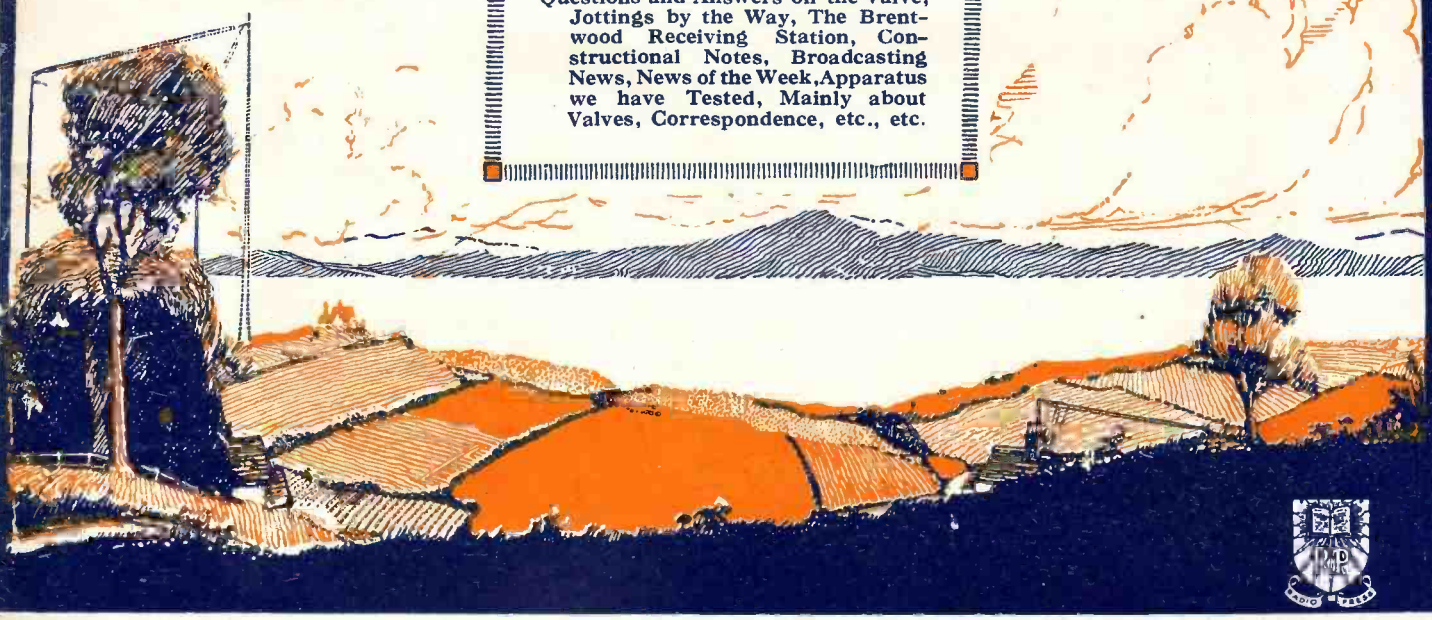
Wednesday, 6d. Net. Vol. 2. No. 3. August 1st, 1923.

Wireless Weekly

and The Wireless Constructor.

Vol. 2. No. 3.

CONTENTS



More About the New Flewelling Receiver.

By A. D. Cowper, M.Sc.

Learn more quickly from RADIO PRESS Books——

AFTER the first few weeks of Wireless your enthusiasm, perhaps, seems to wane and your progress gets slow.

Then is the time to buy one or two good Books on the subject and add theoretical information to your practical knowledge.

Once you have learnt some of the "reasons—why" in Wireless—and anyone with ordinary intelligence can quickly grasp its essentials—your progress will be rapid.

And Wireless becomes a greater pleasure than ever when you know, for instance, how your Set works, how high-frequency amplification increases its range while low-frequency amplification only adds to its volume.

Your Wireless friends, too, are probably worrying you for information. Get them a copy of one or two of the most elementary Radio Press Books, such as *Wireless for All* and *Simplified Wireless* When they have absorbed the explanations contained in these Books they'll be more ready to appreciate your assistance.

RADIO PRESS LTD.,
Devereux Court, STRAND, W.C.2.

Complete List.

	Price.	Post Free.
1. Wireless for All ..... John Scott-Taggart, F.Inst.P.	-/6	-/7½
2. Simplified Wireless .. John Scott-Taggart, F.Inst.P.	1/-	1/1½
3. How to Make Your Broadcast Receiver .. John Scott-Taggart, F.Inst.P.	1/6	1/7½
4. How to Erect Your Wireless Aerial ..... B. Mittell A.M.I.E.E.	1/-	1/1½
5 The Construction of Wireless Receiving Apparatus ..... P. D. Tyers.	1/6	1/7½
7 How to Make a "Unit" Wireless Receiver ..... E. Redpath	2/6	2/8
9 Wireless Valves Simply Explained.... John Scott-Taggart, F.Inst.P.	2/6	2/8
10 Practical Wireless Valve Circuits ..... John Scott-Taggart, F.Inst.P.	2/6	2/8
11 Wireless Licences and How to Obtain Them ..... E. Redpath.	1/-	1/1½
Elementary Text-book on Wireless Vacuum Tubes ..... John Scott-Taggart, F.Inst.P.	10/-	(Post free)

¶ **Those printed in heavy type have been published recently**

Radio Press Books
— a complete Wireless Library

Wireless Weekly

Vol. 2, No. 3
Aug. 1, 1923

CONTENTS

Editor: JOHN SCOTT-TAGGART, F.Ins P.
Assistant Editor: E. REDPATH.

