or electrician's tape. The insulation resistance of windings to laminations should be high.

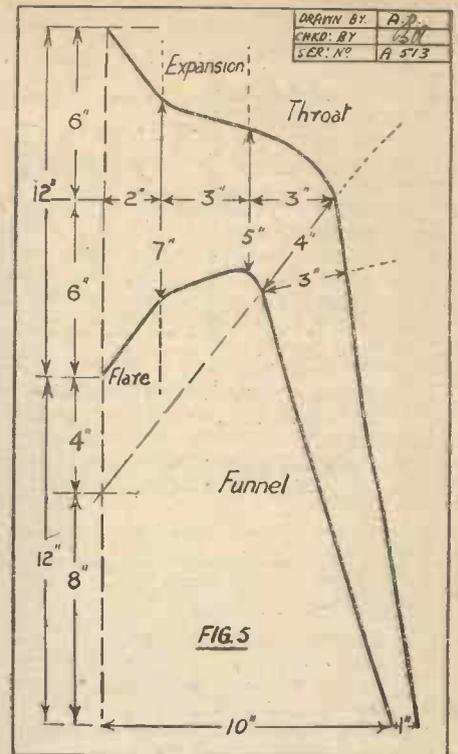
The pole pieces are now assembled on the magnet, the beginning ends of the two windings being soldered together, while the two free ends are connected to the input terminals. A method of suspending the magnet beneath the diaphragm is indicated in Fig. 3, a bracket bolted to the bend of the magnet holding the latter to a bar of wood, and a stout brass stirrup, fastened to the poles

of the magnet, is suspended over a compression spring on a 2 B.A. rod fixed to the bar.

Assembling the Parts.

Screwing the nut on this rod, up or down, raises or lowers the pole pieces with reference to the wooden bar, and, as this is fixed rigidly beneath the diaphragm, the distance between the latter and the pole pieces may be finely adjusted. Further details of the electro-magnetic system are given in Figs. 2, 3, and 4.

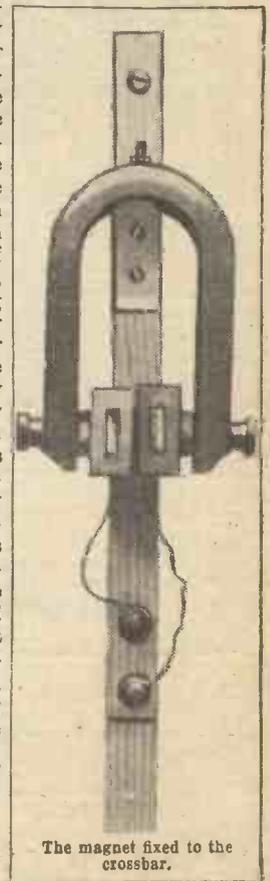
The diaphragm, of thin stalloy $3\frac{1}{2}$ in. in diameter, should be secured over the trumpet orifice in a solid wooden board, by means of two ebonite rings or rubber washers. Where these are unobtainable, two



circles of waxed cardboard will serve quite well. The bar carrying the magnet is securely bolted to the same board, and it is essential to obtain solid construction of this portion of the loud speaker to prevent vibration. See Fig. 3. Finally, the magnet system may be closed in by a wooden or cardboard box fitted to the baseboard.

The sound conduit, or horn, may be constructed or purchased, choosing for preference a non-metallic type of solid construction. The one used in the instrument shown in the photograph was built up of waxed cardboard, each section being riveted together with brass paper fasteners and the whole finally coated liberally with paraffin wax. Such a horn is practically non-resonant at any particular frequency and gives a full and pleasing tone. The dimensions found to give the best results are indicated in Fig. 5, the flare being secured to a square of three-ply wood, in the centre of which is a hole one foot in diameter.

(Continued on page 180)



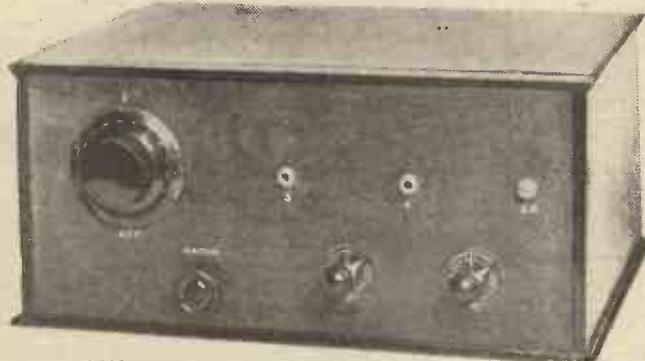
The magnet fixed to the crossbar.



The Set designed and constructed by the "P.W." Technical Staff.

OWING to the recent advances in the price of rubber, constructors are finding the outlay required to purchase the ebonite panels for their sets an ever-increasing burden. Ebonite—good ebonite, that is—has never been really cheap, and

resistance-capacity coupling for the L.F. amplifiers, of which there are three. Next in importance the insulation of the various stages was considered, and at the same time it was decided to do away with ebonite and its accompanying costs as far as possible.



Despite its wooden panel, the "Resistapure" receiver has an extremely finished appearance.

This was found to be possible if wood were used for the panel, but here it was found that the external appearance of the set was likely to suffer unless some method was found by which the wood could be treated in order to give it the appearance of ebonite.

It was at this juncture of the proceedings that a short article contributed by Mr. T. P. Middleton, and published in "P.W." No. 191 under the heading of "Imitation Ebonite," was received, and

upon experiment it was found that the problem of appearance was solved, and the set was put under construction.

now that it has gone up in price by about 50 per cent the panel of any but the smallest receiver is a large item on the list of expenditure.

But why should ebonite be so very necessary for the construction of wireless receivers? True it is convenient to work, and it gives a finished appearance to a set, but it is not at all indispensable. This has been proved in the experiments carried out by the technical staff of POPULAR WIRELESS, and it is now fully realised that a really efficient set can be made with the use of only about sixpennyworth of ebonite—apart from that used in coil holders, etc.

An Efficient Circuit.

The receiver under discussion in this article, it is admitted, is not one that makes use of multi-stage high-frequency amplification, where the use of ebonite might be thought to be necessary—it can be dispensed with even in that case if care is taken—but it is a set that is one of general appeal and can hardly be surpassed for loud-speaker work from the local station or 5 X X.

Designed from the point of view of efficiency first, the set utilises the anode-bend method of valve rectification, and

The wood chosen for the panel was of three-ply, measuring 8 in. by 18 in., and it was treated in exactly the manner described by Mr. Middleton, with the result that a "panel" resembling ebonite was obtained at the cost of about 9d. instead of 10s. to 12s.—a very important saving.

In order to make sure that insulation did not suffer all H.F. and H.T. leads were kept away from the wood so that this merely made contact with points at earth potential—such as the condenser spindle, rheostats, etc. Two strips of ebonite hold the terminals at the rear of the receiver—these strips being the only ebonite in use, except that used in the valve holders and coil holder.

Preparing the Panel.

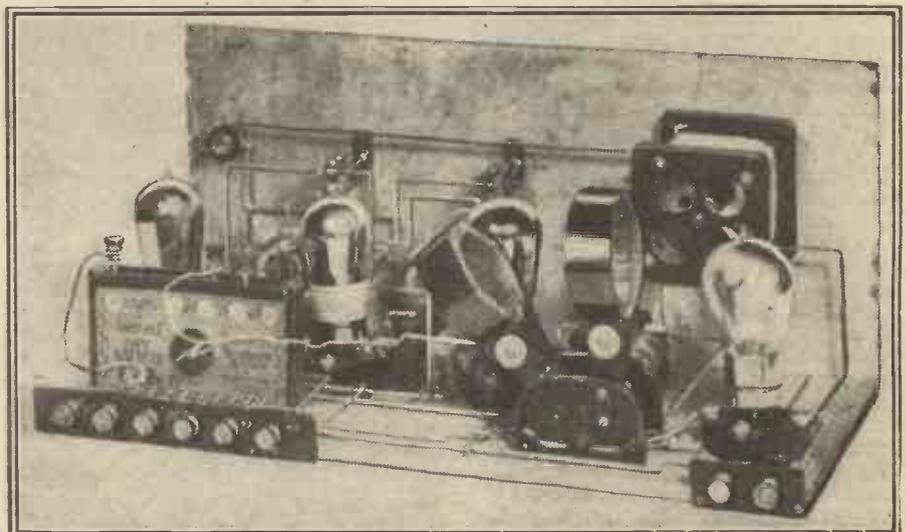
For the benefit of those who did not see "P.W." No. 191, and who are unable to obtain a copy, the method of treating the wooden panel is repeated here, and if care is taken the finished article will be almost indistinguishable from ebonite. Both sides of the panel can be done if desired, but in the set photographed the reverse was left untreated, so that the contrast might be more marked.

The tools and materials required are few, viz.: some plaster of Paris, some shellac varnish, a bottle of Radium jet black stain, a cabinet scraper, and some glasspaper (No. 00.) The plaster of Paris should be fine and free from grit such as that sold for dental use by Messrs. T. C. Lindsey & Co., of Leather Lane, E.C., but ordinary plaster will do if it is carefully sifted through fine muslin.

The Radium jet black stain is sold in leather shops as a leather stain, and is apparently aniline black dissolved in some aniline derivative. The scraper can be bought for a few pence at any tool shop; as, of course, can be procured the 00 glasspaper.

The side of the panel is made smooth by using the glasspaper, and if necessary the scraper. Some plaster is then mixed with water to a thick paste, and is rubbed all over the surface back and forth, and especially across the grain. Use it liberally, and don't attempt to get it smooth; and allow to dry. When dry and hard, scrape off the superfluous plaster and rub down with the glasspaper, and it will be found that the

(Continued on next page.)



This photograph shows the set ready for test, with valves, coils and grid bias battery in position. From right to left the valves are: B.A., D.F.A.4, C.T.25B., C.T.25.

THE "P.W." "RESISTAPURE" SET.

(Continued from previous page.)

pores of the wood have been so filled up that the surface is quite even. If the wood is very rough another application may be given, but this should not be necessary.

A rag is then taken and moistened with the black stain, and the whole surface well covered with the stain till it appears an even black. When dry, it is varnished with shellac varnish diluted with about an equal part of the black stain. It is then allowed to dry, and is rubbed down to remove the gloss and make it even, and is finally polished with a rag moistened with a drop or two of linseed oil mixed with a little black stain. The process is not long or tedious, and results in a very handsome finish.

The drilling of the panel can be carried out in the usual way if care is taken and the components mounted as usual. From now onwards the building of the receiver is quite straightforward, and does not differ from the construction of a set where ebonite is used for the panel.

The baseboard is of 5-ply wood, and measures 8 in. by 18 in., and upon it are

LIST OF COMPONENTS.

	£	s.	d.
1 Sheet of 3-ply wood, 18 in. x 18 in.	0	0	6
Plaster of Paris and shellac	0	0	8
1 Tin Radium, black or similar stain	0	2	0
Cabinet and baseboard	1	10	0
1 Peto-Scott "S.L.F." condenser .0005	0	15	0
1 Lotus 2-way coil holder (extended handle)	0	8	0
2 Cosmos rheostats	0	10	0
4 Benjamin clearer tone valve holders	0	11	0
2 Igranic-Pacent 5-point Jacks (No. 69)	0	8	0
1 Igranic-Pacent Autoplug (No. 60)	0	2	6
1 Lissen key switch	0	2	6
1 Varley anode resistance, 100,000 ohms	0	7	6
1 Varley anode resistance, 80,000 ohms	0	7	6
1 Lotus anode resistance, 60,000 ohms	0	7	6
3 .06 fixed condensers (T.C.C.)	0	7	0
3 5 megohm grid leaks (Mullard)	0	7	6
1 9-volt Battery (Siemens' G.2)	0	2	3
2 pieces of ebonite (7 in. x 1 in. x ¼ in. and 2½ in. x 1 in. x ¼ in.)	0	0	6
8 W.O. type terminals	0	1	0
Wire, screws, brass strip, etc.	0	2	6

D.F.A.4 for first L.F. stage, and two Clear-tion power valves for the last two stages. All these valves need 5-6 volts for the filament voltage, taking about .25 amp. each. The H.T. battery used should be capable of providing a pressure of 120 volts.

The coil holder used for the two plug-in coils must be capable of accurate adjustment, because the reaction has a marked effect upon the volume of reception. A Lotus two-way holder with long handle was used on the set photographed, and this gave every satisfaction.

The actual construction is not difficult, and provided the diagrams reproduced herewith are carefully followed no trouble or "snags" should be encountered. Care must be taken that valve holders, etc., are so placed on the baseboard that the swing of the reaction coil is not impeded.

Constructional Details.

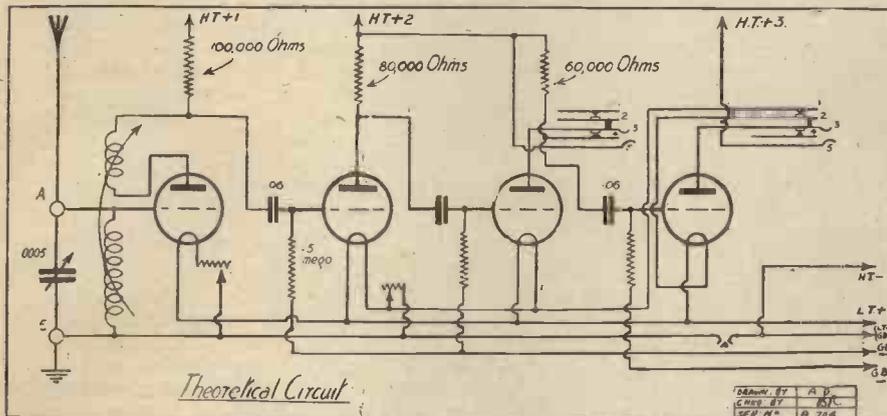
All connections that cannot be made to terminals or nuts should be soldered, care being taken that no dry joints are made.

Two ebonite strips are required for mounting the terminals, and are fixed at the back of the baseboard. One has two terminals (aerial and earth), and is 2½ in. by 1 in. by ¼ in., and the other, which measures 7 in. by 1 in. by ¼ in., is fixed at the other end of the baseboard, and contains six terminals, L.T.+, L.T.-, H.T.-, H.T.+1, H.T.+2, and H.T.+3.

The photographs and wiring diagram show the lay-out of the anode resistances, grid condensers, etc., the former being provided with ebonite mounting so that they can be screwed down on to the wooden baseboard. The grid leaks are supported on the connecting wires (these being soldered to the grid leak clips) at one end, and from the valve grid terminals at the other. Care should be taken to solder the leak clips with the leaks removed, or otherwise the heat may affect the resistance element and cause the leak to become noisy or faulty in operation.

The connections to the jacks are made according to the diagram and point-to-point description, the tags being numbered from the tops of the jacks.

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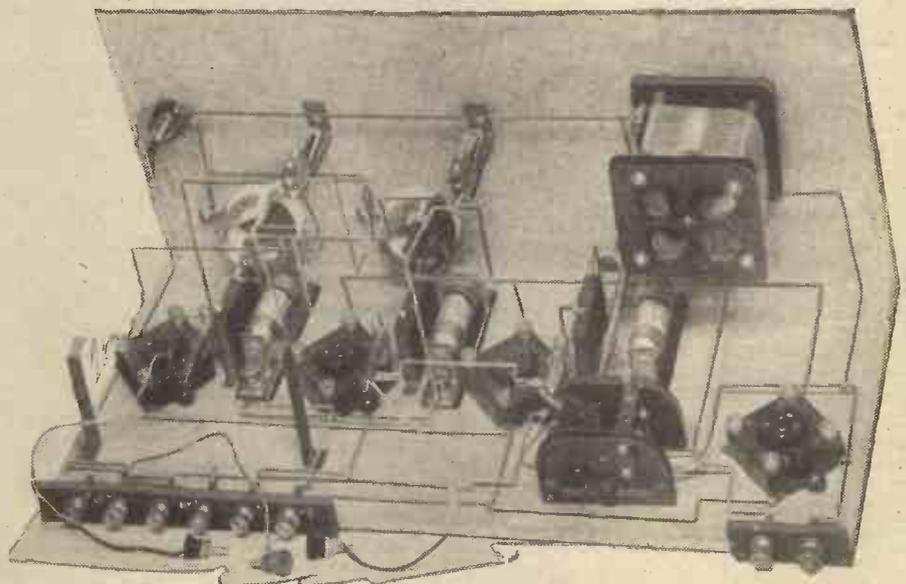


mounted all the components with the exception of the tuning condenser, rheostats, telephone jacks and L.T. switch. Only two rheostats are provided, one to control the first valve and the other to control the remaining three. The last L.F. valve is automatically cut out of circuit when the 'phones or loud speaker are taken out of the second jack and plugged into the first one.

Pure Reception Obtained.

The circuit, as remarked before, is one recommended for pure reception from the local station and 5 X X, and plug-in coils provide means for changing the wave-length ranges and reaction. The output from the detector valve is carried through three stages of resistance-capacity coupled amplification, each containing wire-wound resistances of extremely robust manufacture. Anti-microphonic valve holders are used, and it is advisable to employ power valves throughout.

Under test the set gave excellent results, and full loud-speaker volume without a trace of distortion. Though about 15 volts is usually a sufficient anode pressure for an "anode-bend" detector, this set worked well up to about 40 volts on the first valve. The valves used were B.4 for detector,



The method of mounting the various components is clearly seen from this illustration of the "Resistapure" loud-speaker set. All the components on the panel have one side at earth potential.

THE "P.W." "RESISTAPURE" SET.

(Continued from previous page.)

The rheostats used were those of Cosmos manufacture of the dual type—for bright or dull emitters—and as the second rheostat controls three valves the moving arm will be found to be on the "bright" section all the time.

Suitable Valves.

It must be remembered that the success of the set depends upon the components, so that those specified should be used wherever possible, or if others are substituted

POINT-TO-POINT CONNECTIONS.

Aerial terminal to fixed plates of .0005 variable condensers, plug of fixed coil holder and grid socket of 1st valve holder. Earth terminal to socket of fixed coil holder, moving plates of .0005 variable condenser and one side of key switch, which is also joined to one side of the two rheostats. Other side of key switch to L.T. negative, H.T. negative and grid bias positive.

Other side of 1st rheostat to one filament socket of 1st valve holder. Other side of 2nd rheostat to one filament socket of the 2nd and 3rd valve holders and to contact 1 of 2nd jack. Contact 2 of 2nd jack to one filament socket of 4th valve holder. All other filament sockets are connected together and to L.T. positive.

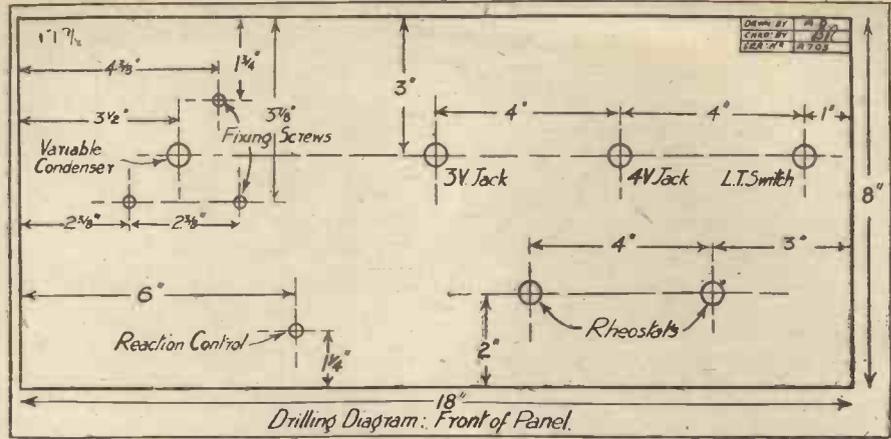
Plate socket of 1st valve holder to socket of moving coil holder, plug of which is connected to one side of 1st anode resistance and .06 fixed condenser. Other side of anode resistance to H.T. + terminal No. 1. Other side of .06 fixed condenser to grid socket of 2nd valve holder and one side of 1st grid leak.

Plate socket of 2nd valve holder to one side of 2nd anode resistance and .06 fixed condenser. Other side of fixed condenser to grid socket of 3rd valve holder, and one side of 2nd grid leak. Other side of 1st and 2nd grid leaks are connected together and to the 1st negative grid bias battery tapping.

Plate socket of 3rd valve holder to contact 3 of 1st jack. Contact 4 is connected to one side of 3rd anode resistance and .06 fixed condenser. Contact 5 of 1st jack is joined to the other side of the 2nd and 3rd anode resistances and to H.T. positive terminal No. 2. Other side of 3rd .06 fixed condenser to grid socket of 4th valve holder and to one side of 4th grid leak, the other side of which goes to the second negative grid bias battery tapping.

Plate socket of 4th valve holder to contact 3 of 2nd jack, contact 5 of which is joined to H.T. positive terminal No. 3.

these should be of good manufacture. The valves mentioned were found to give excellent results, and if other makes are used care should be taken that the types employed correspond in characteristics to those mentioned earlier in the article. A high impedance valve could be substituted for the B.4 if desired, but the other three valves—the amplifiers—should have impedances corresponding to those of the valves mentioned in each case, especially in that of the



first amplifier and in that of the last. The first should have an impedance of about 27,000—30,000 ohms, the next valve can have a lower impedance, and the last valve either the same or still lower impedance.

The impedances of the three amplifying valves used in the test of the receiver were as follows: 1st stage, 27,000, 2nd stage 20,000 (CT 25 B), last stage 10,000 (CT 25). If desired, an H.F. amplifier could be added to the Resistapure receiver to enable more distant stations to be received, but it would necessitate a specially designed amplifier and separate tuning control.

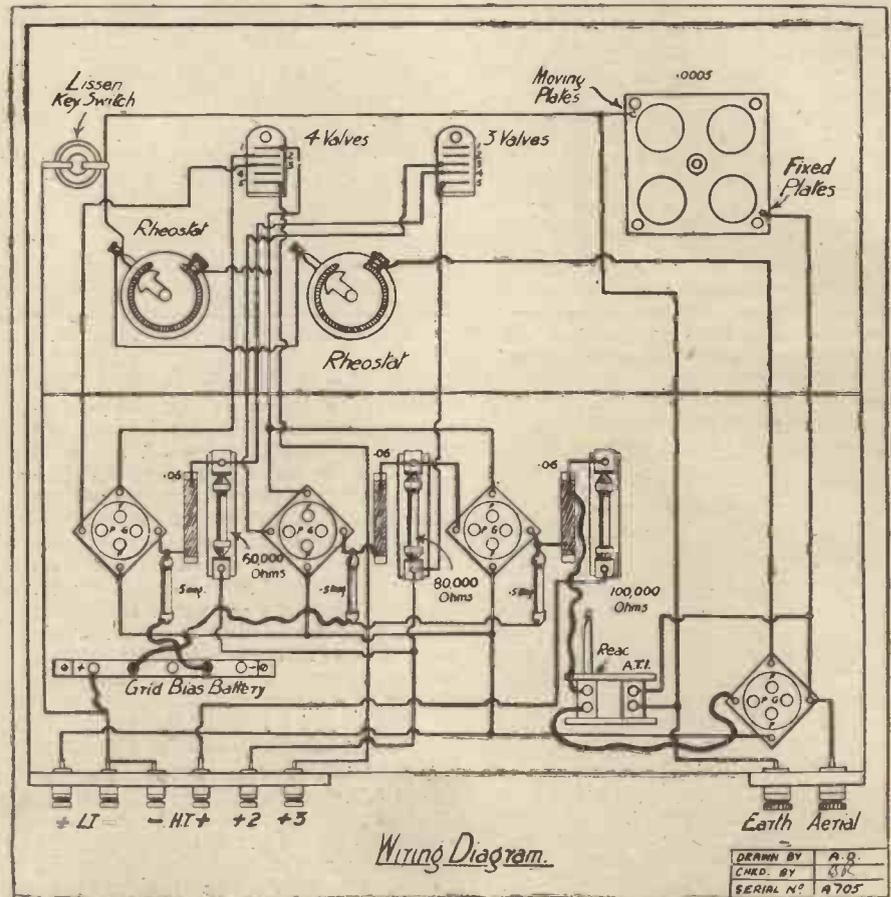
Easy to Handle.