Radio Press, Ltd.
Publishers of Authoritative Wireless Literature
DEVEREUX COURT, STRAND, W.C.2
Tel.—Central 4393.

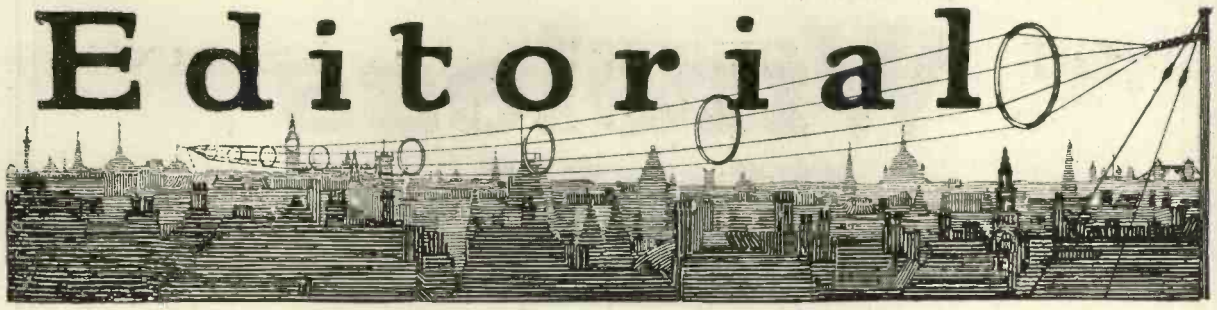
Advertisement Managers: SCHEFF PUBLICITY ORGANIZATION LTD., 125, Pall Mall, London, S.W.1
Tel.—Regent 2440.

Scientific Adviser:
Prof. G. W. O. HOWE. D.Sc., M.I.E.E.
Advisory Editors:
Prof. R. WHIDDINGTON. M.A., D.Sc.
Prof. C. L. FORTESCUE. M.A., M.I.E.E.

Staff Editors:
J. H. T. ROBERTS. D.Sc., F.Inst.P.
E. H. CHAPMAN, M.A., D.Sc.
A. D. COWPER, M.Sc.
G. P. KENDALL, B.Sc.
A. L. M. DOUGLAS.
R. W. HALLOWS. M.A
S. G. RATTEE.
P. W. HARRIS

All correspondence relating to contributions is to be addressed to the Editor of "Wireless Weekly."

Editorial



The Radio Society and Transmitters

IN our issue of July 18th we put forward our opinion that the British Wireless Relay League should hand over its duties to a sub-committee of the Radio Society of Great Britain. We also made it quite plain that it was our view that the sooner the Radio Society assumed definitely the authority which should belong to it the better, and that the weak policy of allowing separate societies to grow up should cease.

Since then we have had remarkable evidence that our opinion is shared by the whole country—ample proof of the value of an independent journal dealing with matters of general policy.

That the Radio Society has acted in a manner contrary to the wishes of the other societies in the country is not to be doubted. We have circularised the different societies in the country, and replies are coming in by every post to this office. Up to the present we have received communications from 43 societies; 40 of these societies agree with the policy outlined in our Editorial; two societies agree with us as regards our attitude towards the Wireless Relay League, but are in favour of the formation of a separate society of wireless transmitters affiliated to the Radio Society. The other society declares that it has not yet formed an opinion.

Now that we have obtained for the Radio Society of Great Britain some indication of the wireless public's views on the matter, we hope that they will take unto themselves the responsibility for wireless transmission work in this country, and that they will form a sub-committee dealing with this important phase of experimental work.

Most interesting of all, we have received from Mr. Evans, the organiser of the British Wireless Relay League, a letter which we reproduce on page 126. This letter is a very frank and broadminded communication. As we pointed out in our Editorial, Mr. Evans has done excellent work for experimental wireless, and in more than one case has given the lead to the Radio Society. It is, however, a very important question of principle, and our principle, briefly stated, is that the Radio Society of Great Britain should strengthen its organisation by the introduction of provincial talent, should make certain that it represents all the provincial societies, and not merely the London area, and that it should refuse to give support to organisations which will lessen its own authority. Our aim is to strengthen the Society, not to weaken it, but a reshuffling of policy must inevitably accompany their acquisition of further authority. It must be remembered that they are the Radio Society of Great Britain by the will of the provincial societies. The Society must not be the Wireless Society of London under the disguise of a national institution.

There were not a few who, when the Radio Society set up a transmitting station in London last year, said that they were following the lead of Manchester, and intended to get all the credit. That such feelings could be aroused is a plain indication that the parent society is still looked upon by some as the Wireless Society of London. We believe, however, that it is the duty of the Radio Society of Great Britain to be the Radio Society of Great Britain, and not the Wireless Society of London, and if it permits the control of experimental transmission to pass into the hands of another body, whether that body is affiliated or not to it, it might just as well change its name back to the Wireless Society of London.

(*Continued on page* 106.)

THE NEW SIMPLIFIED FLEWELLING SUPER CIRCUIT

By A. D. COWPER, M.Sc.