For the local station either a 35 or 50 turn aerial coil should be O.K. with a reaction of 50 or 75 turns. For 5 X X a 150—200 aerial and 100 reaction should be sufficient.

The set will not operate successfully on a frame aerial, though it can be used with reduced signal strength on an indoor aerial if a good earth is available.

The handling is extremely simple, a variable condenser and reaction control providing the only two controls. The grid bias battery is left set once the correct bias is found, while once the best H.T. voltages for the various valves have been ascertained these also need no adjustment. The switch on the right of the panel provides a definite filament break, so that the receiver can be left ready for action and a movement of the switch will either turn it on or off.

Three H.T. + terminals are provided, and these should be connected to tappings on a 120 volt H.T. battery of large size cells. On test 15—40 volts were used for the detector anode voltage, 120 for the next two valves, and about 100—110 for the last valve.





Conducted by our Staff Consultant, J. H. T. ROBERTS, D.Sc., F.Inst.P.

Technical Notes

OF all the different components or parts of a wireless receiving set that offer scope for improvement, probably none offers more scope than the aerial. Great attention has been given to other parts of the system, but the aerial has been singularly neglected. It is true that there are very efficient outdoor aeri-als and that excellent results are sometimes obtained, in special circumstances, with indoor aeri-als and even with frame aeri-als. There have also been special forms of both outdoor and indoor aeri-als brought upon the market during the past year or two, and these, to my knowledge, have often proved very convenient in installation, and have, in general, come up to the claims made for them by their inventors or manufacturers.

But the fact remains that with the average receiving set not employing any H.F. amplification a good outdoor aerial is, if not essential, at any rate very desirable. An indoor aerial, or even a poor outdoor aerial, means a very great handicap from the start.

An Uncertain Factor.

Now, probably the installation of the aerial is the main inconvenience in the setting up of a wireless receiver, and certainly it is the most uncertain factor in estimating the cost. If anyone asks you how much it will cost for a set which will receive such-and-such distance, you can, without very much trouble, give him a fairly accurate estimate of the cost of the set, and when you know his requirements in the accessories, such as loud speaker, batteries, and so on, you can more or less decide the total outlay. But the aerial is a different matter. That depends upon where he lives, the nature of the surroundings, whether he has room for a good outdoor aerial, whether he prefers an indoor aerial, and so on.

What is Wanted.

Surely, then, it is time someone invented an aerial, of about the size and portability of the frame aerial, which will nevertheless have the same pick-up sensitivity as a good outdoor aerial.

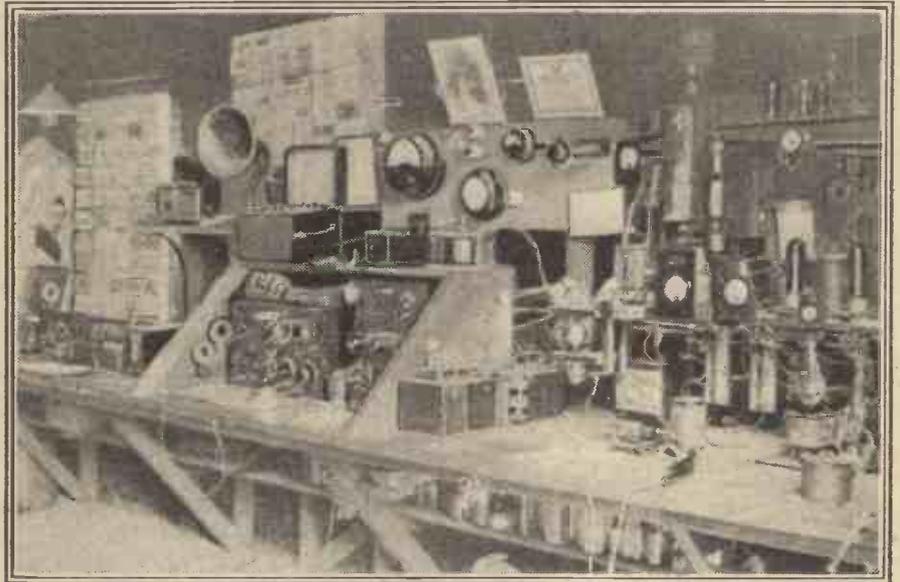
If this could be achieved it would give a tremendous impetus to the industry. For the bugbear of the aerial installation, with its expense and trouble, would be overcome at once. Moreover, the feature of complete portability would be one which would attract an immense number of people.

I am well aware that, according to the usual calculations and theories, it cannot be done. And although perhaps some of my readers might expect me to side with the theorists, that is to do me an injustice, for I believe in learning by experience, and experience has shown us that so many things have been done, especially in wireless, which seemed, according to theory, to

be impossible that it is best to keep an open mind. In the meantime, here is an excellent field for the inventor—a small portable aerial of the size of a frame aerial, which shall have the same pick-up sensitivity as a good outdoor aerial.

* * *

Whilst on this subject I should say that I occasionally receive inquiries as to the relative efficiency of earths and counterpoises. It is difficult to answer this question quite definitely, as a good deal depends upon the nature of the counterpoise or the earth. Speaking generally, however, a good earth



A section of the Australian amateur station, A2CM, which is controlled by Mr. MacLurcan.

is better than a counterpoise, and it is, of course, much simpler and cheaper to construct. For the greatest efficiency, the counterpoise should lie beneath the aerial (that is, if the aerial runs north from the down-lead, the counterpoise should not run south from the down-lead), and the counterpoise should, if possible, contain more wires than the aerial, and should be somewhat longer and should cover a greater area. Counterpoise aeri-als are useful for certain special purposes—which I have not the space to go into here—but for general broadcast reception purposes a good earth is to be preferred.

Safeguarding L.F. Transformer Windings.

A point in connection with the use and care of L.F. transformers that often is not sufficiently borne in mind by amateurs is the fact that a break in the windings can be caused by a sudden rush of current through the instrument. It should be remembered that the turns of the windings

may actually move when current is switched on; this is exemplified by the slight humming that is generally heard from a small-power transformer connected to the alternating-current mains. This humming is due to the vibratory motion of the iron laminations and partly also to the vibration of the wire in the coils. Of course, it goes without saying that the windings should be so constructed and treated that any appreciable motion is prevented. In transformers which are to be in use for very long periods (such as the step-down transformer of a trickle-charger) particular care must be paid to this point.

The so-called burn-out of an L.F. transformer is frequently, in point of fact, a mechanical break due to the too sudden application of current—shifting wander-plugs about with the L.T. current on will often account for it.

The proper thing to do when you wish to switch the H.T. current on or off (and changing the wander-plugs is the same thing) is first of all to switch off the filaments, and then to switch them on again when the change has been made. Owing to the fact that the filament takes a second

or two to light up, or to "go out," the sudden rush of current through the transformer windings is avoided by the expedient mentioned above.

Method of H.T. Adjustment.

I have a letter from a reader of these Notes describing what he evidently believes to be a novel device for regulating a soft valve.

The valve in question was used as detector in a three-valve set—H.F., Det, and L.F.—and, owing to the fact that exact regulation of H.T. voltage was not obtainable with the battery he was using, he introduced a non-inductive resistance, with a maximum value of 100 ohms, in the H.T. feed to the plate of the detector valve.

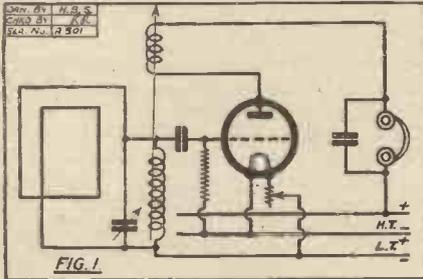
By adjusting the value of this resistance, critical adjustment of the H.T. voltage on the detector was obtained, and the best operating condition secured.

This method often proves useful where the battery used is not tapped.

THE Armstrong Super-Regenerative Circuit (which, by the way, is quite distinct from the Armstrong Super-Heterodyne) has always held a fascination for amateurs, on account of the almost incredible results that have been obtained with it. It should be pointed out, however, that it is a circuit which requires very skilful handling, and the amateur without much experience of valve receivers will probably be disappointed with the results he obtains from a home-made super set. On the other hand, ample scope for experi-

HARD CIRCUITS MADE EASY.

By C. E. FIELD, B.Sc.
The Armstrong Super-Regenerative
Circuit.



ment is presented, and, provided with a knowledge of the elementary theory, the experimenter will find the circuit well worth trying out.

In order to obtain a clear idea of the principle involved in the Armstrong Super, it is essential that we should understand what takes place when reaction is introduced into a valve circuit. Let us consider, then, the operation of a single-valve set in which a reaction coil is coupled to the grid, or aerial coil, as shown in Fig. 1, and assume that the set is receiving signals from a spark station. The signals consist of groups of waves, each of which dies away to zero in, let us say, a hundred cycles.

Effect of Reaction.

As soon as the reaction coil is coupled to that in the aerial circuit, energy is added to the incoming signals, with the result that the magnitude of the wave is increased, as is also the number of waves in each group, which may now be increased to two hundred. As the coupling is further tightened, so will the length of the wave-trains increase, until at length each train contains so many waves—perhaps a thousand—that the last

wave of one group is overlapping the first of the next group. Just before this occurs very loud signals are obtained, and it is at that point that an ordinary valve set should be operated to give the loudest results.

When the trains begin to overlap, however, a "plop" is heard in the headphones, and signals become distorted. The important fact to note is this. The tail-end of one group of waves adds to the beginning of the next group, which is thereby still further lengthened, and still further adds to the next one following, and so on. Hence the waves build up into a uniform stream after a few trains have been received.

Continuous Oscillations.

Now let us suppose that the reaction coupling is tightened still further. If a sufficient degree of reaction is introduced, when the first wave of a group falls on to the valve grid, so much energy is handed back from the plate circuit that the next wave is not merely only a little smaller than its predecessor, as in the cases just considered, but it is actually bigger, the next one being bigger still, and so on. In other words, if a single impulse is given to the valve grid, a continuous stream of waves will at once build up in the plate circuit to a value which is only limited by the carrying capacity of the valve.

In the ordinary way this is a hopeless state of affairs, but there is a very important point to be noted about this condition, upon which depends the operation of all super-regenerative receivers.

At any instant after the reception of the first impulse, the magnitude of the wave is proportional to the magnitude of this initial impulse. For example, after an interval of one thousandth of a second, the magnitude of the waves produced by the initial impulse of one volt will be twice as great as it would be if the initial impulse had been only half a volt.

Suppose, then, that we could suddenly stop the increasing wave-train just before its final steady value was attained, and allow it to start building up over again. We would get a series of wave-trains in which the oscillations increased in value (instead of dying away as in ordinary circuits), and the energy from each train would be proportional to that of the incoming signals. That is to say, we should obtain a reproduction of the received signals, amplified to an enormous extent. This is what is carried out in the Armstrong Super-Regenerative Circuits.

Amateurs who have experimented with ordinary valve circuits will know that a valve may be prevented from oscillating by the application of a positive

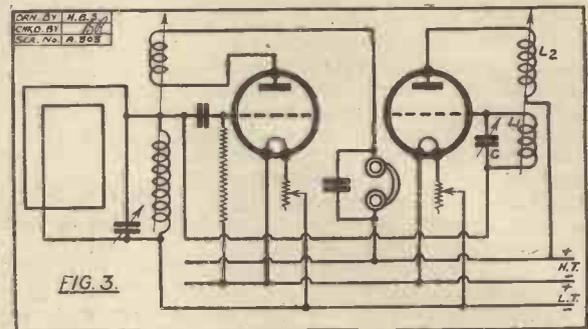
voltage (e.g. by means of a potentiometer, to the grid. If, therefore, we could apply a rapidly alternating voltage to the grid of our oscillating valve, we would alternately interrupt and stimulate the oscillation, and so bring about the effect we have just been discussing.

The most convenient way of producing a rapidly alternating voltage is by means of an oscillating valve. In Fig. 2 are shown the connections for a single-valve oscillator, the coil L_2 in the plate circuit transferring energy back into the grid circuit L_1 , and thus setting up continuous oscillations.

Action of the Quenching Coils.

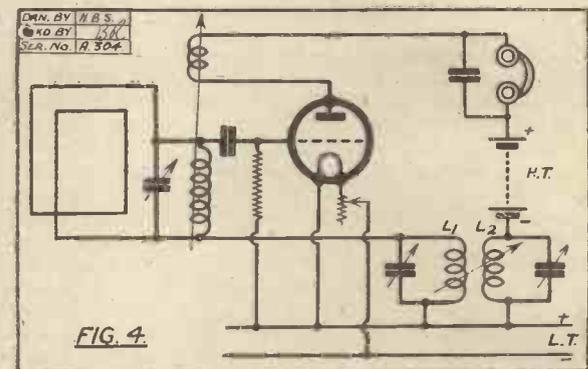
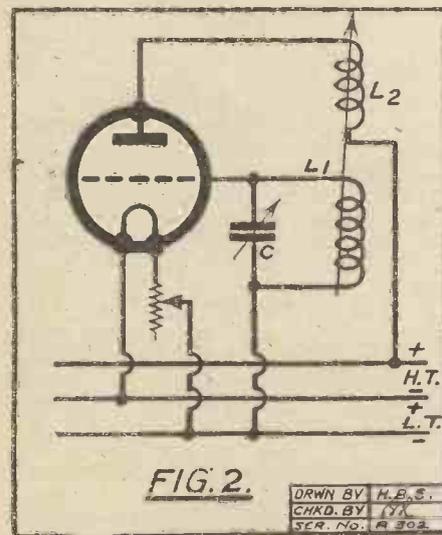
These are the oscillations which are to be employed for interrupting those in the valve shown in Fig. 1. We must therefore decide what is the most suitable frequency for these interruptions. If we choose a very low frequency the oscillations will have time to build up to a high value before they are cut short, and so loud signals will result. On the other hand, if the frequency is too low, a whistle will be heard in the telephones, which will not only be unpleasant, but which will give rise to distortion. The best value, therefore, is one just above the audible limit, 10,000 cycles per second being a suitable frequency. For this purpose the coils L_1, L_2 should be of the honey-comb type, wound with from 1,200 to 1,500 turns.

Assuming that we have the two valves shown in



Figs. 1 and 2 oscillating, all that remains to be done is to connect the two together in such a way that the oscillating grid circuit in Fig. 2 superimposes oscillations on the grid in Fig. 1. The bottom end of the coil L_1 , therefore, is connected to the grid of the valve in Fig. 1 instead of directly to the filament. The same batteries are employed for both valves, and the result is the two-valve Armstrong Super shown in Fig. 3. It will be noticed that the first valve is the detector, but the other one might equally well have been made to serve the purpose.

It is, of course, possible to use three valves—one oscillating, one detecting, and one interrupting. A more usual arrangement, however, consists in making one valve perform all the three functions. In this case the grid circuit must contain, in addition to the usual tuning coil, a 1,200-turn coil shunted by a condenser of large capacity, and the plate circuit must contain a similarly shunted 1,500-turn coil in addition to the usual reaction coil, the two large coils, L_1, L_2 , being variably coupled, as shown in Fig. 4. The



valve is thus caused to oscillate at high frequency, the oscillations being interrupted by the action of the long-wave coils.

The Armstrong Super Circuit should not be used on an outdoor aerial, not only because it will cause powerful radiations and interfere with reception in the neighbourhood, but also because the radiating properties of an open aerial damp the oscillations in the first valve, better results being obtained, therefore, with a small loop or frame aerial.

The circuit is most efficient on very short wave-lengths, but remarkable results can be obtained over the wave-length band covered by broadcasting.



CRYSTAL CHATS

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

(Staff Consultant).

No. IV. BORNITE.

OF all the more commonly employed crystals which are used in perikon detectors in combination with zincite, bornite is probably the one which has found the least favour with the amateur crystal user, firstly on account of the fact that it is not always easy to procure specimens of this mineral in a perfectly sensitive condition, and secondly because bornite, owing to its oxidisable nature, very often falls off in sensitivity after it has been in use for some time.

There are, however, some purposes for which bornite is extremely adaptable. For instance, workers in the realms of double-rectification crystal circuits will find a contact of zincite and bornite to give better results than any other crystal combination, some peculiarity in the properties of this particular contact enhancing the dual-rectification function of the circuit.

Not Very Stable.

For ordinary rectification, bornite is generally used with a crystal of zincite or synthetic zincite, although the mineral may very often be satisfactorily employed in contact with silicon, iron pyrites, molybdenite, ferro-silicon, and a number of other and rarer minerals.

Bornite, when used as a rectifier in conjunction with zincite, is rather more sensitive than a tellurium-zincite contact; but against this there is to be reckoned the fact that a bornite-zincite crystal combination is not always a very stable one. It needs to be adjusted with a considerable amount of care in order to derive the best results from it.

A bornite-zincite combination has a critical contact pressure. It is sensitive, also, to the disturbing influences of atmospheres; and, finally, the sensitivity of a bornite crystal often diminishes owing to the oxidation or tarnishing of its surface under the influence of atmospheric moisture.

A Change of Colour.

This latter property of bornite may be readily observed by the amateur. When a bornite crystal is freshly cut or broken, it generally possesses a bronze-brown or coppery-red colour. However, after exposure to the air the freshly-cut surfaces of the crystal soon take upon themselves a bluish-black colour, due to certain chemical changes which have taken place in the surface layers of the crystal.

A bornite-zincite combination often may be made to afford better results when it has a small local potential of about 5

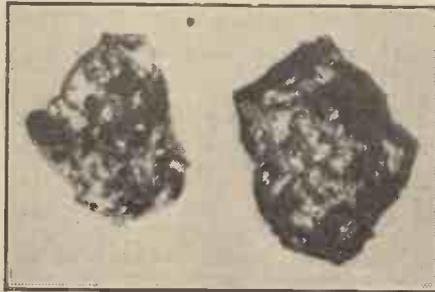
volt placed across it. This arrangement, of course, calls for the employment in the circuit of a single dry cell and a potentiometer.

Bornite is a hard mineral, but, at the same time, it is fairly brittle. Therefore care should be taken not to fracture the crystal when fixing it in the cup of the detector by means of clamping screws.

Its Chemical Composition.

The mineral should not be subjected to a high temperature, owing to the ease with which it oxidises. Wood's metal should, therefore, always be used when a metallic cement is required for the purpose of fixing the crystal in its cup.

In composition, bornite is a sulphide of copper and iron. Chemically speaking, it is a "double sulphide," its composition being represented by the formula $2\text{Cu}_2\text{S}\cdot\text{Cu}_2\text{S}_2\cdot 2\text{FeS}$. The mineral also goes under the



Typical specimens of Bornite crystal.

names of "variegated copper ore" and "erubescite."

Most of the bornite ore is derived from the shores of Lake Superior, in Michigan, although small quantities of the mineral have been found in Cornwall and among the copper deposits in Derbyshire.

Many forms of "copper glance" are very much akin to bornite in composition, but they are not radio-sensitive. Copper glance, however, is a very abundant ore, and it is the one from which most of the copper used in the electrical industry is obtained.

The impurities which are sometimes to be found in the commercially marketed radio-sensitive crystals of bornite are chiefly silica and copper oxide. Veins of silica are not infrequently found in the body of a bornite crystal, running from side to side of it.

Of course, under these circumstances, the crystal is found to be insensitive, for the internal layer of silica acts as an insulator and prevents any of the current

from passing through the crystal, even although it may have been efficiently rectified at the surface contact.

A Synthetic Substitute.

Bornite crystals which have become insensitive owing to oxidation effects can, in the majority of cases, be re-sensitised by dipping them in molten sulphur, and by subsequently dissolving off the layer of sulphur by immersing them in a bath of carbon disulphide. However, this treatment is troublesome and messy, and therefore it will not appeal to any but the most enthusiastic crystal users, especially as more permanently sensitive rectifying minerals are so easily obtainable.

Bornite, being a metallic sulphide, is soluble in mineral acids, but the treatment of the oxidised surface of a bornite crystal with acids will not restore the lost sensitivity of the mineral.

A synthetic substitute for bornite can be made by treating a copper alloy, such as copper bronze, with molten sulphur. A small fragment or rod of this material is dipped in a bath of molten sulphur and afterwards heated gently in order to remove the superfluous sulphur.

The resulting product will be found to rectify quite satisfactorily when used in contact with zincite. Its contact pressure will be far less critical, but, at the same time, its distance sensitivity will be inferior to that of a natural bornite crystal.

USEFUL DATA.

COMPOSITION.—Double sulphide of copper and iron, $2\text{Cu}_2\text{S}\cdot\text{Cu}_2\text{S}_2\cdot 2\text{FeS}$.

APPEARANCE.—Coppery-brown when freshly cut; iridescent bluish-black after standing.

CHARACTERISTICS.—Hard, but fairly brittle. Radio-sensitivity good, but sensitivity not always retained owing to the oxidisable nature of the crystal surface.

BEST CONTACT TO USE.—Zincite.

SOURCE OF MINERAL.—U.S.A.; also, in small quantities, Cornwall and Derbyshire.

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L. C.



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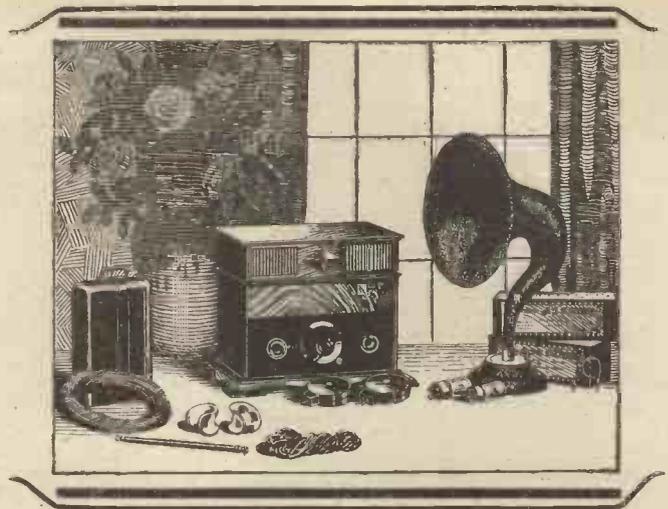
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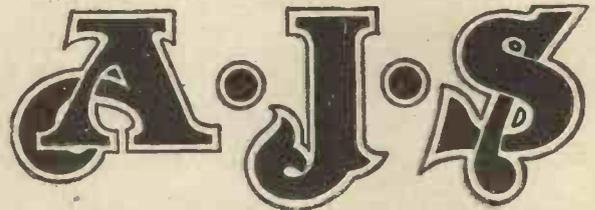
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B.P.S. 6

I HEAR the speeches to be relayed by 2 L O from the annual dinner of the Electrical Development Association on March 19th will contain some important new announcements concerning the progress of the Government's electricity schemes.