Mr. Cowper, one of our Staff Editors, it will be remembered, won the first prize in the Armstrong-Super Competition held by the Radio Society of Great Britain.

GREAT interest has been displayed amongst wireless experimenters in the Flewelling single-valve receiver, in which the quenching-frequency oscillation of high audio or almost super-audio frequency (which controls the radio-frequency oscillations built up by excessive reaction) is generated by a kind of gridleak howl, adjusted to the required frequency by a variable gridleak. A considerable simplification of the original circuit, which, it will

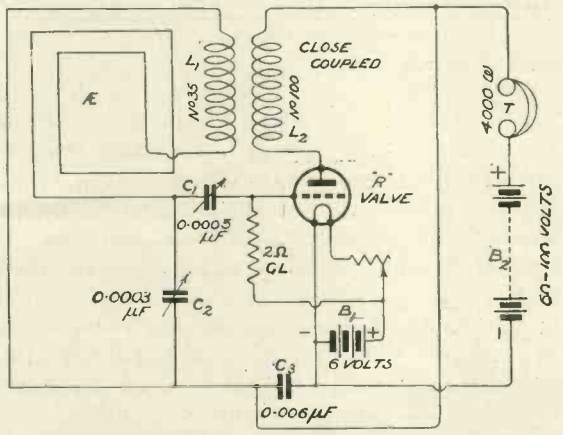


Fig. 1.—The form of Flewelling circuit discussed in this article.

be remembered, involved two variable gridleaks and three large condensers, has been quite recently suggested by the author of the former circuit; in this only one large condenser of 0.006 μF capacity is used, and a single variable gridleak. The circuit is arranged as shown in the diagram, which is similar to that given by Flewelling. The quenching oscillation is generated by the combination of condensers and gridleak when the reaction coil is closely coupled to the tuning inductance.

Practical trial of this circuit, especially in the light of considerable experience with various versions of the single-valve original Armstrong circuit, suggested immediately some slight modifications, which give considerable stability and very clear reception without risk of causing interference. As outlined above, readable signals were obtained on a capacity aerial alone (as in the earlier version of the Flewelling circuit) on loud local telephony at a dozen miles; better signals were obtained on an earth-lead alone. With aerial and earth, the circuit seemed paralysed, and was unsatisfactory. The best results were with a 2 ft. square frame aerial with 15 or more turns of No. 22 d.c.c. wire spaced $\frac{1}{4}$ in. and tapped every turn after the tenth. With this, and especially with the slight modification to be described, very good signal strength and exceptionally clear and distortionless telephony were obtained as soon as the right values of inductance and reaction coil, etc., were found—a matter of a few minutes' trial only.

The series condenser shown by Flewelling was safely omitted with the frame aerial. A small fraction of the capacity of a 0.0003 μF or 0.0005 μF variable condenser in parallel with the frame and fixed inductance gave fine tuning; only the very minimum of this must be used for good signal strength. For about 300 to 400 metres No. 35 duo-lateral for the fixed inductance, and No. 100 for the reaction coil, gave best results; above 400 metres wavelength, Nos. 50 and 150 respectively. These must be coupled as closely as possible and fixed, as they are relied upon to generate the quenching oscillation as well as ordinary reaction, unlike the original Armstrong arrangement, where very loose coupling is called for. By analogy with the Armstrong circuit, the arrangement of gridleak which

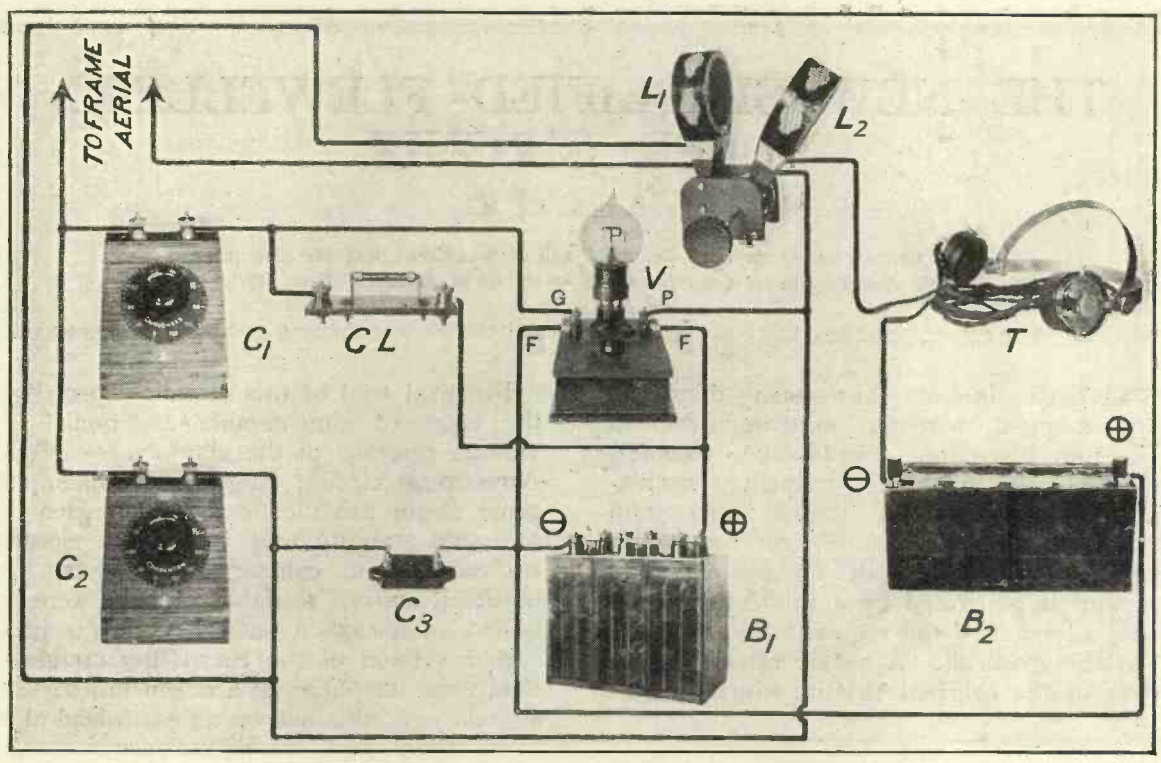


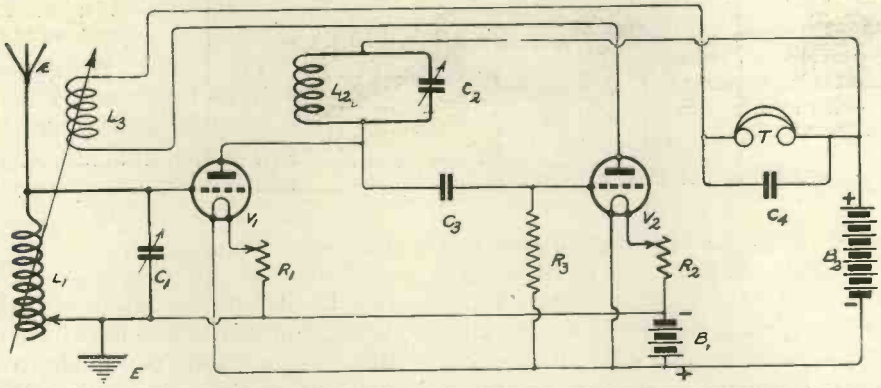
Fig. 2.—A pictorial wiring diagram of the new circuit.

has been found to give such excellent stability in that circuit was tried here, with the expected results—a 2 megohm gridleak (or corresponding value on a reliable adjustable gridleak) to the L.T. plus gave good stability and clear signals, fine adjustment being made here by a variable grid-condenser, actually of 0.0005 μF. Again as in the Armstrong, the former could be replaced by a 4 or 5 megohm leak to the H.T. plus with good results. In every way the circuit comports itself precisely as the original Armstrong as modified by the writer, with the same limitations as to signal strength, the same remarkable range (e.g., the Ecole Supérieure was readily picked up on the single valve and small frame as soon as the receiver was set up), the same stability and freedom from stray-capacity troubles, and so on. If nearly or quite super-audio frequency for the quenching-frequency oscillation is obtained, by suitable adjustment of variable grid-condenser and gridleak, just as in the other circuit, the signal strength suffers, and also the stability.

Wireless Weekly Circuits

No. 16.

A Two-Valve Receiver with Reaction

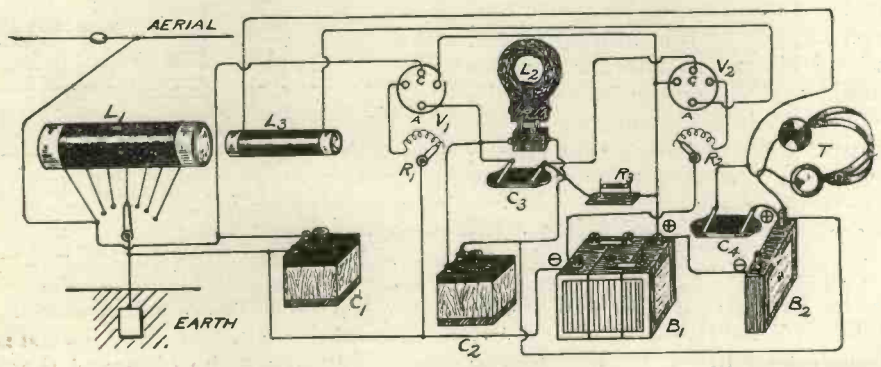


COMPONENTS REQUIRED.

L_1 and
L_2 : Preferably variable inductances.
L_3 : A reaction coil coupled to L_1.
C_1 and
C_2 : Variable condensers having a capacity of 0.0005 μF, or 0.001 μF.
C_3 : A grid condenser having a capacity of 0.0003 μF.
R_3 : A gridleak of 2 megohms resistance.
T : High-resistance telephone receivers.
C_4 : Fixed condenser of 0.002 μF.
B_2 : 60-volt high-tension battery.
B_1 : 6-volt accumulator.
R_1 and
R_2 : Usual filament rheostats.

GENERAL NOTES.

In this circuit reaction is introduced from the anode circuit of the second valve to the grid circuit of the first, and the reaction effect is therefore felt both by the circuit L_1 C_1 and the circuit L_2 C_2. The circuit works very well, but it may not be used for the reception of British broadcasting, as there is reaction on the aerial circuit. For this reason dimensions of coils are not given. The inductance L_3 may be made much smaller than the usual reaction coil, because the high-frequency currents have been amplified twice.