The B.B.C. has decided upon a special spring series of light orchestral programmes which will commence on April 11th, with Sir Landon Ronald as conductor. This is good news for listeners, many of whom feel that the B.B.C. could provide more programmes of this kind. In the past there has been too much emphasis on the special classical and symphony programmes. The great volume of reputable light music outside these categories has been somewhat neglected.

Future Broadcasts.

A surprise programme is being arranged for London and Daventry on April 13th. I have heard enough about this programme to induce me to enter it in my diary; but it would be wrong to spoil the mystery, so *verb. sap.*

April 14th is to be Brighton's day on the wireless. The Royal Marine Band will be relayed S.B. from Brighton on that evening, and there will also be features and talks about Brighton. This should do something to remove Brighton's sense of grievance that Bournemouth gets more than its due share of broadcast publicity because of the presence there of a main station. It would be a good plan for the B.B.C. to visit all the British seaside resorts in turn during the coming spring and summer seasons. British holiday resorts have not been getting the patronage they deserve. After the war this was partly their own fault in that their prices were exorbitant. But this has now been rectified, and, although they cannot hope to strike a parity with the French resorts charging at the favourable rates of exchange, they do give good value. The B.B.C. can get good programme material at nearly all British resorts, and it is only right and proper that the resorts should have their "boosts" attendant upon the broadcasting of their entertainments.

The Chenil Galleries are now the favourite venue for special musical programmes that require more echo resonance than can be provided by any of the studios at Savoy Hill. An "extra special" operatic programme will be given from there on April 16th, when it is hoped to secure the services of Riccardo Stracchiari for the occasion.

Mastering the Microphone.

Sir Harry Lauder's second broadcast has been voted even more successful than his first effort before Christmas. The great comedian has devoted a lot of thought to his new medium, and there is no doubt that he has mastered the secrets of the microphone in a manner quite unexcelled by any other artist so far. I hear that the B.B.C. is so impressed by the performance that new instructions for artistes have been prepared on the Lauder model.

The progressive interpretative classical recitals given early in the London programmes appear to be well received. There

BROADCAST NOTES

By O. H. M.

Future Broadcasts—Radio Drama
Scarcity—The Committee's Report
—An Important Factor—Satisfying
Public Demand.

is now to be a variation of this feature. Beginning on April 12th, there will be a regular ten minutes' poetry reading once a week. The idea is a good one, but I hope that the B.B.C. announcers do the reading. In this connection experiments in the past have usually been carried out by poets or outside critics. There is no doubt a certain degree of general interest in the actual personalities of the poets, but hardly any of them "get across the ether." It is much better for the readings to be done by a trained microphone voice that is also quite capable of adequate poetic interpretation.

Radio Drama Scarcity.

I hear the B.B.C. is somewhat exercised about the scarcity of good broadcast drama. The chief difficulty of course is that eminent playwrights cannot be adequately rewarded for broadcast drama. There is little chance of frequent repetition, and there is not enough money available to pay anything like the fees that could begin to compare with stage fees for successful work.

On the whole, I think the B.B.C. would be well advised to create a staff of dramatic adapters—skilled writers familiar with the medium, who would devote all their time to adapting existing material for broadcasting. No doubt there will ultimately grow up a school of distinctive radio dramatists, but for the present the best practical policy would be to take a leaf from the book of experience of the film-play. It would still be true to say of the film that it remains in its pioneering stage, and the vast majority of its successes represent adapted works. The field of literature abounds in material suitable for radio drama, but it needs "digging" and discriminating treatment. I would hazard the guess that in two years' time the B.B.C. will have a staff of at least six expert dramatic adapters.

The Committee's Report.

Readers of this page will have found little novelty in the report of the Broadcasting Committee. It has been extremely interesting to follow the tortuous course of these proposals during the past six months. What matters now is the drafting of the Statute which will be the permanent constitution. I have not had much success in my efforts to ascertain the private views of the B.B.C. chiefs, but if I read their minds aright they are a little disturbed about the possible

interpretation in the Statute of the functions of the Commissioners.

An Important Factor.

Something was said in the report about the Commissioners devoting energy, zeal, and time to their work in order that programmes would not come to be regarded as matters of mere routine. Nobody wants programmes to become matters of routine, or to lose their present excellent qualities of originality, enterprise, and novelty. But I have a sneaking feeling that these qualities will not be stimulated or encouraged by the constant intervention of an entirely fresh Board of Commissioners. This is a serious affair for listeners, who should watch its development in Parliament most carefully.

The point is that the correct function of the Commissioners should be to determine broad questions of policy. Once they transform themselves into a programme board, the results are bound to be disastrous. We shall have the logical application of excellent theories, a tendency mutually exclusive of good entertainment in the popular sense. Education and high-browism will become rampant, and there will be no wholesome deterrent.

This will never do, and I am sure the committee did not mean it; but the fact remains that there is ambiguity in the wording of the report on the subject. Freedom of action for the executive, flexibility, and responsiveness to public demand have been outstanding characteristics of the B.B.C., and have been largely responsible for its phenomenal success.

Satisfying Public Demand.

These must be retained at all costs, even at the risk of dispensing with some of the otherwise excellent theory and dignity of a logical constitution. There is one basic consideration that transcends all others in the practical sense.

So far there has been no reference to personalities in the discussion of the future constitution. The really important factor is the personal one, and it is that Mr. J. C. W. Reith, the present managing director, should be asked to continue with a free hand as at present as the real executive head of the permanent service. Mr. Reith is known to have made great personal sacrifices to stay on with broadcasting.

Within recent months he has turned down offers of jobs in big business which held out monetary attractions many times as great as he could ever possibly have in broadcasting. But he has held to his post, and there is no doubt whatever that the future of the service depends chiefly on his remaining in unfettered control. In leaving Mr. Reith a free hand the present board of directors displayed their sound common sense and their correct appreciation of genius.

NEXT WEEK.

MY THREE VALVER

By ARIEL.

Giving full constructional details of the set used by "P.W.'s" famous staff contributor.

ORDER YOUR COPY NOW.

A COPY of the report of the British Broadcasting Committee has now been published. It is an interesting little document of twenty-two pages and is published by H.M. Stationery Office at a price of 6d. nett. Readers can obtain a copy by writing to Adastral House, Kingsway, W.C. 2. Here is a brief summary of its recommendations:

1. That the Broadcasting Service should be conducted by a Public Corporation, acting as a trustee, and that the Corporation should be known as the British Broadcasting Commission. It is recommended that it should not consist of more than seven or less than five Commissioners, all nominated by the Crown. The first Commission is to hold office for five years. In the opinion of the Committee the Commissioners should be persons of judgment and experience, with business acumen and experience in affairs. The Commissioners should have the power to appoint Executive Commissioners, with a seat on the Board. The Commissioners should be adequately remunerated.

2. The Commissioners should appoint, in co-operation with proper societies, as many advisory committees as are necessary to carry on broadcasting in all its phases.

3. The entire property and undertaking of the B.B.C. as a going concern should be vested in the Commission on the 1st January, 1927.

4. That the P.M.G. should remain the licensing authority and be responsible for collecting the licence fees.

Little to Quibble at.

The Committee interpolates here a recommendation that the detection and prosecution of those who conceal their equipment may be vigorously pursued.

The fee of ten shillings for the licence should remain the same, but that all expenditure incurred by the P.M.G. in the execution of his work should be accounted as a first charge in the licence revenue, and after paying the Commissioners an income thoroughly adequate to enable them to ensure a full and efficient maintenance and development of the service, any surplus should be retained by the P.M.G. (Those last few words are, to our mind, the one thoroughly objectionable recommendation in the report; but we will refer to that later.)

5. The Commissioners of the new Broadcasting Company should be entitled to all the ordinary rights as regards the use of copyright material, whether in use or otherwise, and that it is unnecessary to invest them with any special privilege or preference.

6. That the claims of those listeners who desire a large proportion of educational matter, though relatively few in London, should be met, and to raise the standard of style and performance in every phase of broadcasting, particularly in music, and, further, that a moderate amount of controversial matter should be broadcast, provided the material is of high quality and distributed with scrupulous fairness, and that the discretion of the Commissioners in the choice of material should be upheld.

7. That licences should be granted to blind persons free of charge, and that the Commissioners should present an annual report to Parliament.

The above brief paragraphs will give our readers an indication of the main and general recommendations of the Broadcasting Committee of Inquiry.

CURRENT TOPICS.

By THE EDITOR.

The Report of the Broadcasting Committee—the Chief Recommendations—Surplus Licence Money—Changing the Staff at Savoy Hill.

On page 6 of the report the Committee elaborate the recommendation as follows:

"We attach the greatest importance to maintaining continuity between the old authority and the new; arrangements must be completed in good time, as it would be most unfortunate were there to be any dislocation of the service, or any withdrawal, even temporarily, of the programmes to which listeners have become attached and for which they have paid. The injury caused by any such interruption might be lasting."

This recommendation of the Committee will, we feel, meet with the approval of everyone, and also the recommendation that the Com-



Lady Asquith and Oxford adjusts the 'phones for a hospital patient.

missioners should be under an obligation to take over the existing staff of the B.B.C.

On the whole there is very little to quibble about in the Committee's report, with the exception of the recommendation that surplus licence money should go into the pockets of the Exchequer. Listeners are probably feeling just what motorists are feeling in connection with the Road Fund raid.

Surplus Money.

We have it on Mr. Reith's authority—and if there is anyone in this country who knows what he is talking about in connection with the broadcasting service, it is Mr. Reith—that the B.B.C. can do with an infinite amount of revenue, and if we think about it carefully we shall realise that broadcasting in its present stage is fully entitled to every penny it can legitimately earn.

If the Government adopt the Committee's recommendation that certain surplus moneys go to the Exchequer, it simply means that listeners, at some figure over the million mark, will be paying their ten-shilling

licence fee, not one penny of which will go to the B.B.C., but every penny of which will go into the Surplus Radio Fund. This is not good enough, and before this clause is adopted some organised effort should be made on behalf of listeners to voice a protest on behalf of the hundreds and thousands of listeners in this country who feel, and quite rightly, that when they pay ten shillings for a wireless licence that ten shillings should be (at least, in the main and with the exception of a small proportion, which rightly should go to the P.M.G. for out-of-pocket expenses in collecting licence fees, etc.) for the maintenance and improvement of British broadcasting.

The Question of Staff.

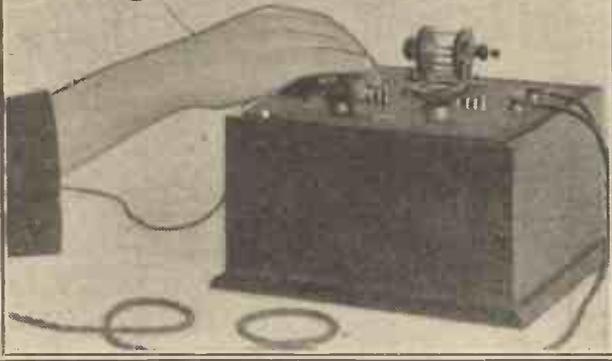
The recommendation that the new B.B.C. should take over the existing staff of the old B.B.C. is one that will meet with universal approval. We do not pretend to be omniscient in the matter of broadcasting; but we think that readers will agree that we are in close touch, and perhaps in closer touch than our readers, with the personnel of the B.B.C., and we have had opportunities of observing during the last three years (and, in fact, ever since the inception of the B.B.C.) the most constant enthusiasm among the members who constitute the staff of the B.B.C. Headed by Mr. J. C. W. Reith, they have, at times, under most galling criticism and most discouraging happenings, carried on with a fervour and with a sincerity which is deserving of the very highest praise. There is no red tape and Civil Service routine among the individual members of the B.B.C. There may be red tape and there may be routine among the B.B.C. as a whole, but a little reflection will show that that is inevitable with such an organisation, which has a multitude of multifarious duties to perform; but taken individually, both on the engineering side, on the business side, and on the programme side, it will be very difficult indeed for any new broadcasting authority in this country to gather

together such a band of devoted, intelligent and thoroughly resourceful workers. If the B.B.C. in its new form, play any monkey tricks with the responsible and experienced members of the B.B.C. as it is to-day, with the result that the listening public is dissatisfied with the programmes or technique of broadcasting in the future, the responsibility and onus will lie at the door of those who may yet think that they can eliminate certain staff members of the B.B.C. and replace them by other people.

But that is an unlikely contingency, and it is hardly possible that the Government will appoint an authority which will so blindly flout the recommendations of the Committee.

There is very little more to say about the Committee's report. It is concise and very much to the point, and, in fact, gives that comfortable feeling to the reader that it has been drawn up by men who have attacked the problem chiefly from the commonsense point of view.

The "P.W. Star" Crystal Set



The Set Designed and Described by **G. V. DOWDING, Grad. I.E.E.** (Technical Editor).
 Constructional Work by **G. V. COLLE** (Technical Staff).

THIS little receiver, suitable for reception of both 5 X X and the main and relay stations, introduces a very novel method of tuning. Four coils of carefully chosen values are employed, and the method of switching is such that they can be used singly or in a greatly varying number of combinations. Any one of the coils can be used singly, or any coil can be used in series with any other coil. Further, any coil can be used in parallel with any other coil. Again, single coils can be employed in series with other pairs paralleled.

How Tuning is Accomplished.

Therefore total inductance values can be selected which will be suitable for any one of a range of wave-lengths from 200 or so metres up to some 1,800 or so. And

all merely by operating two five-point switches; no additional loading coils whatever are required. Fig. 1 shows the theoretical circuit, and it will be agreed that it is decidedly unconventional. The four coils are shown radiating from a common centre. This centre point and the four free ends of the coils are taken to the two switches. Each of the five inductance coil terminations is represented on both switches, although it is very important indeed to note that the order of the connections is varied.

The aerial and earth and detector circuit connections are taken to the centre points or moving contacts of the switches. Thus it will be seen that the coil combinations are obtained by selecting first one coil termination on the one switch, and then another, or others, on the other switch. To bring coils in parallel the switch arm

must be made to rest on two studs at once, thus shorting two terminations. Now it will be clear why the order of switch connections is varied. As a matter of fact the wiring was carefully planned with a view to allowing as many parallel arrangements as possible, for it is these which supply the graduated intermediate values necessary for fine tuning. It is possible to short aerial to earth by placing the switches in certain positions.

Winding the Coils.

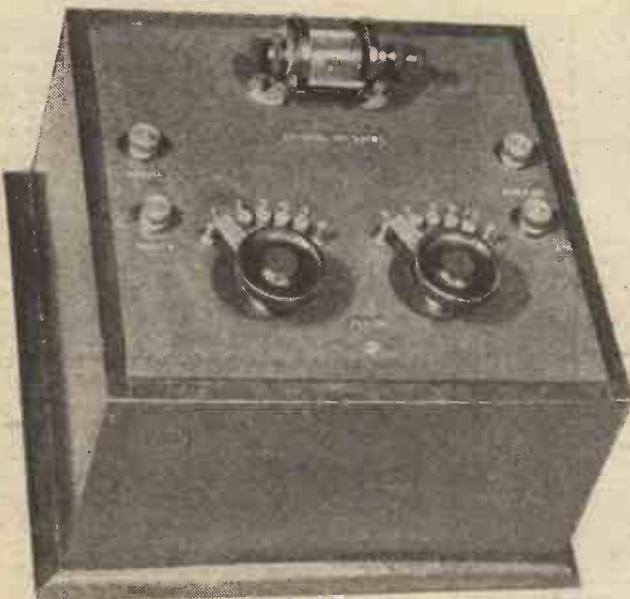
Rearrangements of particular combinations are possible, allowing the aerial or earth to be taken off at different ends. Not that such will cause great increases in signal strength, but the possessor of a "P.W." "Star" crystal set has the satisfaction of knowing that he can rearrange his inductance values or circuit connections simply by rotating switches, and thus obtain optimum efficiency with little or no trouble. The point worth particular notice is that although two combinations may be discovered which give almost identical wave-length tuning, one may include paralleled inductance and provide lower H.F. resistance, which would mean slightly louder signals. But we will have more to say about the handling of the receiver after we have described its construction.

The construction is not difficult. Constructors who are rather taken aback by the apparently intricate circuit need not fear that the wiring is difficult. Everything is quite straightforward, and providing the connections are made in accordance with the wiring diagram and point-to-point check list, nothing can go wrong.

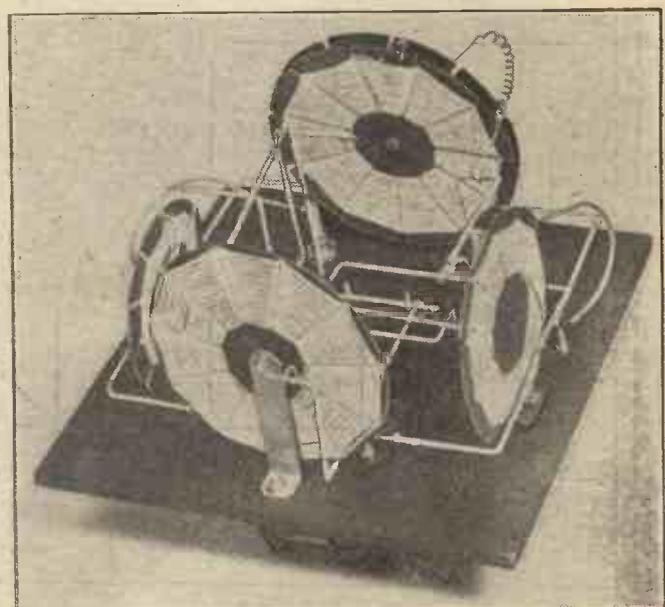
A list of materials and components required is appended. Most of the parts must be made or assembled by the constructor himself. The coils are the first consideration. For these, five spider coil formers of ordinary size are required. They should have eleven slots and centres of 1 1/4 in. diameter. The 21 and 34 turn coils should be wound with 26 S.W.G. and the 65 and 150 with 28 S.W.G. (D.C.C. in both cases). Note the numbers; these are

(Continued on next page.)

LIST OF COMPONENTS.		
1 Panel, 8 x 7 1/2 x 1/4 in. (Peto-Scott)	3	6
Cabinet to fit (Caxton)	6	9
1 Mic-Met Crystal Detector	4	6
2 Switch Arms (good quality)	2	0
10 Contact Studs	5	5
4 Stops	2	2
1 Set Spider-Web Coil Formers	1	3
1/2 lb. 26 S.W.G. D.C.C. Wire	1	2
1/2 lb. 28 S.W.G. D.C.C. Wire	1	5
4 W.O. Type Terminals	6	6
1 Packet 16 S.W.G. "Glazite"	1	0
1 Piece Brass Strip, Transfers, etc.	1	0



Two five-point switches provide tuning variations which cover both ordinary stations and 5 X X.

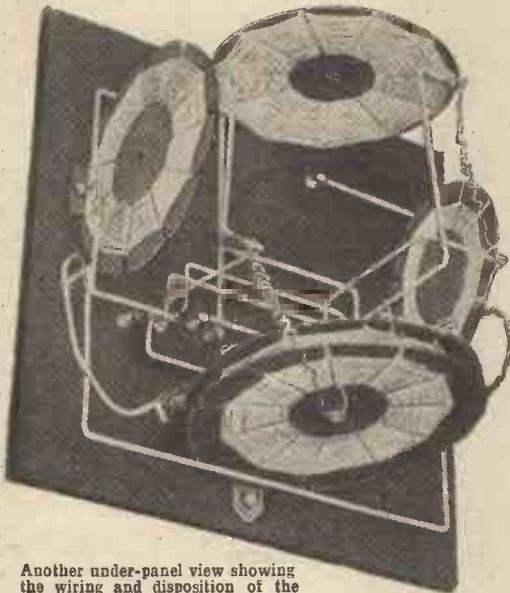


The coils are mounted in the form of a square as shown above.

THE P.W. "STAR" CRYSTAL SET.

(Continued from previous page.)

very important. The formers can be cut down after the coils are wound if desired, although it doesn't matter if they are not.



Another under-panel view showing the wiring and disposition of the various parts.

Now the 150 coil is really two coils, each of 75 turns, clamped together. These coils must be wound in opposite directions: one

clockwise and one anti-clockwise, and in this way they must be mounted with their two outside ends joined together and the centre ends left for external circuit connections.

Work can then commence on the panel. A panel drilling diagram is given, although a slight variation can be made if it is desired to employ a different type of crystal detector to that one specified. The drilling of the holes for the switch studs must be carried out very carefully indeed, for misalignment may cause faulty action of the switch. A compass or dividers can be used to centre accurately, while fairly deep centre punch "starters" should be made before drilling. See "For the Constructor" No. 8, under "Radiatorial" heading, for useful tips concerning ebonite working.

Before mounting terminals, detector or coils, the switch arms and studs should be fixed. The four end stops should be left until the switches are working smoothly. Remember, it is necessary to get the studs smoothed down by means of file and sand-

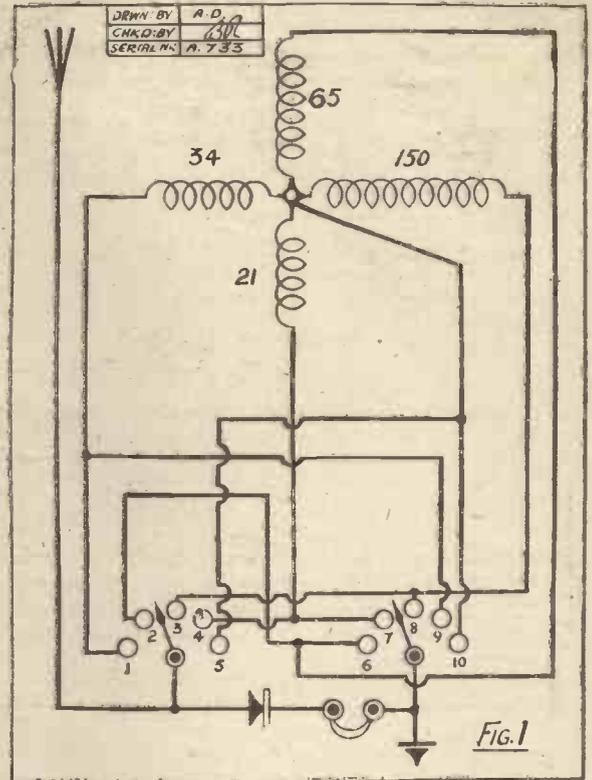


Fig. 1

paper until the moving contacts ride smoothly and make contact simultaneously with any two adjacent studs. When this condition is obtained satisfactorily, the stops can be mounted.