SWITCHING WITH PLUGS AND JACKS

Experimenters will appreciate the suggestions contained in the following article.

THE plug and jack system of switching in wireless receiver circuits offers numerous advantages which those building their own sets would do well to consider.

The first of these is economy. The jacks are very economical in space, both on the panel front and within the instrument itself. They require the minimum amount of fitting

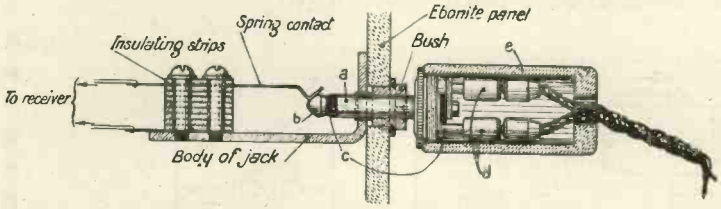


Fig. 1.—A "single open" jack.

(one hole drilled in the panel being all that is necessary), and their use makes it possible to effect a considerable saving in batteries and valves by permitting the operator to throw out of circuit all apparatus not actually in use.

Besides their economy, jacks have undoubted advantages in the matter of efficiency. The spring blades are of German silver, and the contacts, which are generously proportioned, are of sterling silver, thus ensuring low resistance connections which will not burn or oxidise with the passage of current. There are, further, no nuts or sliding contacts to work loose.

Finally, for the experimenter, jacks are particularly useful, as they enable him to switch rapidly from one circuit to another for the purposes of making comparison between the instruments with which he is working.

The most simple form of jack is that known as the "single open" type, which, together with a plug, is illustrated in Fig. 1.

The body of the jack consists of a strip of heavy gauge brass, bent at right angles and tapped to receive a bush. The bush, which has a hexagonal head, is used to secure the jack to the panel, as will be seen from the sketch.

Attached to the body of the jack, and supported at the correct height by a pillar of insulating material, is a spring leaf of "German silver," the end of which is bent up into the form of a "V." The metal screws which support the pillar are insulated from the spring leaf to the extent of withstanding 1,000 volts pressure on test.

The plug, as will be seen, consists of a hollow spindle (*a*) down the bore of which runs a shaft, terminating in a knob (*b*).

The shaft is insulated from the spindle by ebonite collars (*c*), and the shaft and spindle are brought out to two quick-attachment terminals (*d*), which carry the connecting wires and are covered up by the insulating cap (*e*).

When the plug is inserted into the jack, the knob on the shaft is engaged by the spring contact, while the spindle is forced into firm contact with the bush by means of the pressure of this spring upon the knob.

It will now be seen that if a pair of headtelephones is connected to the terminals on the plug, and the jack is joined to the receiving circuit as shown in Fig. 1, then the telephones will be joined in series in the circuit when the plug is inserted.

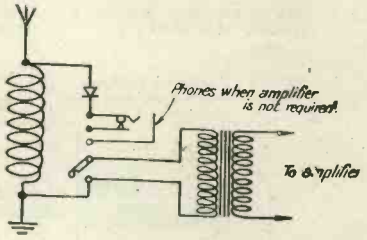


Fig. 2.—A "single closed" jack.

This is the most simple use of the plug and jack.

Fig. 2 shows what is known as a "single closed" jack.

Here it will be observed that there are two spring contacts which, in the absence of the

plug, press against each other at the silver contact points.

When such a jack is included in the circuit, Fig. 2, a low-frequency amplifier can be joined across the auxiliary terminals. The jack being of the closed type, current will still flow in the crystal detector circuit even when

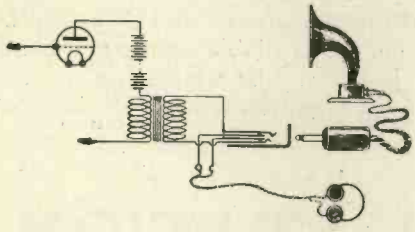


Fig 3.—A "double closed" jack.

the telephones are withdrawn. (This would not be the case if the jack were of the open type.)

If now it is desired to employ ordinary crystal reception, the telephones are plugged into the jack, and the auxiliary terminals may be short-circuited, although this is not essential if the amplifier contains a transformer primary across its "IN" terminals.

In Fig. 3 is shown a "double closed" jack connected into a circuit in such a manner that before the plug is inserted, head-telephones are in circuit, whereas when the plug is put in, a loud-speaker is brought into use and the telephones are automatically disconnected.

The double closed jack is also used in multi-valve sets for automatically disconnecting an

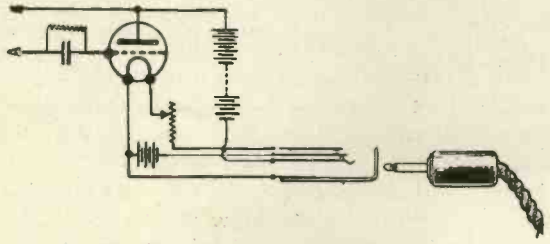


Fig. 4.—A "single filament" jack.

intervalve transformer and connecting a pair of telephones in its place.

So far we have dealt with the jack only as a means of bringing in and cutting out telephones. This, however, by no means completes the number of uses to which it may be put.