The Combinations Available.

The 21-turn coil is held in position beneath the panel by bending back one of its sections, or at least $\frac{1}{2}$ in. of it, piercing a hole through this and holding it with the aerial terminal, which thus serves a double purpose. Similarly the 34 coil is held by one of the 'phone terminals. Brass strips, about $2\frac{1}{2}$ in. x $\frac{1}{2}$ in., are required for fixing the other coils. Two such strips should be cut and holes drilled at their ends. Brackets are then formed by bending these strips, as shown in the photos, nuts and screws holding the coils in the centres to the brackets, and the brackets to the panel. One of these coils is, of course, really two coils clamped tightly together.

The crystal detector and remaining terminals can then be mounted. The wiring should be carried out with Glazite, and must be strictly in accordance with the wiring diagram. Connections to the switch arms should be made with short flexible leads, enough length being provided to allow for "play."

After this the set is finished except for panel transfers, and nothing remains for us but to say a few more words about the tuning. We will not deal with this in detail, as we feel most constructors will enjoy the experience of experimenting with the various combinations. Anyway, any one coil may be used singly by placing either the left-hand switch on No. 5, or the right-hand switch on No. 10, and the remaining switch on any one of the other four studs—i.e. 1, 2, 3, 4, or 6, 7, 8, 9. Optimum signals may result right away, but if not there are dozens of other arrangements available. To place

(Continued on page 163.)

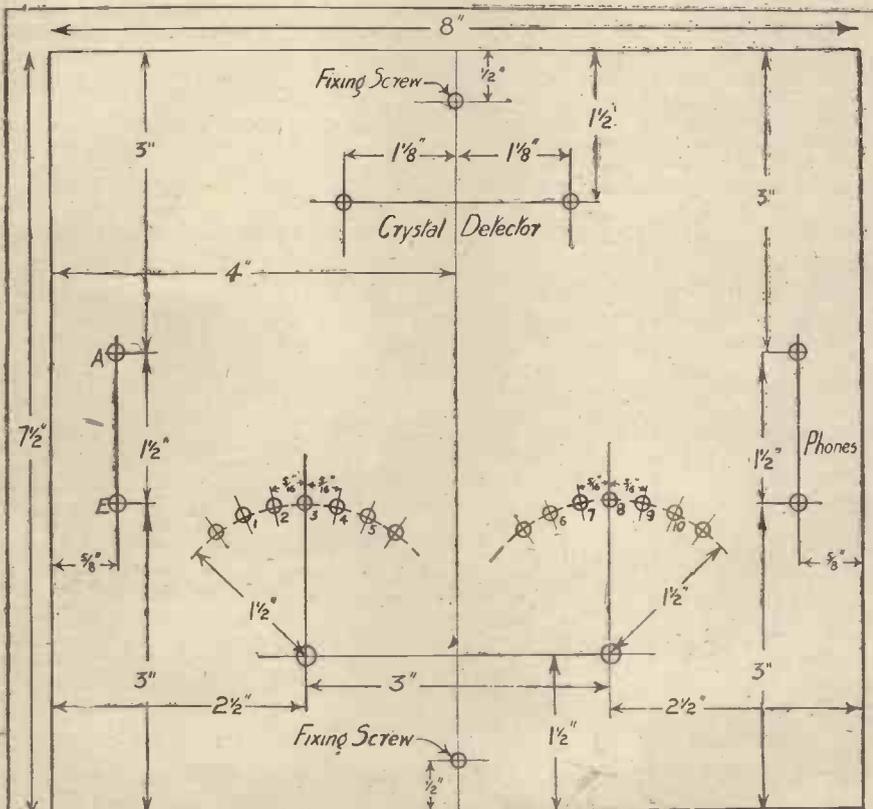
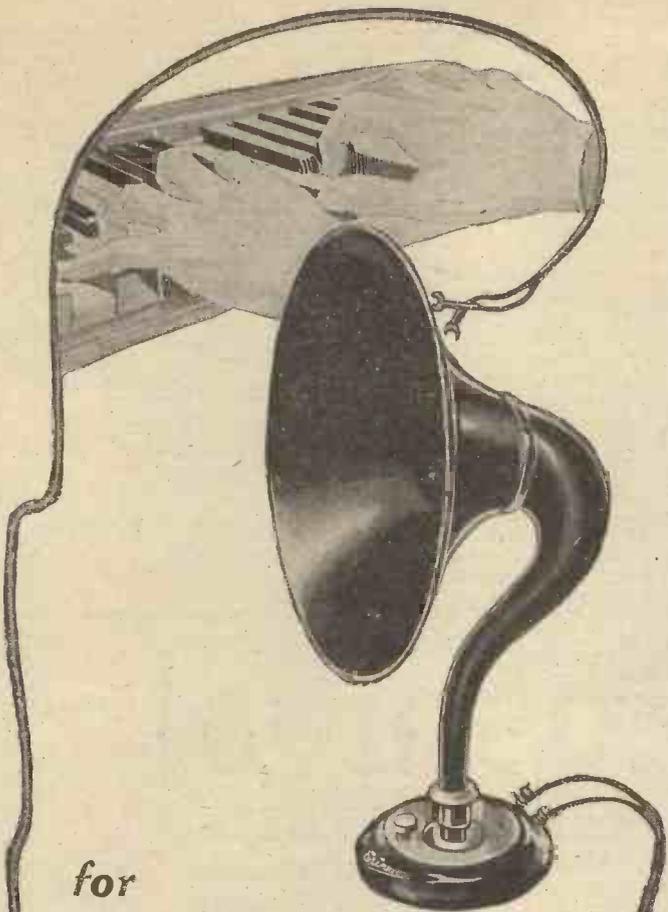


Fig. 2

Drilling Layout (Front of Panel)

DRAWN BY	A. D.
CHECKED BY	A. D.
SERIAL NO.	A. 735



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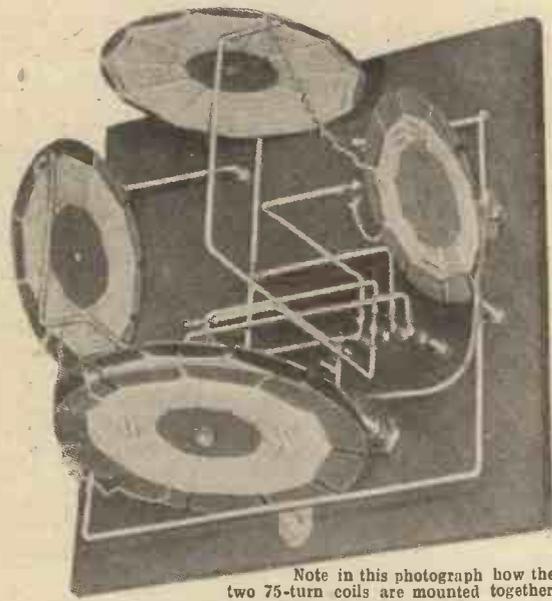
WONDERFUL LONDON

Buy PART 1 To-day 1s. 3d.

THE P.W. "STAR" CRYSTAL SET.

(Continued from page 160)

any one coil in series with any other one, bring one switch to any number except 5 or 10, and the other on some other number. Refer to diagram for orders of switching. A paralleled pair is obtained by placing one switch on 5 or 10 and the other on two studs simultaneously, the range being available by alternately varying the functions of the switches. Series-parallel combinations are made by taking any stud on either switch, except 5 or 10, and shorting



Note in this photograph how the two 75-turn coils are mounted together forming in effect one large coil.

two studs on the other switch and alternating as before. Finally, placing switches to 5 and 10 shorts aerial to earth. It looks all very involved and complicated

POINT-TO-POINT CONNECTIONS.

Aerial terminal to one side of crystal detector, also to first switch arm; other side of crystal detector to one 'phone terminal.

Earth terminal to other 'phone terminal and to second switch arm.

One side of each of the four coils are joined together and taken to studs 5 and 10.

Other side of 21-turn coil to studs 4 and 7.

Other side of 34-turn coil to studs 1 and 9.

Other side of 65-turn coil to studs 2 and 6.

Other side of 150-turn coil to studs 3 and 8.

on paper, but actually it is a very simple procedure. Haphazardly twiddling the switches without any system whatever invariably brings in the local station and 5 X X with excellent strength. But it is very fascinating to work out the order of variations. It should be remembered that the effect of placing two coils in parallel is to obtain the equal to a coil slightly smaller than the smaller coil. For instance, a coil of 21 turns in parallel with one of 34 turns gives the inductance of a coil of 15 or 16 turns. When coils are in series the effect is of a coil equal in size to both coils added together, thus the 65 in series with the 150 equals a coil of about 215 turns, and so on.

But as we mentioned before, constructors need not worry too much about this if they are not interested. Signals will come in easily enough without studying the operation of the receiver closely, and strength and purity will be all that can be desired of an efficient crystal set.

The adaptability of the receiver is its main feature it must be remembered. It is the sort of set that will operate well on varying kinds of aerial. It will provide signals louder than most crystal sets in many cases, but we do not claim that it is a "loud-speaker crystal set." Excellent ranges of reception have been accomplished although here again we consider it polite to be reserved in our claims.

In that 5 X X is obtainable without additional switching or loading the set should be considered an attractive proposition.

We will not be surprised if many readers obtain exceptional results, in fact, we will go so far as to say we anticipate that this will eventuate.

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.

MORE PRAISE FOR "CHITOS."

The Editor, POPULAR WIRELESS.
Dear Sir,—I should like to add another one to the list of your readers who have thanked you for your "Chitos 2."

Although some little perseverance is required to tune it, I think the result is well worth the trouble, as I have been able to log the following stations:

Kiel, Brussels, Bremen, Hanover, Madrid, Manchester, Bournemouth, Dublin, Hamburg, Newcastle, Münster, Breslau, Glasgow, Rome, Stockholm (?), Radio-Berne, Belfast, Radio-Toulouse, Stuttgart, Leipzig, P.T.T., Frankfurt, Birmingham, Munich, Aberdeen, Berlin (505), Croydon, Hilversum, Königs-, wusterhausen, Daventry, and Radio-Paris.

It might interest some of your readers to know that I have put on a wave-trap which enables me to cut out 2 L O and tune in Manchester, Bournemouth, etc.

My aerial is 50 ft. twin, 22 ft. high.
Thanking you once more.

Yours faithfully,
NORMAN E. D. GODSMARK.
90, Woodbine Grove,
Penge, S.E.

MORE "UNIDYNE" RESULTS.

The Editor, POPULAR WIRELESS.
Dear Sir,—Having read from time to time of one-valve "Unidyne" results, I thought my own might prove interesting. I find that by putting a .003 fixed condenser across the 'phones a great increase in volume and range results.

I have logged all B.B.C. stations with the exception of Edinburgh, Hull, and Plymouth, and the following foreigners: Dublin, Radio-Toulouse, Hamburg, Munich, Stuttgart, Berne, Brussels, Rome, San Sebastian, Münster, and several others whose call-signs I have not been able to understand. Most of these came in at excellent 'phone strength, particularly Dublin, Toulouse, Hamburg, Berne, and San Sebastian.

My only trouble is hand capacity effects, but I hope to eliminate this eventually. This is my first attempt at making a valvo set.

Yours faithfully,
JOHN J. CARTER.
Lubenham, Market Harboro',
Leicestershire.

THE 2-VALVE TRINADYNE.

The Editor, POPULAR WIRELESS.
Dear Sir,—As an ardent reader of POPULAR WIRELESS, I wish to thank you for publishing such a fine set as described in your paper on December 19th, 1925, namely "A Two-valve Trinadyne Receiver." I have been watching to see if any constructor would report on this circuit, and not seeing any I thought, whilst listening to mine, that I must write and let you know what a splendid set this is. Being only quite a novice at wireless I built this receiver exactly as described. I cannot say I have received any foreign stations as I am quite satisfied with 2 L O. Results being both loud and clear, and the set silent in working. A friend of mine, an owner of a five-valve set, says it is the finest he has heard. So the best of luck and congratulations to "P.W." and all its staff.

W. H. BEAVEN.
54, Mayfield Avenue,
West Ealing, W.13.

TRANSATLANTIC TELEPHONY TESTS.

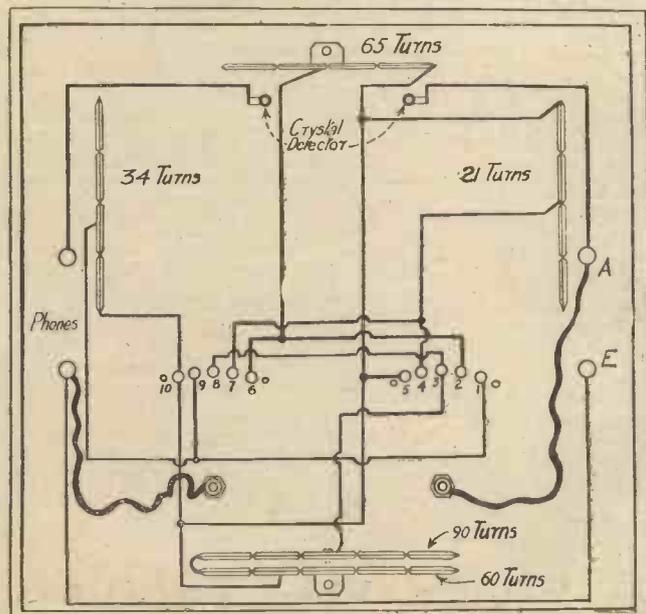
The Editor POPULAR WIRELESS.
Dear Sir,—Re "Rugby's Chat with America" in a recent "P.W." I should like to hear readers results. At 2 p.m. one day I plugged in the nearest coils available—e.g., 1,250 in the aerial, and 1,500 in anode of 4-valve straight 1-V-2.

H.F. valve, D.E.5B, 30 volts on plate; Det. valve, D.E.5, 72 volts on plate; 1st L.F. valve, D.E.5, 102 volts on plate, G.B. 44 volts; 2nd L.F. valve, D.E.5A, 108 volts on plate, G.B. 21 volts; loud speaker, C.A.V. standard.

Rugby was soon picked up, but it was quite obvious that coils were not correct, but they were the nearest at hand.

Results: New York with above coils was almost as strong as Rugby, and it is a peculiar fact that when New York gave the name of the speaker it was clear at once, whereas Rugby was noticed to ask for the name again as they had not got it clear. One other point noted was, that of the speakers from New York, it would seem that those who speak from the throat are heard much more distinctly than those who seem to speak from the lips.

Yours faithfully,
G. BORNER.
207, Shortlands Road,
Sittingbourne, Kent.



DRAWN BY: F.S.O.
CHKD. BY: S.H.
SER. NO. A 734

WIDESPREAD interest has been created in the United States by the announcement there of a contest for the design of an efficient short-wave receiver, and the prizes to be distributed among the successful entrants total \$500 (over a hundred pounds). The contest, which is being sponsored by "Radio Broadcast Magazine" and the National Carbon Company (manufacturers of Eveready batteries) under a co-operative plan, was originally scheduled to close on March 1st, 1926. Various suggestions which have been acted upon, have caused the closing date to be advanced to April 1st, by which date all competitors in the United States must have submitted a complete descriptive manuscript, etc., of the receiver they wish to enter.

The writer, by special arrangement with the officials of the contest, has been successful in having a special plan agreed upon whereby those in Europe interested in contesting, providing they are POPULAR WIRELESS readers, are granted special privileges as regards the closing date. This plan is as follows: POPULAR WIRELESS readers' sets will be considered providing they are shipped from Europe on or before April 1st. Intending competitors are required to fill up the accompanying coupon and send it to the headquarters of the contest immediately, so that it will reach the offices of "Radio Broadcast Magazine" by April 1st. The coupon is merely an intimation that the signatory will submit for consideration a short-wave receiver of the required specifications on or before April 1st—that is, to leave Europe on or before April 1st.

Salient Features.

Steps will be taken at the American end to smooth out any possible difficulty with the Customs when the receivers arrive at New York, and no delay is anticipated in this respect. It is felt by the judges that by making the competition one of international aspect, its value will be considerably enhanced, and competition will naturally be much more keen than if it was merely a national affair.

"One of the interesting things which the contest has brought forward is the fact that up to this time there has been little or no novelty in the design and construction of short-wave receivers," says Edgar H. Felix, who is one of the judges. "The conventional types have given satisfactory results and, consequently, prior to this contest, the stimulation to designing better receivers has been lacking.

"According to present indications, among the contenders for the prize money will be super-heterodynes, regenerative neutro-dynes, and even the much-neglected super-regenerative receiver. Certainly something worth while should be brought forward. In practice, however (this applies to America), Reinartz receivers are being used almost to the exclusion of other types. Attention is called to the basis of points upon which the prize is to be awarded. Contestants should observe that a paramount requirement is that the receiver shall be adapted by its design and construction to practical amateur relaying. The only circuit limitation imposed is that radiation be reduced to a minimum. Otherwise, any type of receiver which will function with the utmost sensitiveness, stability and reliability is eligible for consideration.

"Hence, study the receiver which you

A
**SHORT - WAVE
RECEIVER
COMPETITION**
Over £100 in Prizes
A Chance for British Amateurs.
By L. W. CORBETT.
(Our New York Correspondent).

submit from the standpoint of every factor contributing to the schedule of points. If it is weak in any particular respect, give the matter careful study. With these high frequencies, a slight change in the position of a coil, the substitution of a capacity or resistance of a different value, or, in fact, any minor adjustment may make a marked difference in performance."

D.X. Telephony Reception.

Interest in short-wave reception seems to have advanced exceedingly rapidly in England and other European countries during the last year or so, and the judges in the competition fully expect to have a hard job in deciding whether to award the first prize to a European or an American made set. A year or so ago, perhaps, the European would not have been considered as a serious competitor, but now the reverse is the case. Short-wave DX feats are just as common in England, for example, as they are in the States—probably more so. Such notable feats as those of Mr. Gerald Marcuse and Mr. Simmonds, to mention only two offhand, are envied by quite a few "hams" in America. The writer has had the pleasure of listening to Mr. Marcuse talking to a Newfoundland amateur on 'phone. In this instance, I listened to Mr. Marcuse's cheery voice, probably seeming to the listener twice as cheery as it really was (if that were possible), for it was a voice from "Blighty," from a point located on Long Island about twenty-five miles out of New York City. Audibility was about R2—fluctuating.

How Marks Are Awarded.

To get back to the issue in hand, though. As mentioned above, all sets entered in the short-wave competition must be shipped from Europe to bear a postmark of not later than April 1st. This should give intending competitors about ten days from the time this announcement appears to get the sets they wish to enter into shape. All sets submitted will, of course, be returned prepaid. The writer will be responsible for this. The necessity for careful packing cannot be over-emphasised. Remember, your sets will have to travel nearly three thousand miles over, perhaps, the roughest of seas. Another point. Note that one of the stipulations is that all receivers must be constructed with standard parts. In this instance, the writer would suggest that valve holders capable of taking American valves should be used. I have seen such valve holders, of the low-loss type, advertised in POPULAR WIRELESS. The actual receptacles for the valve legs are mounted

on the end of short springs, if I remember correctly, and are therefore adaptable to any four-prong valves. The basis of points in the contest is as follows:

Workmanship	15
Simplicity of handling	20
Ease of calibration	
Freedom from hand capacity	
Independence of tuning and re-generation	
Low cost	10
Use of standard or easily constructed parts	5
Performance	25
Overall amplification of signals	
Use in relaying	
Ability to use break-in	
Ability to cover all amateur bands	
Appearance	15
Method of avoiding radiation	10
Total	100

Much comment has resulted from the insistence on the non-radiating feature. Certainly, the sponsors are aware that there are differences between continuous-wave reception and broadcast reception. The enjoyment of a broadcast entertainment can be completely ruined by a nearby radiating receiver, but continuous-wave reception is not necessarily impossible within range of a radiating receiver. Continuous-wave reception is not the only thing to consider, however. Short waves are also used for re-broadcasting purposes in America, and for supplying programmes to broadcasting stations from remote points. A few hundred radiating receivers on short wave-lengths, used for re-broadcasting purposes, would be sufficient to make these short-wave radio telephone links practically inoperative.

THE CONTEST.

OBJECT.—The object of this contest is to aid in the development of improved short-wave receiving apparatus, so that the possibilities of higher frequencies may be more effectively studied.

PRIZES.—First prize, \$250; Second prize, \$150; Third prize, \$100. Only one prize to a contestant.

ELIGIBILITY.—Anyone interested in short-wave reception is eligible to compete, though no prizes will be given to manufacturers making short-wave receivers or parts therefor.

CONDITIONS.—Each contestant must submit a complete receiver, which receiver should be adapted to the entire short-wave band from 8,586 to 1,999 kc., although this may be accomplished by interchangeable coils.

Arrangements have been made whereby the winning receiver, whether European, American, or Australian, etc., will be fully described in POPULAR WIRELESS. The decision to choose POPULAR WIRELESS to co-operate in announcing this contest was arrived at as a result of the whole-hearted and enthusiastic support that this magazine has given to matters pertaining to short-wave advancement. It is felt that the excellent short-wave articles which appear in these pages from time to time are doing more than anything else in European countries to encourage the embryonic short-wave enthusiast. The borrowed slogan, "Eventually, Why Not Now?" seems especially befitting the policy of the magazine. Now, then, POPULAR WIRELESS readers, look to your laurels!

It is not necessary to submit a constructional article with the set. A covering letter giving a few details of its circuits, capabilities, etc., and the full name and address of the competitor is all that is required.

THE S.W. CONTEST COUPON

This is to intimate my intention of entering the Radio Broadcast Eveready Short-wave contest. I will submit my set before April 1st, on the understanding that it will be returned. I am a POPULAR WIRELESS reader.

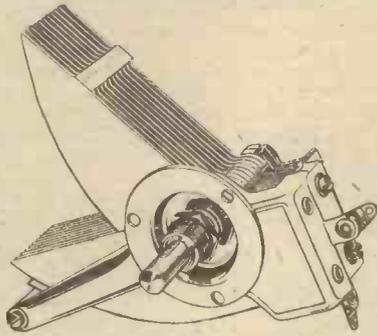
NAME

ADDRESS

To Keith Henney,
Director, Radio Broadcast Laboratories,
Garden City, Long Island,
New York, U.S.A.

The True Straight Line Frequency Variable Condenser

is the IGRANIC-PACENT



A high-grade variable condenser with low-loss characteristics, a true straight line frequency curve and negligible minimum capacity. Fixed and moving plates are of brass, riveted together and soldered, ensuring permanent alignment and sound electrical connection. Rigid channel-shaped framework in continuous electrical connection with moving plates prevents hand-capacity effects. Only two small pieces of highest quality insulating material are used, so arranged that the absorption losses are negligible. Dust-proof bearings result in smooth, silky movement. Positive stops at minimum and maximum are contained within the bearing. Single or three-hole fixing is provided for. Two condensers can be mounted to form a dual with single dial control.

PRICES: .00035 mfd. - 14/6 .0005 mfd. - 18/6

All reputable dealers stock them. Write for List P 60.

Exclusive Manufacturing Licensees of



PACENT Radio Essentials

149, Queen Victoria Street, LONDON.