Fig. 4 represents a "single filament" jack, which, as its name implies, is a jack used to control the filament current of valves. It resembles the single open jack with the exception that in addition to the long spring leaf which touches the plug, there are two shorter springs.

These are normally "open," but when the plug is inserted a fibre block on the long spring leaf presses upwards and forces them together, thus closing the circuit which is connected to them in this case the filament circuit of a valve.

It will be noted that the jack still controls the telephones attached to the plug, and that the one action of inserting the plug, lights up the valve and at the same time brings the telephones into the circuit of that valve.

A "double filament" jack is illustrated in Fig. 5.

This is a combination of the double closed and the single filament types. It can very

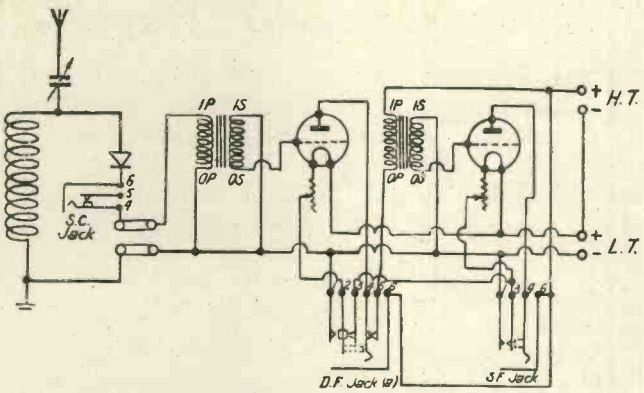


Fig. 5.—A "double filament" jack

conveniently be used in a multi-valve amplifier for the purpose of disconnecting valves and transformers which are not for the moment required. It will be seen that when the plug is inserted, contacts 4 and 5 are opened, thus bringing the telephones into the plate circuit of the first valve and cutting out the primary of the second intervalve transformer which is not required. Similarly contact 2 is moved away from 3 and into contact with 1, thus lighting up the filament of the first valve.

From a short study of Fig. 5 it will be evident that the telephones may be plugged in at any of the three jacks shown, and that in each case only that portion of the instrument which is required is brought into use.

Jacks can be used to control any desired number of stages of low-frequency amplifi-

cation, a "double filament" being placed in the intermediate positions, and a "single filament" in the circuit of the last valve.

It is not very usual to control stages of high-frequency amplification by means of jacks, but this could be done by placing a "single open" jack in the grid circuit of each H.F. valve, joining a plug to the aerial terminal of the set, and plugging direct into the required valve.

Besides being obtainable ready for panel mounting, jacks can also be supplied mounted in ebonite boxes with the connections already soldered on and brought out to external terminals. This method of mounting makes them particularly suitable for use in sets where the tuner and amplifiers are built up on the "unit" system.

There are many uses to which plugs and jacks may be put, other than those already dealt with in this article, and complete books of diagrams are available on the market showing how jacks may be adapted to the various circuits most commonly met with in practice.

THE MANCHESTER STATION

In the following short article, contributed by one of our Manchester Correspondents, are given the latest happenings at 2ZY.

THURSDAY evening, August 2nd, marks the final broadcast transmission of the Manchester Station from the works of the Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park. This final programme promises to overflow with surprises and comical stunts, and it behoves all those radio enthusiasts who desire to hear something out of the ordinary run of broadcast transmissions to get right on to 385 metres—and stay there.

Mr. Percy Pitt, controller of music for the British Broadcasting Company, Ltd., paid a special visit to the Manchester Station on July 20th. The object of his visit was to examine the musical arrangements and methods, and give advice to the staff.

To those who have followed the evolution of 2ZY from its inception it will be a matter for surprise if Mr. Pitt succeeds in finding any room for improvement. Those of us who are able to receive other broadcasting stations, not excluding 2LO, will agree that the high state of efficiency of the Manchester Station has been most evident. As a musical and entertaining medium it is second to none, and its artistes are of an unusually high order. Mr. Kenneth Wright has succeeded in gathering about him a staff of which any station director would be proud.

On Friday, August 3rd, the Manchester Station will make the first broadcast transmission from its new and permanent home in Dickenson Street, off Portland Street. Situated in the centre of the city and within a few hundred yards of the most important music halls, theatres and the well-known Free Trade Hall, the possibility of permanent land-line connections with these places would appear to be a thoroughly practical proposition.

We may yet enjoy the annual Christmas season feast of music from a microphone transmitter in the Free Trade Hall by listening-in to the one hundred instrumentalists of the renowned Hallé orchestra supported by one of the largest organs in the North of England. The rendering of the "Messiah" by this combination as accompaniment to choir and soloists of the first rank has become an annual Christmas institution in Manchester.

There will be some ceremony attendant upon the opening of the new studio in Manchester, and Lord Gainford (chairman of the British Broadcasting Co.) is expected to be present. The band of the Irish Guards has been specially retained for this occasion, and the programme is to be a special one.

The change from Trafford Park to the centre of Manchester, a distance of about four miles, will no doubt have the effect of creating widespread dismay in the hearts of crystal users on the Stretford side of the city, to whom signals were previously of great strength.