Works: BEDFORD.

Figures to Remember



The Sweep

He went about with his long-handled brushes crying "Sweep, Sweep!" and he made all the difference to your fire. **SIX SIXTY VALVES** make all the difference to your set; they hold a potential store of volume at your bidding, while they ensure perfect quality of tone. The secret of this wonderful difference is to be found in the extensive research and perfect workmanship expended on each particular valve.

Not only has this research been the means of ensuring a wonderful purity of tone and increased power, but due to our success in considerably reducing filament temperatures, the life of 660 Valves has been immeasurably increased. Every valve of our new range is specially designed to carry out its particular job; they are all stamped with the Six Sixty mark of PERFECTION OF QUALITY.

If you want a general purpose valve you have the S.S.1. This valve can be used in any position in a set, either as Detector, H.F. Amplifier or L.F. Amplifier—a useful valve as a spare. Although a bright valve, its current consumption is only .66 amps, a figure which compares very favourably with the average Bright emitter to-day.

For Dull Emitters you have the rest of the Six Sixty range to choose from. The S.S.4 is a power amplifier designed to operate the largest types of Loud Speakers, giving remarkably pure reproduction.



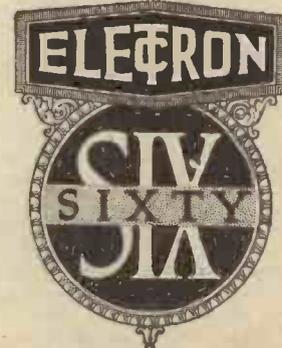
S.S.1

Bright Emitter General Purpose Valve.

Voltage - - - 3.7 volts.
Consumption .66 amps.

PRICE 8/-

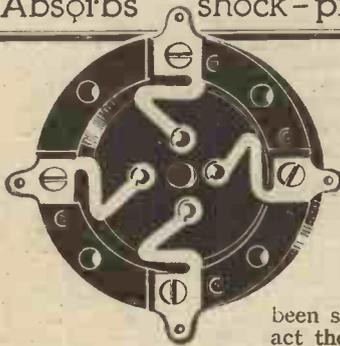
Ask your Dealer for Leaflet S.S.1.7 for full particulars of complete range



BETTER BY SIX TIMES SIXTY

The Electron Co., Ltd., Triumph House, 189, Regent Street, London, W.1.

Absorbs shock - protects the valves



You know it's good because of the name 'LOTUS'

Don't have your valves spoiled by shock. The Lotus Valve Holder has been specially designed to counteract the microphonic elements that are so injurious to the delicate valve filaments.

The unique and original springs of the Lotus Valve Holder absorb any shock and eliminate all microphonic noises. Protect YOUR valves by fitting the Lotus Holder.



From all Reliable Radio Dealers.
GARNETT, WHITELEY & Co. Ltd.,
Broadgreen Road, Liverpool.
Makers of the famous LOTUS Coil Holder.

Valve sockets and springs are locked together by a mechanical process, making a definite and permanent connection. Bakelite mouldings, nickel silver springs and phosphor bronze valve sockets Nickel plated

2/3
With Terminals

and now Real Economy!

How long do your accumulators last? Would you like to get twice or thrice the life out of them? By using the new all British Lustrolux Valves—you can have a 2-valve set using 12 amps. only, or a 3-valve set consuming 46 amps for loud-speaker results. The Lustrolux Economical Combination consists of 2 volt .06 amp. H.F. and L.F. with 2 volt .34 amps. P.V., and is the most economical set of valves for any circuit.

If your accumulator is 4 or 6 volt then parallel it up and get the full benefit of each charge. You should have no voltage loss on resistances or rheostats and the quality of your reception will be purer and clearer.

Price List :

2 volt, .06 amp.	9/-
Type 206 H.F.	
2 volt, .06 amp.	9/-
Type 206 L.F.	
2 volt, .34 amp.	11/-
Type 234 P.V.	
2 volt, .34 amp.	9/-
Type 234 H.F.	
2 volt, .34 amp.	9/-
Type 234 L.F.	

The H.F. is noted for its selectivity and long range, and the L.F. for its volume of clear and distortionless reproduction.

Lustrolux Valves are the product of deep and keen research. Highly efficient organization and scientific methods of manufacture enable us to market these Valves at the low prices shown.



The Better British Valve

Send for Catalogue "A."

Agents wanted everywhere. Showcards and literature free for the asking.

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The Topical Illustrated Sports Weekly

ALL SPORTS is the paper for all who love sport for sport's sake or for those who specialise in Boxing, Football, Tennis, Racing, Hockey, etc.

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ALL SPORTS

Every Thursday - - 2d.

Build the "Resistapure" described in this issue.

If you decide to build the excellent "Resistapure" Loud Speaker set described in this issue, it is not necessary to get the parts from several shops or manufacturers. You can get them all from us ready to mount on the panel—and if required the panel can also be supplied ready drilled and engraved. Take advantage of this service to-day.

List of Parts

1 Peto-Scott S.L.F. Condenser, .0005 mfd.	15 0
1 2-way Coil Holder (roller pattern with long handle)	5 6
2 Peto-Scott 30 ohms Rheostats	6 0
4 Benjamin Anti-interphone Valve Holders	11 0
2 Igranic Patent 5-spring Automatic Jack (No. 69)	8 0
1 Igranic Autoplug (No. 60)	2 6
3 Mullard Wire Wound Resistances, 100,000, 80,000, 60,000 respectively	16 6
1 Igranic Key Switch	3 0
1 Hellesen 9v. Tapped Grid Battery	2 9
2 Terminal Strips, drilled and engraved	3 6
3 T.C.C. Fixed Condensers, .06 mfd.	7 0
3 Dubilier .5 meg. Grid Leaks	7 6
8 Mark III Terminals	1 4
12 2 ft. lengths Square Tinned Copper Wire, Flex, Screws, etc.	1 6
1 Pilot Panel, 18 x 8 x 1/2, drilled and engraved	£4 11 1
1 Polished Mahogany Cabinet, with Baseboard	17 0
	1 10 0

Parts for "Star" Crystal Set (described in this issue).

2 Rotary Switches (1 1/2" radius)	2 0
10 Contact Studs	5 4
4 Stops	4 4
1 Peto-Scott Crystal	1 6
1 Mic-Met Detector	4 6
4 Basket Coils (ready wound)	8 0
2 Brass Strips (for supporting above coils)	6

3d. POST FREE

A copy of the 56-page Pilot Manual will be sent to all who send 3d. in stamps to cover postage. Send also for new 48-page Catalogue of Components.

1 Coil "Glazite Wire," Flex, Screws, Transfer, etc.	2 0
4 Mark III Terminals	8
1 Ebonite Panel, 7 1/2 x 8 x 3/16"	3 3
1 Cabinet, approx. 4 1/2" deep	4 6
	£1 7 8

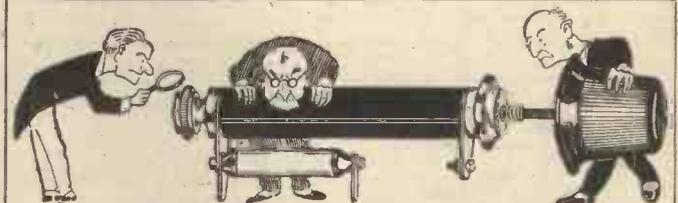
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Head Office, Mail Order and Showrooms: 77, CITY RD., LONDON, E.C.1. Branches—62, High Holborn, London, W.C.1. Walthamstow: 230, Wood Street, Plymouth: 4, Bank of England Place. Liverpool: 4, Manchester Street.

When a complete set of parts is repurchased at the same time as the panel a Marconi Royalty of 12/6 per valve-holder must be returned with order.

PILOT SERVICE ENSURES SATISFACTION

P.S. 4865.

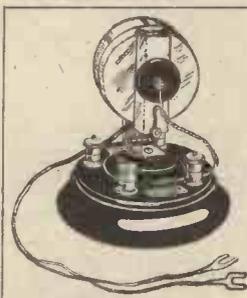


Bretwood Grid Leaks

Price bear inspection and stand constant use. They are guaranteed to give efficient performance for a period of three years. Price

3/- GRID LEAK OR ANODE RESISTANCE 3/-

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NO Valves Accumulators H.T. Batteries

The **MAGNETIC MICROPHONE BAR AMPLIFIER**

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A Boon to Deaf Persons.

Also supplied in separate parts. Further particulars 1d. stamp. Order from your dealer or direct from Sole Manufacturers and Patentees.

NEW WILSON ELECTRICAL MANUFACTURING Co. Ltd. 18, Fitzroy St., Euston Rd., London, W.1. Phone: Museum 2703.

IS YOUR AERIAL SAFE ?

By A MASTER MARINER.

I HAVE been so repeatedly asked by my radio friends, both amateur and professional, "Please show me how to splice this!" that I have decided to write a short article on the subject. The simple knots and splices described here have been tested on shipboard from time immemorial, and readers may be sure, that if these directions are followed, the result will be a

the accuracy of your work, no two strands should come out in the same place.

For the second row, tuck each strand over the one next to it, and under the following one; in other words, over one and under one, always against the lay of the rope. Do this with all three strands, and again verify your work as before. Two rows of tucks are ample, so cut off the loose ends, and the job is finished.

It often happens that a guy carries away, and it is required to join the ends together again. The short-splice is the one to use in this case, and is very simple. First, cut off about six inches on either side of the break to get rid of the weak parts. Open out the strands on each end for about three inches, and clutch the two sets of strands together, just as you interlace the fingers of one hand with the fingers of the other (Fig. 2.) Then start to tuck, taking each strand over the one next to it, and under the following one. Work one side of the joint first, before starting on the other side (Fig. 3). Two tucks each side are sufficient, then cut off the loose ends.

If your mast is tapered, a simple method of fixing the top ends is by means of a cut splice. Take the two lengths of rope you have for the side guys, and lay the ends parallel to each other (Fig. 4). Measure your mast where the guys are to fit, and make a splice that size by simply splicing the strands of each end into the standing part, in exactly the same way as making the eye splice. The result should look like Fig. 5, and it can be slipped over the top of the required position.

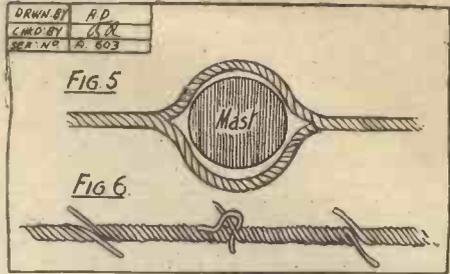
Some Useful Knots.

If your halliards have carried away, and you wish to make a splice that will travel through the pulley at the top of the mast, the long splice will meet your requirements.

First, cut away about six inches from either side of the broken portion to get rid of the weak part. Unlay each end for about six inches, and clutch them together as described for the short splice. Then select any one strand and commence to unlay it back along its own part, filling up the gap by laying in the strand from the opposite side that is nearest to it. Do the same with the remaining strands till you only have two left. Knot these two together with a single overhand knot, and tuck each strand once through the standing part. Tuck the other loose ends the same way (Fig. 6), and cut off short.

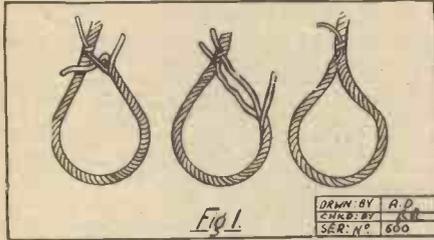
If you are in a hurry and haven't time to splice your rope, use a good knot. The bowline can take the place of the eye-splice, and is made like this. Take a fairly long end of rope and make a loop, holding same in your left hand (Fig. 7). Take the end in your right hand and pass it up through the loop, round the back of the standing part, and down through the loop again.

I think the most simple of all knots is two half-hitches (Fig. 8). Pass the end of the rope round the thing you want to secure, and



bring it up and over the standing part and through its own loop from the back; repeat the process and the knot is complete.

To have a lot of fag-ends of rope fraying away is most untidy and not economical, so here is a method of curing it. Open out

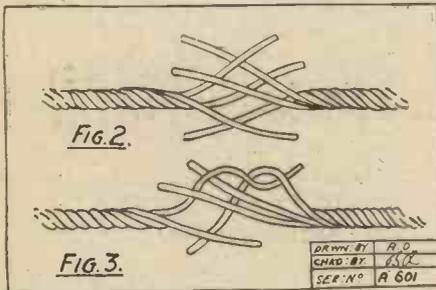


knot or splice that will last as long as the rope, and one that will never slip, and let you—and the aerial—down.

Most rope is made up of three strands, usually right-handed, therefore I will confine my remarks to that particular kind.

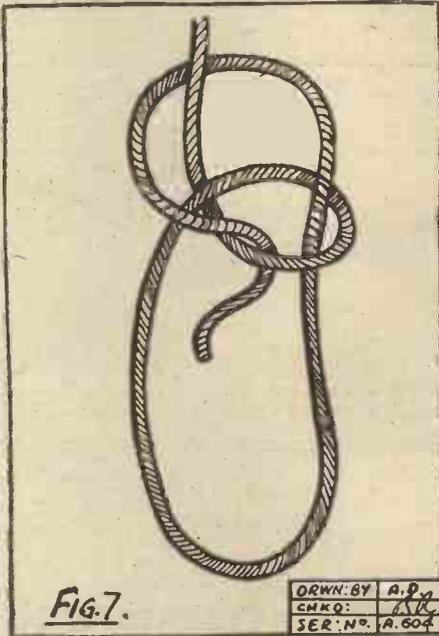
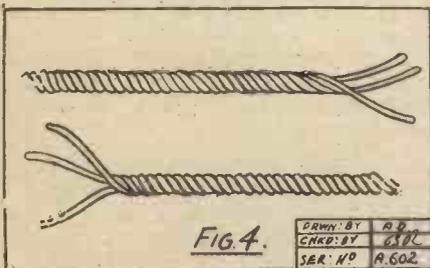
How To Splice.

About the most useful splice for staying masts, and for insulators and spreaders, is the eye-splice. Push the rope through

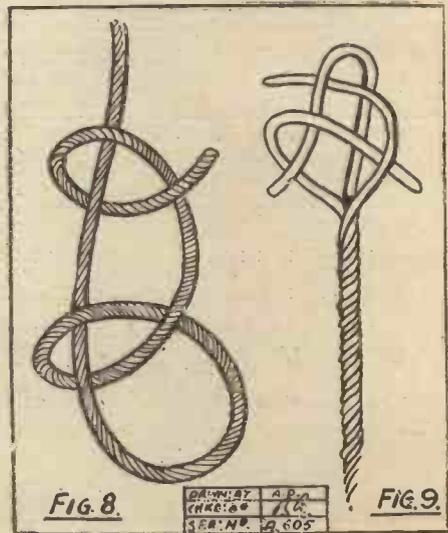


the insulator, or round the thimble, as the case may be, and unlay the end for about three inches, placing the end you have unlayed across the standing part, at the distance you require as in Fig. 1.

Choose the middle strand, and tuck it under the strand in the standing part that it is nearest to, and tuck against the lay, that is to the left, and pull tight. Do the same with the left-hand strand, being careful to avoid getting under the same strand as the first one. The right-hand strand calls for the same procedure, thus completing the first row of tucks. To check



the ends for about four inches, then bend the middle strand over towards you. Cross the left-hand strand in front of it, then push the right-hand one through the little loop formed by the middle strand. Pull all strands well tight, then tuck each strand under one and over one strand in the standing part, just the same as in previous splicing, against the lay. Two tucks are sufficient, then cut off short (Fig. 9).



THE "POPULAR WIRELESS" CONTINENTAL BROADCASTING TIME-TABLE. Specially compiled by ROBERT R. PECORINI, M.Inst.R.E. ("2RI").

Transmits in Starts Ends G.M.T. G.M.T.	Station and Call Sign	Wave-length metres	Frequency kilo-cycles	Days of the Week	Nature of Transmission	Transmits in Starts Ends G.M.T. G.M.T.	Station and Call Sign	Wave-length metres	Frequency kilo-cycles	Days of the Week	Nature of Transmission
05.30 19.15	Koenigswusterhausen (L P)	525.5	119	Daily (throughout day)	Woolf's Press Service.	10.05 11.40	Hilversum (H D O)	1050	285.7	Sunday	Divine Service.
05.55 06.05	Hamburg*	392.5	764.3	Weekdays	Time.	10.30 11.50	Munster*	410	732	"	Concert.
05.55 06.05	Bremen	279	1075	"	Usually relay Ham-burg.	10.30 11.50	Eberfeldt	240	1240	"	Orchestra, Esperanto Concert.
05.55 06.05	Hanover	296	1013	"	Relay	10.30 11.50	Koenigswusterhausen (L P)	1300	995	"	Concert.
05.55 06.05	Kiel	283.5	1284	"	News.	10.30 11.50	Radio-Berng	301.5	995	"	Sacred Service.
06.00 20.30	Koenigswusterhausen (L P)	4000	75	Daily (throughout day)	Time.	10.30 12.30	Stuttgart	446	672	Weekdays	Weather.
06.25 06.30	Hamburg*	392.5	764.8	Weekdays	Weather (local).	10.30 12.30	Koenigsberg	463	648	"	"
06.35 06.42	Lansanne (H B 2)	850	353	"	"	10.45 11.00	Leipzig	482	660	"	"
07.12 16.10	Eifel Tower (F L)	2650	113.1	Daily (except M., Sat.)	News, Bourse.	11.00 11.10	Zurich*	515	582	Sunday	Orchestra.
07.30 08.30	Amsterdam	1955	153	"	Concert	11.00 11.30	Voxhaus (Berlin)	505.6576	594.521	"	Orchestra.
07.30 08.30	Frankfurt-on-Main*	470	1096	"	Relaying Frankfurt.	11.00 11.30	Frankfurt-on-Main*	470	638	Th., W., Th., Fr., Sat.	Markets, Cotton.
07.30 18.50	Koenigswusterhausen (L P)	2600	103.4	Daily (throughout day)	T. U. News Service.	11.00 11.15	Eifel Tower (F L)	2650	113	Weekdays	Music.
07.30 18.50	Dresden	452	663.7	"	Sacred music & Service.	11.00 11.50	Leipzig	452	663.7	"	Weather.
07.30 18.50	Leipzig*	294	1020	"	Relaying Leipzig	11.00 11.10	Helsingborg	522.317	574.946	"	Time.
07.30 08.05	Eberfeldt	210	1249	"	Sacred Service.	11.15 11.25	Eifel Tower F. L.	2650	113	Daily	Fish prices.
07.30 08.05	Dortmund	410 (287)	731 (1045)	"	"	11.30 12.25	Munster	410	731	Weekdays	Concert (stat. orch.).
07.30 08.45	Koenigsberg	463	648	"	Relaying Munster	11.30 12.10	Breslau*	2650	113	"	House, Markets.
07.30 11.00	Stettin	505.6576	594.521	"	"	11.30 12.10	Munster	410	731	Daily	Weather, Bourse, Time (Naren).
07.50 08.07	Vienna	241	1244.8	Weekdays	Relaying Berlin	11.30 11.40	Stockholm (S A S A)*	427	702.5	Weekdays (except Thur.)	Weather.
07.50 08.07	Graz	399	566	"	Markets, Berlin	11.37 11.46	Dutch Meleo (K N M L)	1100	272.6	"	Police News.
08.00 08.10	Koenigsberg	463	744	Weekdays	Relaying Vienna.	11.40 12.00	Hilversum (H D O)	1050	285.7	"	Time.
08.15 08.30	Marignane	1525	196	Daily	Markets	11.55 12.00	Leipzig	452	663.7	"	"
08.45 10.15	Copenhagen*	390	882	Sunday	Weather	11.55 12.00	Frankfurt-on-Main	470	638	"	"
08.45 10.15	Oslo	950	316	"	Sacred Service.	11.55 12.00	Radio-Berne	301.5	995	Daily	T. S., Weather, Bourse.
08.45 10.15	Hjerring	240	1240	"	Relaying Copenhagen.	11.55 12.15	Voxhaus (Berlin)*	505.6576	594.521	"	"
09.00 11.00	Brunn (O K B)	730	410.9	Sunday	Concert.	11.55 12.15	Breslau	410	721	Sunday	"
09.00 09.20	Voxhaus (Berlin)*	505.6576	594.521	Weekdays	Markets and Weather.	11.55 12.15	Zurich	582	682	Weekdays	"
09.00 09.10	Vienna (R W)	530	566	Sun., Wed., Friday	Organ and Choir.	11.55 12.30	Hamburg*	392.5	764.3	Sundays	"
09.00 09.10	Aalesund	382	785	"	Relaying Oslo.	11.55 12.30	Frankfurt-on-Main	470	638	Weekdays	"
09.00 09.35	Helsingfors & Raikola long*	515	582.5	Sunday	Relaying Oslo.	11.55 13.00	Rome (L R O)	485	618	"	Government comm'n.
09.00 09.35	Komarlov (O K B)	311	965	"	News, Concert.	12.00 13.00	Odense	1100	259	"	Time, Weather.
09.00 09.15	Ryvang	1100	259	Sunday, Thursday	Sacred Service.	12.00 13.00	Hjerring	950	316	"	Divine Service.
09.05 09.30	Leipzig*	452	663.7	Weekdays	News.	12.00 13.00	Vienna	1250	240	"	Relaying Ryvang.
09.30 10.00	Rome (L R O)	425	706	Sunday, Thursday	News, Concert.	12.15 13.30	Munster*	410	731	Weekdays	Locura, Concert.
09.30 10.15	Radio-Berne	301.5	995	Alternate days	Organ music.	12.15 13.30	Eberfeldt	240	1249	Monday, Friday	Relaying occasionally.
09.40 10.30	Bloemendaal	345	869	Sunday	Religious Service.	12.15 12.40	Oslo	382	785	Weekdays	Markets: Exchange
09.42 09.50	Toulouse (M R D)	1525	196	"	Weather.	12.30 13.40	Lansanne (H B 2)	1750	358	Weekdays	Weather (Zurich), Time.
10.00 11.30	Stockholm* (S A S B)	427	702.5	Daily	Sacred Service.	12.30 13.40	Toulouse	441:180	680 & 1866.6	Daily	Music.
10.00 11.30	Gefte (S M X F)	212	1419	Sunday	"	12.30 13.40	Zurich	515	582	Weekdays	Concert.
10.00 11.30	Eskestuma (S M V X)	218	1234.5	"	Relay Stockholm.	12.30 13.40	Moscow (R D W)	1450	207	"	Orchestra, Relays
10.00 11.30	Oslo	218	1234.5	"	"	12.40 12.50	Radio-Agen	318	171.3	Sunday	Orchestra, Relays
10.00 11.30	Kalmar	258	1125.5	"	"	12.45 13.45	Radio-Paris	1750	1013	"	Hanover.
10.00 11.30	Non-koeping (S M V V)	260	1154	"	"	12.45 13.45	Hanover*	296	1013	"	T. S.
10.00 11.30	Joekooeping (S M Z D)	265	1131	"	"	12.45 13.45	Hamburg	392.5	764.3	Daily	Weather, News.
10.00 11.30	Feulun (S W Z K)	370	810	"	"	12.45 13.45	Hamburg	392.5	764.3	Saturday	Concert.
10.00 11.30	Sundsvall (S A S D)	545	550	"	"	12.45 13.45	Hamburg	392.5	764.3	Sunday	Orchestra.
10.00 11.30	Linkoeeping (S A S E)	467	642	"	"	13.00 13.08	Gothenburg	515	1249	Weekdays	Time, News, Weather
10.00 11.30	Boden (S A S E)	1300	222.1	"	"	13.00 14.00	Eberfeldt	240	1249	"	"
10.00 11.30	Karlsberg	222.1	1350	Sunday	Sacred Service.	13.00 14.30	Toulouse	441:180	680 & 1666.6	Daily	"
10.00 11.30	Garlstad (S M X C)	221	1041.6	"	"	13.00 13.15	Munster	410	731	Weekdays	Children.
10.00 11.30	Trollan (S M X Q)	332	993.7	"	Relaying Gothenburg.	13.00 13.15	Brussels (B A V)	1100	272	Weekdays	News, Concert, Talk.
10.00 11.30	Varberg	340	880	"	"	13.00 14.00	Leningrad	940	319	Weekdays	Children.
10.00 11.30	Malmoe (S A S C)	270	1111	Sunday	Sacred Service, Relays	13.05 15.00	Hamburg*	392.5	764.3	Saturday	Children.
10.00 11.30	Barcelona (E A J 13)	460	652	"	Stockholm as also does.	13.05 15.00	Bremen*	270	1075	Weekdays	Concert, relaying
10.00 11.30	Zurich	515	582	"	Concert.	13.15 13.40	Toulouse	441:180	680 & 1006.6	Daily	Bremen, Concert.
10.00 11.45	Sokolnitski (Moscow)	1010	297	Daily	Concert.	13.20 13.30	Voxhaus (Berlin)*	505.6576	594.521	"	Orchestra.
10.00 11.50	Voxhaus (Berlin)	505.6576	594.521	Th., Thur., Fri., Sat.	Tests.	13.30 14.00	Radio-Paris (S F B)	1750	594.521	"	Bourse
10.00 11.00	Leipzig*	452	663.7	Daily	Political Lecture	13.35 13.52	Voxhaus (Berlin)	505.6576	594.521	Weekdays	News etc.
10.00 11.00	Oslo	382	785	Sunday	Educational Talk.	14.00 14.30	P. T. T. (Boole Supérieure)	438	655	Sunday	News, Press, Exchange
10.00 11.00	Toulouse	382	785	Weekdays	Sacred Service.	14.00 15.00	Lyons la Doua	379	626.3	"	Chess.
10.00 10.15	Munich*	441:080	1066.0	"	Market prices.	14.00 15.00	Pic-au-Midi	350	855	"	Concert relay.
10.00 10.15	Nuremberg	485	618	Wednesday	Chimes.	14.00 15.00	Toulouse	441:180	680 & 1006.6	Weekdays	Relaying P. T. T.
10.00 11.00	Breslau	340	880	Weekdays	Relaying Munich	14.00 14.30	Frankfurt-on-Main	470	638	"	Talk.
10.00 11.50	Gleitwitz	251	1195	Sunday	Sacred Service & Music.	14.00 16.00	Breslau	416	721	Weekdays	Concert.
10.00 11.30	Voxhaus (Berth)*	505.6576	594.521	Weekdays	Relaying Breslau.	14.00 17.00	Munich	485	618	Sunday	Women's talk.
10.00 10.10	Vienna	530	560	Sun., W., Th.	Worker's Concert.	14.00 15.00	Voxhaus (Berlin)*	505.6576	594.521	Sunday	Chess.
10.00 10.10	Koenigsberg	463	648	Weekdays	Weather.	14.00 14.30	Voxhaus (Berlin)*	505.6576	594.521	"	"