Questions & Answers on the Valve

A COMPLETE COURSE ON THERMIONIC VALVES

By JOHN SCOTT-TAGGART, F.Inst.P., Member I.R.E., Author of "Thermionic Tubes in Radio Telegraphy and Telephony," "Elementary Text-book on Wireless Vacuum Tubes," "Wireless Valves Simply Explained," "Practical Wireless Valve Circuits," etc., etc

PART XIV

(Continued from Vol. 2, No. 2, page 57.)

What is meant by the term "High-frequency Coupling"?

This means the method of transferring the amplified high-frequency currents produced in the anode circuit of one valve to the grid circuit of the next.

What is meant by the term "Tuned Anode Coupling"?

Tuned anode coupling is the method of coupling the anode circuit of one valve to the grid circuit of the next by means of a single tuned anode oscillation circuit.

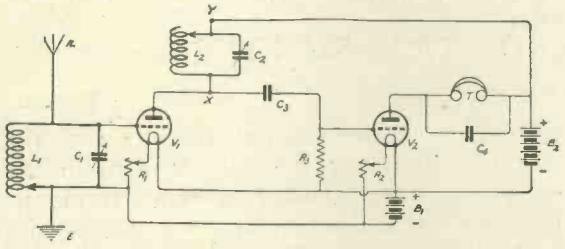


Fig. 1.—"Tuned anode" H.F. coupling.

How are the High-frequency Potentials communicated to the Grid of the Valve?

If we simply regard the tuned anode circuit L_2, C_2, we will see that the point X will have a high-frequency potential with respect to the point Y. The potentials across X and Y will be high-frequency ones, and they will be stronger than those across the grid and filament of the first valve. The point Y is connected to the positive of the high-tension battery B_2. The high-tension battery itself does not affect, in any way, the high-frequency potentials across X and Y. The point Y is, therefore, really at the same potential, as regards high-frequency currents, as the negative terminal of the high-tension battery, which, in turn, is connected to the filament of the second valve. The point Y is, of course, at a positive potential of, say, 60 volts, with reference to the filament; but, since this 60 volts is not communicated to the grid of the second valve owing to the condenser C_3, it will be clear that the only potentials communicated to the grid will be those established across the oscillation circuit XY. The point X is connected to the grid through the condenser C_3, while the point Y is connected to the filament of the second valve through the high-tension battery B_2, which does not affect the high-frequency currents.

We can, therefore, say that the circuit L_2, C_2, is not only in the anode circuit of the first valve, but is also in the grid circuit of the second valve.

What other methods of Coupling Valves are used besides Tuned Anode Coupling?

1. Tuned transformer coupling.
2. Aperiodic transformer coupling.
3. Transformer coupling in which one winding only is tuned.
4. Reactance-capacity coupling.
5. Resistance coupling.

Explain the action of Tuned Transformer Coupling.

Fig. 2 shows a theoretical circuit in which tuned transformer coupling is used. It will be seen that in the anode circuit of the first valve there is a tuned oscillation circuit L_2 C_2, the inductance L_2 being coupled to another inductance L_3, which, in turn, is tuned by means of the variable condenser C_3. This circuit L_3 C_3

is connected in the grid circuit of the second valve, which acts as a detector, a leaky grid condenser being provided for that purpose. The circuit $L_2 C_2$ is tuned to the same fre-

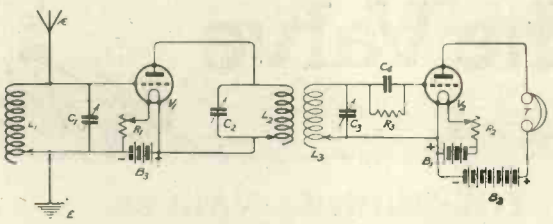


Fig. 2.—Tuned transformer coupling.

quency as the incoming signals, and therefore we find in this circuit very much stronger oscillations than those in the aerial circuit. Since $L_3 C_3$ is also tuned to the same wavelength, and since L_3 is coupled to L_2, the energy in the circuit $L_2 C_2$ will be transferred to the circuit $L_3 C_3$ which will now contain the amplified oscillations. These oscillations are now detected by the valve V_2 and produce the signals in the telephones T.

Draw a practical Circuit embodying the Tuned Transformer method of Coupling.

Fig. 3 shows a practical circuit in which a single accumulator and single high-tension battery are used. The circuit remains exactly the same as before as regards its principle of action. It will be noticed that the gridleak may now be connected directly across the grid condenser, as the high-tension battery would not, in any case, affect the potential of the grid of the second valve.

What are the advantages and disadvantages of Tuned Transformer Coupling?

Tuned transformer coupling is very selective and helps considerably to lessen interference

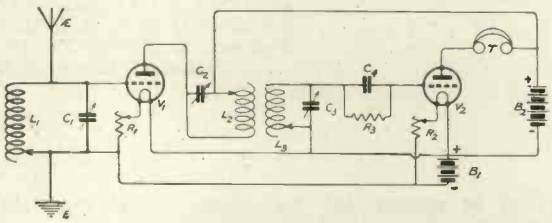


Fig. 3.—The practical form of Fig. 2.