(Continued on page 170).



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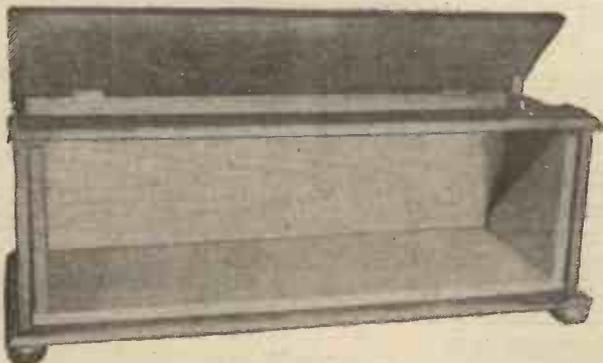
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(Continued from page 168.)

THE "POPULAR WIRELESS" CONTINENTAL BROADCASTING TIME-TABLE.

Transmitter's Start/End G.M.T.	Station and Call Sign	Wave-length in metres	Frequency in kilocycles	Days of the Week	Nature of Transmission	Transmitter's Start/End G.M.T.	Station and Call Sign	Wave-length in metres	Frequency in kilocycles	Days of the Week	Nature of Transmission
14.10-14.30	Voxhams (Berlin)*	505.6576	594.521	Weekdays	Talk, News.	17.45-19.15	Moscow (R D W)	1450	207	Weekdays	Concert, News.
14.15-14.45	Hamburg	392.5	764.3	Sundays	Esperanto.	18.00-18.10	Radio-Berlin	301.5	995	Daily	News.
14.30-15.30	Madrid (E A J 7)	373	804	Daily	Concert or Orchestra.	18.00-20.00	Madrid (E A J 7)	373	804	Tues., Thurs., Sat.	Concert.
14.30-15.25	Voxhams (Berlin)	505.6576	594.521	Sunday	Children or Children.	18.00-19.00	Hamburg*	392.5	764.3	Sunday	English. [Concert, Talk, Lecture, Talk.
14.30-15.30	Frankfurt-on-Main	470	638	Weekdays	Children, Children.	18.00-19.00	Stuttgart	446	672	Weekdays	Con., Dance, News, Talk
14.30-16.30	Copenhagen	340	882	Sunday	Lecture, Children.	18.00-21.00	Zurich	515	582	Monday	Esperanto.
14.45-15.30	Munich	485	618	Weekdays	Testing regularly.	18.00-20.00	Stuttgart	446	672	Tues., Wed., Fri.	Concert.
14.45-15.30	Reval	350	856.6	"	Children.	18.00-20.00	Kiel	1000	300	Daily	" or Dance.
15.00-16.00	Frankfurt-on-Main	470	638	Sunday	Children.	18.00-20.00	Bilbao (E A J 9)	300	1000	Mon., Thurs.	"
15.00-16.00	Radio-Berlin	301.5	995	Daily	Con. Chat., Chil. (Wed.)	18.00-20.00	Brunn (O K B)	392	765	Weekdays	Agricultural Talk.
15.00-16.30	P. T. T. (Ecole Supérieure)	458	655	Saturday	Concert.	18.05-18.50	Madrid (E A J 1)	324	926	Weekdays (see Notes)	Testing.
15.00-16.30	Marselles	479	628.3	"	Relaying F. P. T. T.	18.10-19.10	Barcelona (E A J 1)	400	750	Daily	Talk, News, Concert, etc.
15.00-16.30	Toulouse	350	856.6	"	Lecture.	18.15-19.10	Vienna (O T W)	400	750	Weekdays	Time, Concert.
15.00-16.30	Bordeaux	410	732	Weekday evenings only	Concert.	18.15-19.10	Koenigsberg	463	648	Daily	Concert, News, [News.
15.00-16.30	Dijon	498	602.5	Sunday	Children's Hour.	18.15-19.10	Oslo	382	785	Daily	Concert, News, [News.
15.00-16.30	P. T. T.	458	655	Weekdays	Lecture.	18.15-19.10	Eiffel Tower (F L)	2650	113.1	Sunday	Recital.
15.00-17.30	Stuttgart	446	672	Daily	Concert.	18.30-19.00	Barcelona (E A J 1)	324	926	Saturday	Lecture, Concert.
15.00-17.30	Eiffel Tower F.L.	2650	113	Weekdays	Children's Hour.	18.30-19.15	Rome (I R O)	425	706	Daily	Press, Gov't Communica's
15.00-17.30	Berlin	505.6576	594.521	Saturday	News.	18.50-19.00	Barcelona (E A J 1)	324	926	Weekdays	Concert.
15.00-17.00	Koenigsberg	463	648	Sunday	Concert.	18.55-19.00	Eiffel Tower (F L)	2650	113.1	Daily	Concert.
15.00-15.15	Lynghy (O X E)	2400	125	Weekdays	Own Concert.	19.00-21.00	Prague (Starasitz)	388	1000	Wednesday, Thursday	Orch., Conc., News.
15.10-16.30	Vienna*	580	566	S. M., Th., Sat.	Relays, Vienna.	19.00-20.30	Ryvang	1160	259	Daily	Con., Dance.
15.10-16.30	Graz	390	752	Tues., Wed., Fri.	Operatic Music.	19.00-21.30	Oslo	382	785	Weekdays	News, Nav'g'n, Withr.
15.15-16.00	Hamburg*	392.5	764.3	Sunday	Relaying.	19.00-21.00	Karlshoerz	446	672	Weekdays	Concert, News, Talk.
15.15-16.00	Bremen	279	1075	Saturday	Concert.	19.00-21.45	Stuttgart	446	672	Sunday	Lecture, Carillon, Time.
15.30-17.15	Munster*	410	732	Weekdays	Children's Hour.	19.00-21.00	Berlin	353	832.8	Monday	Theatre.
15.30-19.30	Madrid (E A J 4)	382	882	Saturday	Concert.	19.00-21.00	Barcelona (E A J 1)	324	926	Weekdays	Organ, Concert, Talk.
15.30-17.15	Dortmund	283	1060	Tues., Wed., Fri., Sat.	News, Lect., or Concert.	19.00-22.15	Cadiz (E A J 3)	360	832.8	Thursday, Friday, Sat.	Lecture, Con., News.
15.30-17.30	Berlin	505.6576	594.521	Daily	Relay	19.00-21.30	Hamburg*	392.5	764.3	Daily	Music, Dance.
15.30-17.00	Leipzig	452	663.7	Weekdays	Concert.	19.00-21.00	Berlin	353	832.8	Weekdays	Time.
15.30-17.35	Leipzig	240	1249	Wednesday	Children's Hour.	19.00-22.00	Hamburg*	392.5	764.3	Sunday	Concert.
15.30-17.30	Eberfeldt	280	1071	Saturday	Orchestra.	19.00-22.00	Cadiz (E A J 3)	360	832.8	Thursday, Friday, Sat.	Music, Dance.
16.00-17.30	Radio-Lyon	16.00	171.3	Daily	Light Music.	19.00-22.15	Cadiz (E A J 3)	360	832.8	Daily	Time.
16.00-17.15	Zurich	515	582	Weekdays	Dance.	19.00-21.00	Radio-Cataluna (E A J 13)	460	652	Monday	Police News, etc., Conc.
16.00-17.30	Dresden	294	1080	Thursday	Thé Damsant.	19.10-20.40	Cartagena (E A J 10)	335	895	Sunday	Theatre.
16.00-18.00	Breslau	416	721	Saturday	Concert.	19.10-20.30	Koenigsberg	463	648	Weekdays	Police News, etc., Conc.
16.00-18.00	Eberfeldt	280	1071	Wednesday	Concert.	19.10-20.30	Hilversum (H D O)	1050	285.7	Weekdays	Religious Lecture.
16.00-17.00	Radio-Lyon	16.00	171.3	Sunday	Talk and Concert.	19.15-20.30	Malaga (E A J 25)	325	923	Weekdays	Orch., Lecture, News.
16.00-17.30	Madrid (E A J 6)	392.5	765	Sun., Wed., Sat.	News, Bourse, etc.	19.15-20.15	Radio-Geneva	760	394	Weekdays	Esperanto (Tues.).
16.30-16.45	Hamburg	1750	171.3	Daily	Children, News, Con.	19.20-20.30	Dortmund	283	1060	Saturday	Lecture (Thursday).
16.30-16.45	Radio-Paris	340	882	Sunday	Ryvang relaying Co.	19.30-20.00	Leipzig*	452	663.7	Almost daily	Opera (21.45), News.
16.30-20.00	Copenhagen*	288	1041.6	Weekdays	Bourse.	19.30-21.30	Eberfeldt	240	1249	Saturday	Concert.
16.45-17.00	Eiffel Tower	2650	113	Wednesday	Concert.	19.30-22.00	Frankfurt-on-Main*	470	638	Daily	Lecture, Music.
16.45-17.45	Radio-Paris	1750	171.3	Wednesday	Testing.	19.30-20.00	Lausanne	850	353	Weekdays	News, B'urse Con. (Tu.)
16.45-17.45	Tauresa (R A W)	1800.6	1250	Daily	Concert.	19.30-19.45	Radio-Agen	318	913	Daily	Concert, News.
17.00-19.00	Warsaw	380	789	Sat., Tues., Thurs.	"	19.30-21.00	Breslau	416	721	Saturday	Concert, News.
17.00-18.30	Radio-Belgium	262	1106.8	Mon., Wed., Fri.	Lecture Talk.	19.30-21.30	Berlin*	505.6576	594.521	Daily	Bourse, News, Weather.
17.00-18.30	Lige (Radio-Wallonie)	285	1052.6	Weekdays	Children.	19.30-20.30	Frankfurt-on-Main*	470	638	Weekdays	Relaying Berlin.
17.00-17.30	Frankfurt-on-Main	470	638	Daily	Children, Talk, News.	19.30-19.40	Rome (I R O)	425	706	Daily	Esperanto Course.
17.00-17.30	Rome (I R O)	425	706	Daily	Concert, Dance.	19.30-21.30	Koenigswusterhausen	1300	281	Daily	Concert or Opera.
17.00-23.00	Stockholm (with relays)	427	702.5	Daily	Chil. Talk, Con., News.	19.30-21.40	Oslo	382	785	Weekdays	W'kd'ys., News, Conc.
17.00-23.00	Gothenburg	288	1041.6	"	Dance, Sometimes relays Stockholm.	19.40-21.40	Eiffel Tower (F L)	2740	109.4	Sunday, Wed., Fri.	Lecture.
17.00-23.00	Malmoe	270	1111	"	As S.A.S.B. Sometimes relays.	19.55-22.30	Hilversum	1150	285.7	Weekdays	News, Time, Weather.
17.00-23.00	Leningrad	940	319	Mon., Thurs., Sat., Tu.	Lect. Con. News, Opera.	20.00-21.00	Lige-Belgique	202	1196.8	Mon., Wed., Sat.	Relaying Copenhagen and for 5 X X (after 22.30).
17.00-18.45	Helisingors*	522	574.7	Sunday	Concert, News, Tama-tors relays Helisingors	20.00-21.00	Radio-Paris	205	1191.6	Daily	News, Esperanto.
17.05-17.40	Berlin	505.6576	594.521	Weekdays	Opera.	20.00-22.30	Copenhagen*	340	882	"	Lecture, Concert.
17.15-17.30	Zurich	815	368	Weekdays	News.	20.00-22.30	Seville (E A J 5)	357	840.3	Sunday	Children.
17.15-18.00	B'unn (O K B)	368	815	Daily	Children.	20.00-21.00	Radio-Lyon	357	840.3	Daily	News.
17.15-18.30	P. T. T.	730	410.9	Saturday	Lecture.	20.15-20.30	P. T. T.	1071	260	Saturday	Talk.
17.30-18.30	Stuttgart	446	672	Weekdays	Radio Talk.	20.15-21.45	Radio-Belgique	202	1068	Weekdays	Music, Lecture, News.
17.30-18.00	Rome (I R O)	446	672	Sunday	Lecture.	20.15-22.10	Radio-Paris	205	1191.6	Saturday	Opera (M. W.)
17.30-18.00	B'unn (I R O)	492	706	Weekdays	Orchestra.	20.15-20.40	Radio-Paris	205	1191.6	Sunday	News Bulletin, Radio Talk.
17.30-20.15	Batsjlong (Finland)	492	706	Tues., Sat., Thurs., Sun.	Concert.	20.15-20.40	"	1750	171.3	Weekdays	Talk and Bourse.
17.30-20.15	San Sebastian (E A J 8)	317	946	Daily	Bourse.	20.15-20.40	"	1750	171.3	Weekdays	Talk and Bourse.
17.30-23.00	Radio-Toulouse	346	867	Tues., Wed., Fri.	Lecture.	20.15-20.40	"	1750	171.3	Weekdays	Talk and Bourse.
17.30-18.30	Graz	441	680	Weekdays	Bourse, News.	20.15-20.40	"	1750	171.3	Weekdays	Talk and Bourse.
17.45-18.00	Radio-Paris	390	732	Sunday	Talk.	20.15-20.40	"	1750	171.3	Weekdays	Talk and Bourse.
17.45-19.15	Berlin	505.6576	594.521	Sunday	Talk.	20.15-20.40	"	1750	171.3	Weekdays	Talk and Bourse.

(Continued on page 178.)



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WARNING

Use of Patents in the Home Construction of Broadcast Apparatus

MARCONI'S Wireless Telegraph Company, Ltd., of Marconi House, Strand, W.C.2, published in this paper, during December a notice concerning the unauthorised disposal of broadcast receivers by amateurs and others. From correspondence subsequently received it is clear that a large section of the public is under the impression that the Company has given the free use of its patents to all home constructors, and therefore it is desirable that this misunderstanding should be rectified.

AS far back as 1922 the Marconi Company placed at the disposal of the bona-fide experimenter or amateur the use of their patents. Whilst the Company has no intention of withdrawing this, they cannot consider persons who make up receivers at home merely for the purpose of obtaining amusement from the broadcast programmes as "experimenters," and therefore the concession referred to above is not applicable to them.

IT is clear that any other attitude on the part of the Company would be tantamount to converting the royalty into an unfair penalty imposed upon the manufacturer, who has not only to pay royalties, but also to bear the cost of heavy overhead manufacturing charges.

THE Company, not only for the protection of the legitimate trader, but also to safeguard their own interests, wish to make it known therefore that, while they have no desire to influence the public as to whether a set shall be bought complete or constructed at home, royalties are payable in either case. The Company also desire to give notice of their firm intention to take such action as may be necessary to uphold their patent rights.



**CLAYTON
EBONITE**

The "No-trouble" Ebonite

You never find Clayton Ebonite chipping or cracking when you are drilling it—it's just like boring cheese. It never comes to you warped nor streaky in appearance. Clayton is a real ebonite, finished with either matt or polished surface, and has been tested with surprising successful results by Professor Low.

If you want to be sure that your set will be the best possible and have any difficulty in obtaining Clayton—the ebonite that is ebonite—send us a p.c. for the name of your nearest stockist. It is worth the while.

Ask always for CLAYTON—the no-trouble Ebonite.

CLAYTON RUBBER CO. LTD.

Dep't. E.6,
Progress Works, Croft Street, Clayton, MANCHESTER




TIGER SINGLE COIL HOLDER



For panel mounting, No. T.C.101.
Perfect insulation, only best English porcelain used.
Brass Fittings. Price **9d.** each.

ATHOL ENGINEERING CO., Seymour Road, Crumpsall, Manchester.

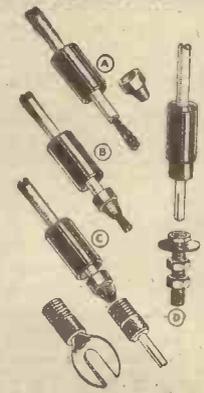
LISENIN

POSITIVE GRIP PLUGS & SOCKETS

Pat. No. 245586.

THERE can be few amateurs who have not been troubled with broken leads, or said hard things about faulty connections. Of the whole set there is probably no part which is so often abused as the connections. "Lisenin" Positive Grip Plugs alleviate this evil. They are designed to take the smallest flex up to 5 m/m cable. Sleeves and indication discs red and black. N. Plated. **PRICE 6d.** Plug and socket complete, or Spade End Terminal. Obtainable of all dealers. Liberal Trade Discount.

Sole Manufacturers and Patentees:—
THE LISENIN WIRELESS CO.,
1a, Edgware Road, London, W.2
Phone: "Posgrip, Padd., London."
Tel. Address: Paddington 2734.



Plug and Socket or Spade End, 6d. each.



They are robust, energetic, and speak for themselves in no uncertain tones. The C.T.25 is a power valve which acts efficiently in all other positions. It is by no means unique in this respect, but, nevertheless, such adaptability is none the less commendable. Few valves have the impedance and emission values of the C.T.25, and, while its characteristics render it theoretically more suitable for det. and subsequent positions, we were surprised to discover that it "H.F.'d" well. The C.T.25B proved to be a very good super-het. valve, operating very well indeed in the intermediates. It showed a most commendable aptitude for H.F. work, and in the detector stage of a straight circuit it gives every satisfaction. Cleartron valves can certainly be recommended to the attention of our readers, who, at the price of 12s. 6d. each for

Traders and manufacturers are invited to submit wireless sets and component parts 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.

MESSRS. CLEARTRON RADIO LTD., of 1, Charing Cross, London, recently sent us a range of Cleartron valves for test. The following types were included: C.T.25, fil. volts 5, fil. amps. .25, impedance 10,000 ohms; C.T.25B, fil. volts 5, fil. amps. .25, impedance 20,000 ohms; C.T.08, fil. volts 3, fil. amps. .08, impedance 18,000 ohms; C.T.15, fil. volts 1.8, fil. amps. .15, impedance 18,000 ohms.

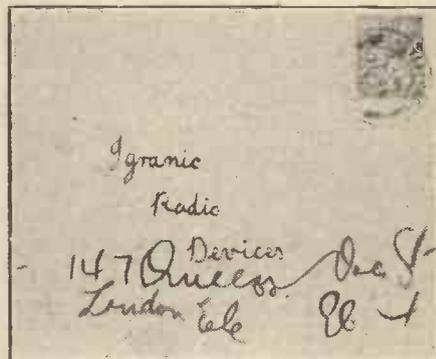
The whole range is stated to be suitable for general purposes work, the C.T.25B being specified for resistance-coupled amplifiers in addition.

We first of all took a number of C.T.15's (1.8 volts) and tried them in a super het. (9 valves, H.F., det., oscillator, three intermediates, 2nd det., 2 L.F.). In all positions the little Cleartrons gave very good results. It was, of course, a gruelling test for

unspecialised valves, and, all things being equal, a similar performance we have seldom seen. In straight detector positions with 60 volts or so H.T., excellent results were obtained. They functioned splendidly in H.F. stages with somewhat lower anode voltages and equally well in first L.F. positions with about 90 volts H.T. In a second L.F. transformer-coupled stage with 7½ volts grid bias and 108 volts H.T., a C.T.15 operated with the "punch" and freedom from wave distortion of a small-power valve.

The C.T.08's worked well with dry cells, and gave very similar results to those provided by the C.T.15's, which was only to be expected in view of the fact that their characteristics are almost identical.

The 25's are perhaps the leaders of the Cleartron range; at least, that is our opinion.



That this letter was safely delivered and with but little delay instances the fame of the Igranic people.

(Continued on page 174.)

EDISON BELL RADIO

DANGER!



Quite recently storms of considerable violence have visited this country, causing extensive damage and interfering with transmission from **DAVENTRY** and **MANCHESTER** stations of the British Broadcasting Company. The latter station, according to a Press report, advised listeners to

'SWITCH OFF UNTIL DANGER IS PAST.'
THEREFORE
FIT AN EDISON BELL
Earthing Plug & Lightning Arrester
AND BE

SAFE!



PRICE
5/-

The contacts are made of pure silver and will not corrode. Catalogues free from your dealer or direct from J. E. Hough, Ltd., Edison Bell Works, London, S.E.15.

PRICE
5/-



INSIST ON EDISON BELL CONDENSERS

THEY ARE BRITISH MADE AND GUARANTEED BY A NAME WITH 30 YEARS REPUTATION BEHIND IT



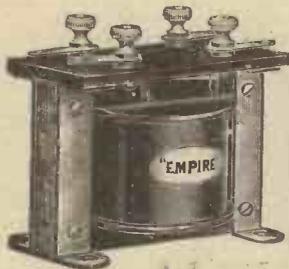
FILAMENT RHEOSTATS AND POTENTIOMETERS

With the windings carried on a porcelain bobbin and having the contact arm moving on its inner side, the "Cosmos" Filament Rheostat takes up remarkably little space, is strong in construction, and has a very smooth and reliable movement. It is fixed by ONE HOLE, and is provided with a handsome knob and dial. Made in four types, two of which are double wound for Dull OR Bright Valves, and one a Potentiometer, the prices are given in an adjacent panel.

METRO-VICK SUPPLIES, LTD.
 (Proprietors: Metropolitan-Vickers Electrical Co., Ltd.),
 4, Central Buildings, Westminster, London, S.W.1.

Description	Ohms	Carrying Current	Price
Single Wound	6'0	1'0 amp.	s. d. 4 6
Double "	18+2	4-1'5	5 0
Double "	30+4	2-1'0	5 0
Potentiometer	300	—	6 0

Cosmos
 RADIO COMPONENTS



BUY! BRITISH GOODS

THE H.T.C. "EMPIRE" L.F. TRANSFORMER Price 7/6

POSTAGE 3d.

12 MONTHS GUARANTEE and money back if dissatisfied. Guaranteed Distortionless Standard Ratios 4-1.

WHY BUY A FOREIGNER?

If your dealer cannot supply send direct to the manufacturers.

This transformer makes an efficient Choke when P.O. and S.I. are short circuited between the terminals. P.I. and S.O. are then connections of a choke of 2,000 ohms resistance.

THE H.T.C. ELECTRICAL CO., LTD.,
 2, Boundaries Road, BALHAM, S.W.12.

Telephone: BATTERSEA 374.

BROADCAST SATISFACTION



Not until you have soldered your set with **FLUXITE** will you discover the secret of faultless reception. For **FLUXITE** soldered joints always provide perfect contact, they never come undone.

Soldering the **FLUXITE** way is so simple—a minute's practice and you are an expert.

Ask your Ironmonger or Hardware Dealer to show you the neat little

FLUXITE SOLDERING SET

It is perfectly simple to use, and will last for years in constant use. It contains a special "small space" Soldering Iron with non-heating metal handle, a pocket Blow-lamp, **FLUXITE**, solder, etc., and full instructions. Price 7/6. Write to us should you be unable to obtain it

Price 7/6



FLUXITE SIMPLIFIES SOLDERING

All Hardware and Ironmongery Stores sell **FLUXITE** in tins, price 8d., 1/4, & 2/6.

Buy a Tin To-day.

FLUXITE LTD. (Dept. 324), West Lane Works, Rotherhithe, S.E.16. **ASK FOR LEAFLET** on improved methods.

ANOTHER USE FOR FLUXITE. Hardening Tools & Case Hardening.

APPARATUS TESTED.

(Continued from page 172.)

the C.T.15 and C.T.08, and 15s. each for the C.T.25 and C.T.25B, should discover in them an attractive proposition.

The advertisement concerning the Ormond Ball-Bearing Friction control condenser, which appeared on page 25 of our Feb. 27th issue, contained an unfortunate error. The ratio quoted was 15-1. and this should have read "Ideal Ratio 55-1."

Messrs. Radio Instruments, Ltd., have produced an L.F. transformer of exceptionally novel design. In shape it does not greatly differ from standard types, but it is provided with six terminals instead of the usual four. The additional two represent tappings, one from the primary and one from the secondary winding. By means of these it is possible to obtain seven different ratios varying from 1-1 to 9-1, and a number of primary impedances is made available which covers the astonishingly wide range of from 7,000 to 60,000 ohms.

Thus the transformer is adaptable to practically any L.F. purpose, and in L.F. amplifier circuits its connections can be varied until optimum efficiency is obtained. At last it is possible, in fact, for the amateur to experiment with impedances while a set is in operation, noting by results the increase in amplification and purity when the correct combination is discovered.

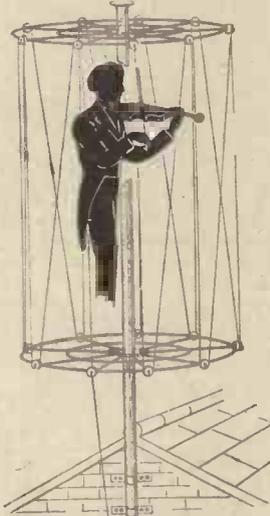
The new R.I. "Multi-Ratio," as it is

called, is shrouded, and the casing is coloured a bright blue, thereby making the instrument very distinctive, although it must not be imagined that it is garish.

According to the makers the primary is wound with approximately 50 % more turns than the standard model, while the number of turns on the secondary has been increased, but not in the same proportion. The famous sectionalised winding, which is responsible for the low self-capacity of the R.I. transformer, has been retained.

The six terminals are plainly marked P 0, P 1, P 2, S 0, S 1, S 2. Connections to P 0 and P 2, and S 0 and S 2 bring the total number of turns on both sides into service. P 1 and S 1 represent tapping points.

We have not tested this new R.I. component thoroughly yet, but it is being included in a "P.W." receiver shortly to be described, and full particulars concerning results obtained will then be given. We



An artistic showcard issued by the makers of The Ashton Perfect Aerial Spreaders.

have no doubt but that it will prove quite satisfactory in operation, for the principles involved are eminently sound, while R.I. products invariably conform to a very high standard both mechanically and electrically.

We append a table prepared by Messrs. Radio Instruments, Ltd., in which details of the ratio combinations possible with the new transformer are given. Its "elasticity," it will be agreed, is extraordinary in view of the fact that only two extra terminals are introduced. The price is attractive, too, being only 2s. 6d. higher than the standard model that is 27s. 6d.

APPROXIMATE IMPEDANCE OF POWER VALVES.
3,000—14,000

APPROXIMATE IMPEDANCE OF GENERAL PURPOSE VALVES.
30,000—60,000

Ratio	Terminals		Suggested Position in L.F. Amp'r.	Approx. Primary Impedance in Ohms.
	P	S		
1-1	P 0-P 2	S 0-S 1	Telephones or loud speaker	60,000
1½-1	P 1-P 2	S 0-S 1	1st or 2nd	28,000
2-1	P 0-P 2	S 1-S 2	1st or 2nd	60,000
	P 0-P 1	S 0-S 1	2nd or 3rd	7,000
3-1	P 1-P 2	S 1-S 2	1st or 2nd	28,000
	P 0-P 2	S 0-S 2	1st	60,000
4½-1	P 1-P 2	S 0-S 2	1st or 2nd	28,000
6-1	P 0-P 1	S 1-S 2	2nd or 3rd	7,000
9-1	P 0-P 1	S 0-S 2	2nd or 3rd	7,000

Make no mistake with Your RADIO COMPONENTS
The BEST will always be found **CHEAPEST.**

Our Ebonite is of the highest possible grade and is used by all the leading experimentalists, having stood the test of time. Ordinary finish, 4/6 per lb. Sand-blasted matt surface, 5/- per lb. Any size cut while you wait.

We have a full range of all makes of High Tension Accumulators now in stock.

High Glass solid Mahogany and Oak American Type Cabinets with sliding base boards from 10/- each.

A full range of the best components from the world's markets always in stock.

Send 6d. for the World's Finest Radio Catalogue (Callers Free), second edition ready shortly; or call and see our great Shop Window Display. (Mention this paper.)

WILL DAY, LTD.,
19, Lisle St., Leicester Sq., London, W.C.2

Telephone: Regent 4577. Telegrams: "Titles, Westrand, London."

Shake it as you will
—you cannot lose
the loudest spot.



From your Dealer
3/-

The "Permatector" has been built to fit instantly any model "Brownie Wireless" Receiver, but brackets, screws, and nuts are provided in each box to allow it to be fitted to any other crystal set in a very few minutes. The outer case is turned out of solid brass rod, and heavily nickel-plated—the finished product being a handsome addition to any receiver. And lastly, it is sold at the moderate price of 3/- complete.

If your Dealer is out of stock, send direct.

This new product of the Brownie Wireless Co.—the "Permatector"—gives extraordinarily voluminous reproduction. That's one point in its favour, but more important still, it is exceptionally stable—a fact you can easily prove yourself. Set it to give the loudest signals, then shake the receiver vigorously. Reception is entirely unaffected. The secret lies in the unique spring construction and the use of two rectifying minerals discovered in the course of many experiments. Every crystal is especially selected and tested, and is unconditionally guaranteed to give perfect results.

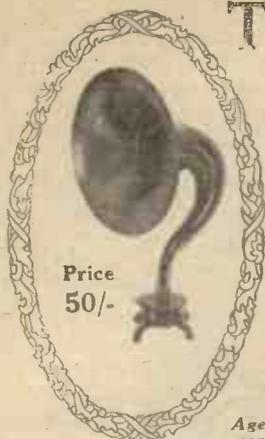
For trouble-free crystal reception, use
THE "PERMATECTOR"
—the ever-set crystal detector.

Built by the makers of the famous "Brownie Wireless" Crystal Receivers:

THE BROWNE WIRELESS CO.
(of Great Britain), LTD.
(Incorporating the J.W.B. Wireless Co.),
310a-312a, EUSTON RD., LONDON, N.W.1.
Phone: Museum 3747.

UNAFFECTED BY VIBRATION.

The two Biggest Bargains in Radio



Price
50/-

Height
21 inches
Diam. of
Flare
12 inches

Ask your Wireless Dealer to deliver a Red Seal to you for a Seven Days' Free Test. If he has no stock, send us his name and address, and we shall send one to him for you to test, then if you do not like it you need not buy, but can return it, and we will take it back from him.

Red Seal Loudspeakers Nos. 10 and 7

Test One on Your Set.

Height
12 inches
Diam. of
Flare
7 1/2 inches

Price
30/-



Red Seal Radio Company

61, Borough Road, LONDON, S.E. 1

Agents
wanted.

Dealers write
for terms.

The Circuit that has brought hundreds of testimonials!

THE Ormsby Long-Range Selective Circuit has brought hundreds of glowing testimonials which endorse the claims we make for it. We claim that this Circuit will cut out your local station, and bring in others five hundred miles away at Loud-speaker strength.

READ WHAT OTHERS SAY!

"I cannot speak too highly of the efficiency of your 4-Valve long distance Receiver. What places it in a class by itself is not merely its extreme selectivity and power, but also the remarkable purity of reproduction."

"Although I am within sight of the chimneys which support the aerial of 5 I.T., I can cut out this Station and tune in others."

Do not be compelled to listen to your local station. The Ormsby Long-Range Selective Circuit will enable you to cut it out and tune in many foreign ones. The Circuit includes two simple wiring charts, Valve and Baseboard Template and full instructions. State if three or four Valves required.

"I have, so far, received 60 Stations, B.B.C. and European, and all can be got at Loud-speaker strength on 4 Valves. I can get Radio Paris any evening without interference from Daventry."

"I have just enjoyed service at Berlin as a start-off to-day, and am greatly delighted at the clearness of reception."

2/6
Post free.

M. ORMSBY & CO.,
28, Page Street, Westminster, London
Telephone: Victoria 1987.

SAVE 50%

by using a

MELLOWTONE COUPLER

—in place of COILS and HOLDERS!



PRICES
from
5/6

The "MELLOWTONE" Coupler is neat, compact and finely finished—plugs into standard valve holder, takes up small panel space and replaces coils and holders. It is designed to avoid distortion, giving excellent selectivity and perfectly smooth reaction control.

Obtainable at all dealers. Write for Illustrated List of this and other Specialities.

MELLOWTONE

Radio-Ads.

LONDON DEPOT: TRIUMPH HOUSE, STOURBRIDGE 189, REGENT ST., W.1
MIDLAND RADIOTELEPHONE MFRS LTD. BRETTELL LANE WORKS

To get pure EBONITE, ask for



REGISTERED TRADE MARK

QUALITY
EBONITE

RODS, TUBES, SHEETS, PANELS, MOULDINGS

Ask your dealer for "BECOL"

THE BRITISH EBONITE CO., Ltd., HANWELL, LONDON, W.7

It is made from finest rubber and sulphur and is guaranteed free from surface leakage.

It proves its quality in every test. Its polish will also please you—ask to see it.

"POPULAR WIRELESS" Advertisement Rates

WHOLE PAGE £40 QUARTER PAGE £10
HALF PAGE.. £20 EIGHTH PAGE £5

Narrow Column Advts. (3 cols. to page) per inch 30/-
Minimum Space accepted - - - - half inch 15/-

NO SERIES DISCOUNTS. ALL ADVERTISEMENT COPY SUBJECT TO EDITORIAL APPROVAL
COPY AND BLOCKS MUST BE IN HAND 11 DAYS BEFORE DATE OF ISSUE TO ENSURE PROOFS.

ALL Communications respecting advertising must be made to

JOHN H. LILE, LTD., 4, Ludgate Circus, London, E.C.4.

'Phone: City 7261

RADIO TUTORIAL

All Editorial Communications to be addressed to The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

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Technical Editor: **G. V. DOWDING**, Grad.I.E.E.

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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 contributions to be addressed to The Editor, The Fleetway House, Farringdon Street, London, E.C.4. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The Editor desires to direct the attention of his readers to the fact that, as much of the information given in the columns of this paper is of a technical nature and 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.

PATENT ADVICE FOR READERS.

The Editor will be very pleased to recommend readers of POPULAR WIRELESS who have any wireless invention to patent, or who desire advice on patent questions, to our patent agent. 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.

TECHNICAL QUERIES.

Letters should be addressed to: Technical Query Dept., "Popular Wireless," The Fleetway House, Farringdon Street, London, E.C.4.

They should be written on one side of the paper only, and MUST be accompanied by a stamped addressed envelope.

Queries should be asked in the form of the numbered questions: (1), (2), (3), etc., but may be accompanied by a short letter giving any necessary additional particulars as briefly as possible.

For every question asked a fee of 6d. should be enclosed. A copy of the numbered questions should be kept, so that the replies may be given under the numbers. (It is not possible to reproduce the question in the answer.)

IMPORTANT—If a panel lay-out or list of point-to-point connections is required, an additional fee of 1/- must be enclosed. For wiring diagrams see page 178.

Wiring diagrams of commercial apparatus, such as sets of any particular manufacture, etc., cannot be supplied. (Such particulars can only be obtained from the makers.)

Readers may submit their own diagrams, etc., for correction or for criticism. The fee is 1/- per diagram, and these should be large, and as clear as possible.

No questions can be answered by phone. Remittances should be in the form of Postal Orders.

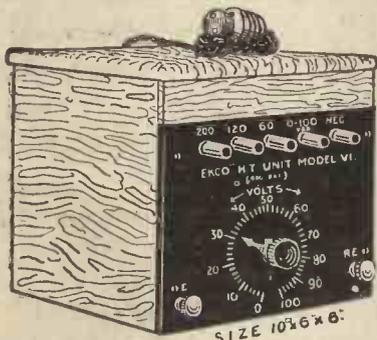
Questions and Answers

SWITCHING AN H.F. VALVE.

A. A. F. (Atherstone, Warwickshire).—How can I insert a switch in my two-valve set to cut out the H.F. valve when not required? What type of switch should be employed?

A single pole double-throw switch can be utilised for this. The connections are as follows: Break the connection between grid condenser and plate of H.F. valve and connect this side of grid condenser to the centre of the switch. Connect plate of H.F. valve to one side of switch and aerial to the remaining switch contact. This switch makes no provision for cutting off the L.T. supply, but most rheostats have an "off position," making this unnecessary. (The leads to the reaction coil must be reversed when the H.F. valve is switched over.)

(Continued on page 178.)



SCRAP YOUR H.T. BATTERY!

If your Electric Supply is by DIRECT CURRENT obtain H.T. through the

"EKCO" VARIABLE H.T. UNIT

(Patents Applied for)

by just attaching adaptor to electric light lamp-holder!

BY THE MERE TURNING OF AN INDICATOR:—

A TRULY VARIABLE H.T. SUPPLY is obtained, giving a smooth, continuous variation of voltages between 0 and 100, so that the exact fractional voltage which best suits the detector or high frequency valves, is easily and smoothly obtainable; a vast improvement on the dry battery, where the variation depends upon a series of "jerky jumps" of 3 to 6 volts.

TONE AND VOLUME are regulated and controlled.

DISTANT STATIONS, the reception of which depends largely on the correct voltage applied to the detector valve, are tuned in with much additional ease, clarity and purity of tone.

OSCILLATION POINT is controlled at will.

Three additional voltage tappings of 60, 120 and 200 are also provided for the low-frequency amplifiers. These voltages may be used either in conjunction with, or independent of, the variable voltage.

PRICE complete with adaptor and 6 yards of flex, £6 : 17 : 6 SATISFACTION OR CASH RETURNED.

ILLUSTRATED CATALOGUE { Giving full particulars of all the 7 "EKCO" H.T. UNIT MODELS, from 35/- } FREE!

Trade Enquiries invited.

E. K. COLE (Dept. A), 505, London Road, WESTCLIFF-ON-SEA.

The INVENTION of 1926

Clearer reception, guaranteed stability, unaffected by vibration; exceptionally selective. No holes to be drilled, no crystals to replace. **SECURE YOURS NOW!**

Of all Dealers and from: **TUNGSTALITE LTD.**, 47, Farringdon Rd., E.C.1. and 41, CALL LANE, LEEDS.

3/9

TUNGSTALITE AUTOMATIC DETECTOR

PANELS AND CONDENSERS

1st ASK THE TECHNICAL EXPERTS
2nd ASK YOUR DEALER

but if you experience difficulty in securing supplies write direct to us giving dealer's name

PARAGON RUBBER MANUFACTURING Co., Ltd.
SCULCOATES, HULL.

Invaluable to EVERY Amateur and Constructor.

The "POPULAR WIRELESS"

BLUE PRINTS of TESTED Circuits.

Every wireless amateur and every wireless constructor will find these "POPULAR WIRELESS" Blue Prints absolutely reliable. They have been most accurately drawn, and every circuit has been tested under normal broadcasting conditions by the technical staff of "Popular Wireless." It will be seen from the complete list given below that the series covers a very wide field. The veriest tyro will find each print most straightforward to follow and the receivers most easy to construct.

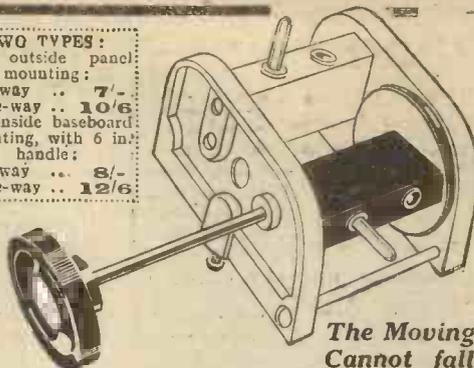
**P.W. BLUE PRINT
Number**

1. DETECTOR VALVE WITH REACTION.
2. UNIDYNE DETECTOR VALVE WITH REACTION.
3. 1-VALVE L.F. AMPLIFIER.
4. CRYSTAL DETECTOR WITH L.F. AMPLIFIER.
5. H.F. (Tuned Anode) AND CRYSTAL, WITH REACTION.
6. H.F. AND CRYSTAL. (Transformer Coupled, Without Reaction).
7. 1-VALVE REFLEX WITH CRYSTAL DETECTOR (Tuned Anode).
8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
9. H.F. AND DETECTOR (Tuned Anode Coupling, with Reaction on Anode).
10. H.F. AND DETECTOR. (Transformer Coupled, with Reaction).
11. DETECTOR AND L.F. (With Switch to Cut Out L.F. Valve).
12. DETECTOR AND L.F. UNIDYNE (With Switch to Cut Out L.F. Valve).
13. 2-VALVE REFLEX (Employing Valve Detector).
14. 2-VALVE L.F. AMPLIFIER (Transformer coupled with Switch to Cut Out Last Valve).
15. 2-VALVE L.F. AMPLIFIER (Transformer-Resistance Coupled with Switch for Cutting Out Last Valve).
16. H.F. (Tuned Anode), CRYSTAL DETECTOR AND L.F. (with Switch for Last Valve).
17. CRYSTAL DETECTOR WITH TWO L.F. AMPLIFIERS (with Switching).
18. 1-VALVE REFLEX AND CRYSTAL DETECTOR, with 1-VALVE L.F. AMPLIFIER, Controlled by Switch.
19. H.F. DETECTOR AND L.F. (with Switch to Cut Out the Last Valve.)
20. DETECTOR AND 2 L.F. AMPLIFIERS (with Switches for 1, 2 or 3 Valves).

**ALL "POPULAR WIRELESS"
BLUE PRINTS—6d. EACH**

All orders for these Blue Prints should be sent direct to the "Popular Wireless" Queries Department, Fleetway House, Farringdon Street, E.C.4. enclosing a stamped addressed envelope and a postal order for 6d. for each Blue Print Ordered.

TWO TYPES:
For outside panel mounting:
Two-way .. 7/-
Three-way .. 10/6
For inside baseboard mounting, with 6 in. handle:
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**The Moving Block
Cannot fall back**

Do away with that irritating, time wasting fading away of volume caused by the falling of your moving block!

Fit a Lotus Geared Vernier-Coil-Holder and get really accurate tuning. Has an easy Vernier movement which reduces the speed by eight times, and stays where it's put—exactly!

Fit in any position, with any weight of coil—you'll be satisfied with the results.

Bakelite mouldings for the side plates, coil blocks and knobs; heavy Nickel Plating for the metal parts.

LOTUS

VERNIER
COIL HOLDERS

From all reliable Radio Dealers

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

Makers of the New LOTUS BUOYANCY VALVE HOLDER

Only 7/- Each and Guaranteed for Twelve Months

So carefully are Bowyer-Lowe H.F. Transformers matched and tested at our works that you may buy any two at random and use them with perfect confidence for two stages of H.F. Amplification.

So well are these Transformers made that every one you buy is guaranteed up to the hilt for twelve months after purchase. If it fails it will be exchanged without charge. In spite of their superiority these Transformers cost less than most. Ranges are made covering all wave-lengths from 150 to 2,000 metres and up, as well as a special Neutrodyne Unit. All are sold at uniform price of 7/-.

Ask for them by name and see that you get them.



Bowyer-Lowe Matched H.F. TRANSFORMERS.

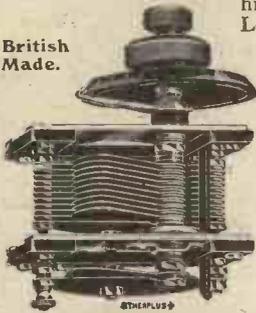
Good dealers stock them, or you may order direct from The Bowyer-Lowe Co. Ltd., Letchworth.

Quality—

In material and construction this distinguishes the Etherplus + Brass-vaned Condenser.

Heavy gauge brass vanes, brass pointer, brass pig-tail spring connection, latest type friction washer. All metal parts highly polished. Loss practically negligible.

British Made.



PRICES.
Without Vernier—
Capacity
00025 .. 10/-
0003 .. 11/-
0005 .. 11/-
001 .. 14/-

With Vernier,
1/6 extra in each case.

ETHERPLUS

RADIO ACCESSORIES
—ENSURE PERFECT RECEPTION

From your dealer or direct from—

MANDAW
9/15, Whitecross St., London, E.C.1

HEADPHONES REPAIRED

Re-wound & re-magnetised 5/- per pair, Loud Speakers repaired 5/-. Transformers re-wound 5/- each. All work guaranteed and tested before delivery.

Write for Trade Prices. Phone: Clerk, 1795. MASON & CO., 44, East Road, City Road, N.1.

RADIA X COILS

Low Loss. Low Price. Well made and individually packed, these are the finest coil proposition made through all Dealers and Factors.
Set of 9 mounted, 28/6. 300-5/3



RADIA LTD.
ACCESSORY HOUSE,
Palmer Place, London, N.7.

H&H Patent Tubular Galvanized Steel Telescope WIRELESS MAST

35 ft. HIGH.

Complete with base plate, ground pegs, stay wires, straining screws, pulley and cleat.

Price Complete £3:2:6 Carriage Forward
25 ft. Rigid Masts, 20/-

HILDICK & HILDICK, Pleck Rd., Walsall.

H.T. Accumulators —

60 Volts

3 Actual Amp-hour **37/6**



MONEY RETURNED IF NOT SATISFIED.

Obtainable only from:
ACCUMULATORS ELITE,
31, Waterhouse Street, HALIFAX.
Trade Supplied Telephone: 1301.

RADIOTORIAL QUESTIONS & ANSWERS.

(Continued from page 176.)

FADING.

“FADEAWAY” (Solihull, Birmingham).— Why do the signals fade away very often? Sometimes when I am receiving well the sounds slowly die away, and at other times they will fade away fairly quickly but come back again. Is this all due to what is known as fading? And, if so, what causes it?

There is a scientific phenomenon known as “fading” which affects long-distance signals, but all “fading-away” effects are not due to this cause. An effect like fading is often produced by a run-down battery. This is particularly the case when a large dry battery is used for lighting dull-emitter valves. When the battery is nearly exhausted it will sometimes become irregular in its action, the voltage falling away almost entirely and then picking up spasmodically nearly to its full value.

It is possible for a fading effect to be produced by the intermittent energising of a near-by aerial. Somebody living not very far away may own a valve set, and may have his first H.F. valve on the point of oscillating, so that when he adjusts any of his tuning

(Continued on next page.)

IMPORTANT NOTICE.

REVISION OF CHARGES FOR TECHNICAL QUERIES.

The following important reductions and alterations have been made in the charges for diagrams, specially drawn up by the Query Department, and come into force immediately.

DIAGRAM.	CHARGE.
Crystal Sets	s. d. 0 6
One-Valve Sets	0 6
Two-Valve and Crystal (Reflex) ..	1 0
Two-Valve and Crystal (Reflex) ..	1 0
Two-Valve Sets	1 0
Three-Valve Sets	1 6
Three-Valve and Crystal Reflex ..	1 6
Four-Valve Sets	1 6
Multi-Valve Sets (straight circuit) ..	1 6

EXCEPT
SUPER-HETERODYNE DIAGRAMS,
all of which, irrespective of number of Valves used, are 2 6

Apart from diagrams specially drawn up, “P.W.” issues a series of twenty Sixpenny Blue Prints, which are obtainable from the Queries Department. A full list of the circuits covered appears fortnightly in **POPULAR WIRELESS.**

THE “POPULAR WIRELESS” CONTINENTAL BROADCASTING TIME-TABLE (continued from page 170).

Transmiss'n Starts G.M.T.	Ends G.M.T.	Station and Call Sign	Wave-length in metres	Frequency kilo-cycles	Days of the Week	Nature of Trans-mission
20.15	21.15	Radio-Geneva	760	394	Weekdays	Conc., Dance., News (A.T.S.).
20.15	21.00	Dresden	294	1020	Wed. (almost daily)	Talk and News.
20.30	21.00	P.T.T.*	458	655	Wednesday	Talk.
20.30	22.00	Dortmund*	283	1060	Saturday	Opera.
20.30	22.00	Munster	410	731	.. . . .	Relaying Dortmund
20.30	22.00	Eberfeldt	240	1249	.. . . .
20.30	21.00	Frankfurt-on-Main	470	638	Weekdays	News, Talk, Sport.
20.30	21.00	Radio-Paris	1750	171.3	Saturday	Concert.
20.30	21.00	Eiffel-Tower (F L)	2740	109.4	Sunday .. . . .	.. . . .
20.30	20.45	Radio-Toulouse	441&180	680 & 1666.6	.. . . .	Sports, News.
20.30	21.30	Radio-Lyon	280	1071	Daily	Orchestra.
20.30	21.30	Radio-Belgique	262	1106.8	Sunday	Concert.
20.30	22.00	Seraing-Radio	195	1538	Mon., Thurs., Sat.	.. . . .
20.30	20.40	Rome (I R O)	425	706	Weekdays	Weather, News.
20.30	22.09	Copenhagen*	340	882	Saturday	Dance.
20.30	20.45	Radio-Toulouse	441&180	680 & 1666.6	Weekdays	Press.
20.30	24.00	Madrid (E A J 4)	340	.. . . .	Sun., Mon., Thurs. ..	Concert.
20.40	22.30	Rome (I R O)	425	706	Daily	Opera or Concert
20.45	22.00	P.T.T.*	458	655	.. . . .	Talk
20.45	22.30	Radio-Paris	1750	171.3	.. . . .	Dance or Concert.
20.45	22.30	Radio-Toulouse	441 & 180	680 & 1666.6	.. . . .	Concert, Talk.
20.50	22.00	Koenigsberg	463	648	Sunday	News, Concert.
21.00	24.00	Madrid (E A J 6)	392	765	.. . . .	Concert.
21.00	22.00	Radio-Berne	301.5	995	Saturday	Dance.
21.00	22.30	P.T.T.*	458	655	Daily	Concert and Tests.
21.00	21.05	Rome (I R O)	425	706	.. . . .	Time Signals.
21.00	22.45	Oslo	382	785	.. . . .	Dance.
21.00	21.00	Salamanca (E A J 22)	355	845	.. . . .	Concert.
21.00	22.00	Frankfurt-on-Main*	470	638	.. . . .	Theatre or Concert.
21.00	23.00	Sokolnicchi (Moscow)	1010	297	Tues., Thurs., Fri. ..	News, Lect. or Con-
21.00	23.10	Barcelona (E A J 1)	325	923	Weekdays	cert.
21.00	21.10	Radio Catalana (E A J 13)	460	652	.. . . .	.. . . .
21.00	21.30	Breslau*	416	721	.. . . .	News, Sport.
21.00	21.15	Seville (E A J 5)	357	840.3	.. . . .	.. . . .
21.00	23.00	.. . . .	357	840.3	.. . . .	News, Talk, Concert.
21.15	22.30	Petit-Parisien*	358	865.9	Sat., Sun., Tu., Thurs.	Concert.
21.30	22.15	Eberfeldt	240	1249	Weekdays .. . . .	.. . . .
21.30	22.30	Rome (I R O)	425	706	Daily	Dance.
21.30	22.10	Dortmund	283	1060	Sunday .. . . .	.. . . .
21.30	24.00	Radio-Toulouse	441&180	680:1666.6	Weekdays	Concert or Play.
21.30	23.00	Berlin	505&576	504 : 521	Daily	Dance.
21.30	23.00	Koenigswusterhausen	1300	231	.. . . .	Relaying Berlin.
21.40	21.50	Lvngby (O X E)	2400	125	Weekdays	Weather.
22.00	24.00	Milan	320	937	Daily	Concert.
22.00	23.30	Cassel*	275	1091	Weekdays .. . . .	.. . . .
22.00	23.30	Frankfurt-on-Main	470	639	.. . . .	Relaying Cassel.
22.00	24.10	Bilbao (Viscaya) (E.A.J.11)	418	717	Daily	News, Concert.
22.00	23.10	Radio-Cima (E A J 19)	402	745.8	Weekdays	Speech, Music.
22.00	23.00	Hamburg*	395	759	Sunday	Dance.
22.00	24.00	Madrid (E A J 7)	373	804	Mon., Wed., Fri. ..	Concert.
22.00	21.00	Madrid (E A J 6)	392	764	Tuesdays and Fridays	.. . . .
23.00	23.25	Norddeich (K A V)	1800	166.6	Weekdays	Weather, News.
23.00	24.00	Radio-Geneva	760	394	.. . . .	Dance.
23.00	24.00	Vienna (O T W)	400	750	.. . . .	Tests (see Notes).
24.00	01.00	Seville (E A J 5)	357	840.3	Sunday	Concert.

NOTES.—Relay stations are mentioned under initial entry of main station. An asterisk (*) marks main station with relays working. The following stations may be occasionally heard testing: Reval, 350 m. (855 kc.); Milan (Sch. Teleg.); Riga, 488 m. (614 kc.) mostly 20.10 to 21.00; Bergen, 350 m. (856.6 kc.); Vienna (O T W), 400 m. (750 kc.) 07.45.—10.00. 17.00—19.00; Budapest, 588 m. (510 kc.); Amsterdam 700 m. (428.3 kc.); Asturias (E A J 12), 345 m. (872 kc.); Skieen, 201 m. (1493 kc.); Notodden; Barcelona (E A J 19), 300 m. (1009 kc.) PROJECTED STATIONS: Bratislava, 400 m. (733 kc.); Innsbruck (E.A.J., 1926); Trondheim; Tromsø; Stavanger; Christiansand; Rosenbrugel; Salzburg; Klagenfurt; Ceuta (Spanish Morocco); Varsow; Craew; Hammeren, 1900 m. (157.8 kc.); Seville E A J 21; Jyväskylä, Malaga. Grenoble temporarily closed. Dijon replaces on evening transmission.

HOW TO MAKE A LOUD SPEAKER.

(Continued from page 148.)

In Fig. 3 is shown a distinctive feature of the original instrument which improves reproduction in a manner hard to describe exactly. This is the side tube, a short length of tube, 1 in. in diameter, fixed over an orifice in the base of the horn. Volume is not reduced by any discernible degree by the presence of this free orifice, but reproduction is more natural, for, whereas orchestral items sound flat and "congested" without it, the inclusion of this device seems to relieve the "congestion," and reproduction approximates more closely to true binaural hearing.

The framework of the cabinet may be built according to the constructor's own ideas, and designs and dimensions will also depend upon the size of the horn. But here, also, all construction should be sound and solid to prevent unwanted vibration. If desired, the horn may be mounted upside down with the magnet system on top, when the adjusting screw becomes more accessible; but, in any case, this needs no further attention when once adjusted for best results.

FOREIGN RADIO NEWS.

From Our Own Correspondents.

International Radio.

THE use of radio is daily extending in every department of life, and particularly of international affairs. The fall of the French cabinet, which took place on Saturday morning at 6.45 a.m., was wireless to Berlin and immediately relayed to the express train on which the German delegation was travelling to Geneva to attend the meeting of the League of Nations.

Dr. Stresemann, the German minister of Foreign Affairs, on receiving the message within forty minutes of the fateful figures being read out in the French Chamber, was able, without interrupting his railway journey, to have a long talk with the Press at taché of the French Embassy in Germany, who was on the same train, and explore with him the possibilities of the French political situation. After which he was able to hold a conference with his colleagues on the effect which the fall of M. Briand was likely to have on proceedings at Geneva.

Wireless Torpedoes.

Secret experiments are being carried out in France of an invention by which it is claimed that the flight of air torpedoes can be controlled over distances of from 30 to 60 miles.

Technical experts from the military, naval and air departments were present at these tests, the result of which is being kept secret. From a usually reliable source, however, it is gathered that the tests were not completely successful. The principle of wireless control over bodies hurtling through the air was established, but in practice imperfections were revealed which it is hoped may soon be remedied.

Finland Reorganises Its Radio System.

The Finnish radio broadcasting system has now been reorganised on a sound basis. The main Helsingfors station uses 318 metres on Tuesdays, Thursdays and Sundays for the broadcasting of concerts, and these are relayed in the various districts by the three provincial stations: Iyvaskyla (561 metres), Uleaborg (233 metres) and Tamafors (360 metres).

The second Helsingfors station, using 500 watts only, broadcasts on the same days, half an hour later, at 6.30 p.m. Central European time, the programme lasting usually till midnight. The wave-length is 522 metres.

Finnish radio enthusiasts in addition to the home programmes, frequently listen to the Russian and Swedish station, so that they are well provided for and radio is winning new adherents daily.

RADIO PANELS

REGISTERED TRADE MARK

CROXSONIA

7" x 5" 1/2	8" x 5" 1/2
7" x 6" 1/3	9" x 6" 1/7
10" x 8" 2/1	11" x 8" 2/3
10" x 9" 2/4	12" x 8" 2/6
11" x 9" 2/7	12" x 8" 2/10
12" x 10" 3/1	14" x 10" 3/5

3/8" thick Post Free.

Money back guarantee that each and all Panels are free from surface leakage, Megger test Infinity. Callers, cut any size, & quote by post, or Phone Clerk-enwell 7853. Sample & Prices, post free to the Trade.

CROXSONIA CO., 10, South St., MOORGATE, E.C.

CAN YOU?

Obtain better value? Why waste time and risk spoiling components? I will build any set as described in this or other journal for cost of components only. Class work guaranteed. — **BROOKERS, 68, Cornbury Road, Rotherhithe, London, S.E.**

AMATEURS!

Buy YOUR wireless components and sundries at **KEENEST PRICES**. American and Continental equipment also stocked. List Post Free.

LIARSTON RADIO SERVICE (Mail Order Dept.), 4-5, Honey Lane Market, Cheapside, London, E.C.2

THE 'PHONE REPAIR SERVICE

Phones Rewound and Remagnetized ... 4/6
 Phones Remagnetized and Readjusted ... 2/-
 Loud Speakers and Transformers Rewound.
 Earcaps, Leads, Diaphragms. Postage extra.
The H.R.P. Co., 46, St. Mary's Road, Leyton, E.10

BANISH SOLDERING!!

Make your own High-Tension Batteries from pocket flash-lamp batteries. "Ezale-clip" takes the ordinary wander plug. Send your order to-day to

G. RIDLEY
 "Radio House," Dandas
 Mews, MIDDLESBROUGH
 Telephone 1366 M'bro.

PRICES:
 8d. dozen
 plus 3d. postage.
 6/9 Gross lots.

THE BROWN 'A'

at 22/6 or 'A2' at 15/- are the best for use with the P.W. Paper Diaphragm, Loudspeaker, Frames, etc. Stamp for List. **GOODMANS, 68, Farringdon Street, E.C.4**

PAY AS YOU LISTEN!!

Loud Speaker Sets of Fine Quality are supplied on terms to suit 4/- to 10/- all pockets. A postcard brings particulars. WEEKLY. **RADIAX LTD., Accessory House, Palmer Place, London, N.7.**

HEADPHONES 3/9 Only.

We have 700 pairs of Headphones, ALL-BRITISH manufacture, light aluminium headbands, 4,000 ohms resistance, 7 feet cords. Every pair is brand new, and tested before despatch. These are to be cleared at the exceptional price of 3/9 per pair, post paid. This is an offer which can never be repeated after present stock is cleared, so write NOW and make sure of getting your pair.

C. WILDE, Wireless Dealer, WILLESBOROUGH, ASHFORD, KENT

VALVES Repaired Quick

Let our valve making plant repair your broken or burnt out valves efficiently & promptly (most makes). Guaranteed equal to new. Bright emitters 5/-; "DE's" 2 and 3v types) 7/6. Power valves slightly more, see list. Not repairable: 8 P's WECC v.24, Concor D.E.s.

RADION Ltd., Bollington, Nr. MACCLESFIELD, Ches.
 Largest valve-repairing firm in the world. List Free.

SCRAP YOUR H.T. BATTERY

and buy H.T. Supply Unit complete with Flex and adapter to plug in ordinary lamp holder. Running cost rd. per week. Money back guaranteed. Complete with full instructions 30/- postage 1/-. **CONTINENTAL SUPPLIES, 497, Old Ford Road, London, E.**
 NOTE: — To work off D.C. Current only.

SPINK'S GENUINE EBONITE

Passed severe tests. No leakage. 3/16 thick.

7 x 5 1/4	7 x 6 1/8	10 x 8 2/8	10 x 9 2/11
11 x 9 3/3	12 x 10 3/10	14 x 12 5/3	8 x 5 1/5
9 x 6 1/8	11 x 8 2/10	12 x 8 3/2	13 x 10 4/4
15 x 9 4/8	8 x 8 2/2	8 x 7 1/10	12 x 9 3/7

Any size cut (also 3 in. and polished) post free. Stamp for sample. Other components equally cheap. Write for lists. Shrouded Transformers, 7/6. All genuine new goods. Cabinets in sections (oak). Everything on approval. Direct: Jacobean Factory, Somerton, Somerset.

REPAIRS

Headphones and Loud Speakers rewound to any resistance and remagnetised

EQUAL TO NEW!
 at small cost. Our 27 years' experience of electrical instruments and wire winding is your guarantee. A customer writes: "— thanks to the excellent manner in which it was reconditioned, the results achieved have been astounding."

VARLEY Magnet Co.
 Repairs Dept.
 Woolwich, S.E.12.

Proprietors: Oliver Bell Control Ltd.

2-VALVE AMPLIFIER, 35/-

1-Valve Amplifier, 20/-, both perfect as new; Valves 4/6 each, smart Headphones, 8/6 pair; new 4-Volt Accumulator, celluloid case, 13/-; new 66-Volt H.T. Battery, guaranteed, 7/-; 2-Valve All-Station Set, £4. Approval willingly.
P. TAYLOR, 57, Studley Road, Stockwell, LONDON

REPAIRS SETS PHONES TRANSFORMERS

Officially Approved by Radio Association.
 ALL WORK GUARANTEED LOWEST RATES 24 HOUR SERVICE
JOHN W. MILLER, 68, Farringdon St., E.C.4.
 Phone: Central 1950.

A POCKET KNIFE FOR EVERY WIRELESS CONSTRUCTOR.

Contains screw-driver, file, insulation scraper and one useful blade. Made for me in Sheffield by a firm renowned for the 3/3 post quality of its Cutlery. Satisfaction guaranteed. 3/3 free
From H. OSBORN, 27, High St., DAVENTRY.

CROIX Transformers, 5-1 & 3-1, 4/- each, post 1d.

BRUNET Transformers, 5-1 & 3-1, latest shrouded model 8/6 ea. post 6d.

RADIO MICRO Valves, latest type, 3-4 v. '06 amp. 8/9 each, post 6d.

RADIO MICRO Power Valves, 4 v. 25 amp. 11/9 each, post 6d.
 All goods guaranteed genuine.
CONTINENTAL SUPPLIES, 497, Old Ford Road, LONDON, E.

LITTLE WIRELESS GADGETS

MAP

SMALL PARTS TO THE TRADE.

MAP Co., 246, Gt. Lister St., Birmingham.

There!



A Filament that can be tied in knots after 1000 hours life

A FILAMENT that remains ductile so that it can be tied in a knot after 1000 hours life is an achievement that assures **VASTLY INCREASED VALVE LIFE**

This wonderful filament is the key feature of Mullard P.M. Valves. In Mullard P.M. Valves the filaments are so economical that no glow is visible during operation, and they require

ONLY ONE-TENTH AMPERE

In addition the reception they give is free from all microphonic noises.

If you use a 4-volt accumulator or 3 dry cells

ASK FOR THE P.M.3

A general purpose valve for every circuit

16/6

ASK FOR THE P.M.4

The finest loudspeaker valve ever produced

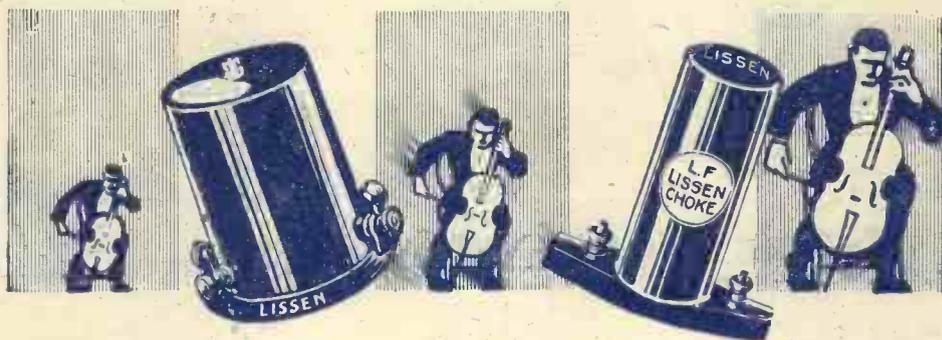
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Mullard

THE MASTER VALVE



Building up volume without a trace of distortion

Lissen Amplifying Devices build up whispers into voluminous sound, yet never do they sacrifice tone purity for the sake of volume. Add a 2-valve Amplifier built from Lissen parts to your receiver and it's just as though the player had changed his instrument for one that was much larger—much more powerful. But volume is the only thing you add—harshness and distortion have no place in a Lissen Amplifier.

For the first L.F. stage use the Lissen T.1 Transformer, Price 21/-. Then follow this with a Lissen L.F. Choke, Price 10/-; or if you prefer it, use Lissen Chokes throughout.

When building a Choke Coupled Amplifier it is always advisable to use a variable grid leak having a wide range of variation. Use the Lissen Variable Grid Leak—you can obtain any resistance between



$\frac{1}{4}$ and 12 megohms, smoothly, gradually and *noiselessly*. One hole fixing, of course. Price 2/6.

The capacity of the Lissen Fixed Condenser recommended for choke coupled stages is .01 mfd., Price 2/4. It is also worth while to fit Lissen Fixed Condensers in every stage of your receiver. Accurate to within 5% of their marked capacities they will not vary and will not leak.

NOTE THE NEW PRICES:
.0001—.001 1/3 .002—.006 2/-
(mica dielectric).

With each .0002 and .0003 there is included free a pair of clips to take a grid leak.



LISSEN

THERE IS NO 'WEAKEST LINK' IN THE LISSEN CHAIN

Lissen Limited, 8-16, Friars Lane, Richmond, Surrey

Phone: Richmond 2285 (4 lines).

Grams: "Lissenium, Phoné, London."

L. 18