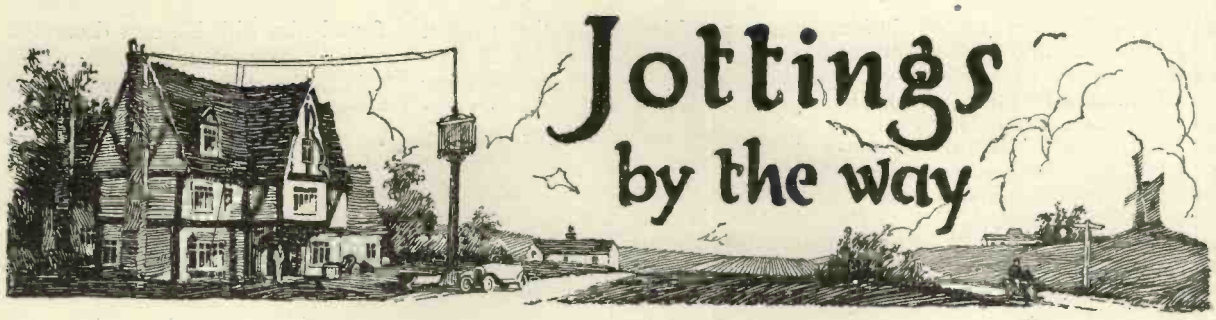
from other stations The principal disadvantage of the method is that two separate circuits require tuning, whereas with the tuned anode method of coupling only one single oscillation-circuit is necessary.

THE RADIO SOCIETY AND TRANSMITTERS

(Continued from page 98.)

Mr. Evans, judging by his letter, is apparently more anxious to shield the Radio Society than the Wireless Relay League. The failure of the British Wireless Relay League to gain the support and confidence of wireless transmitters, and the fact that our own investigations have resulted in certain decided opinions is a clear indication that wireless transmitters in this country prefer to acknowledge the authority of the Radio Society. Our criticism is that the policy of patronising sectional societies is a mistake, and how such criticism can be called unfair in view of the almost unanimous support from other parts of the country is more than we can understand. As regards any difficulty which the Radio Society has met with, the country knows perfectly well that the Radio Society of Great Britain has received every encouragement from the Government and other bodies to assume full authority, and the Post Office would, we are certain, prefer to deal with one central authority than with a number of sectional societies, whatever their connection with the Radio Society of Great Britain.

It is now for the Radio Society to take the next step, and now that they know they have momentarily lost touch with public feeling in the matter, we trust that they will withdraw their support from the Wireless Relay League and form a sub-committee to deal with transatlantic tests and other matters which concern experimental transmitters.



The Genuine Article.

MANY readers whose wireless career dates since last autumn will by now have made the acquaintance for the first time of really good atmospherics. Like picnics, straw-hats and river girls, they flourish during the hot weather. You may, and probably do, have feeble imitations of the genuine article during the cooler months, but it is not until Old Sol has put in a few days of his best work that atmospherics which seem about to rend the 'phones asunder and strew the floor with their scattered fragments, come to greet our ears when they are listening for things of quite a different kind.

To-day, after a week of hot weather, they are surpassing themselves. My mother-in-law, who, flying in the face of the gospel preached by our most eminent comedians, is a very charming person—this is really true, though I should feel bound in any case to say it, since having become a radio enthusiast she now reads *Wireless Weekly* like all the best people—my mother-in-law, then, dropped in to hear 2LO's Sunday afternoon concert which, marvel of marvels, came through to perfection. But when later in the evening she asked for Radiola I could produce nothing but crackles, rumblings, bangs and sizzles.

Hoist on my own Petard.

Delighted to be able to give for once a truthful explanation of the set's misbehaviour, I told her what it was. You may judge of my feelings, you may imagine how just wrath, righteous indignation and a sense of injured virtue were mingled in my bosom when she smiled indulgently and said that I could hardly hope to work that on *her*. She pointed out that I had in the past explained to my readers that all defects in reception should be put down unhesitatingly to atmospherics, and that I had even described the means of producing them artificially in case the loud-speaker failed, as loud-speakers will, to respond to the touch of the switch. She made it very clear that she did not believe a word of it.

Now was not this a cruel blow? I have lied readily on past occasions when trouble arose, and even my tallest excuses eked out with a few fine long words, mostly invented for the occasion, have been swallowed quite readily. In fact my experience has been that the greater the lie the more genuinely sympathetic one's friends have been. But here was I telling the truth, the whole truth, and nothing but the truth and yet utterly disbelieved. My most fervent asseverations produced nothing but polite incredulity. I was utterly discredited. My name in fact was mud.

Professional Secrets.

A correspondent has been kind enough to ask me to provide some more explanations of wireless terms. Realising how useful those already given must have been to persons called upon to expound the mysteries of wireless in simple language I hasten to oblige. The average text-book is far too dry. It tells you baldly that the energy stored up in a condenser is directly proportional to the capacity of the condenser and proportional to the square of the voltage applied to it, or something of that kind, and leaves it at that. You may, the author implies, put *that* in your pipe and smoke it. There is nothing cordial or friendly about the atmosphere, no lightening of the burden that the brain must bear.

Yet there is nothing really fearsome, as I shall show, about most of the Terrible Terms of wireless. They are merely shibboleths invented by the committee of the Experts' Union to keep the vulgar horde, people like you and me, from getting to know too much. All professions protect themselves in the same way. No self-respecting doctor would talk of a black eye; he would refer to it as a contusion of the orbital process with pronounced extravasation into the surrounding tissues. A headache to him is cephalalgia. This makes you feel that you are getting your money's worth.

Wireless Made Easy.

Aerial.—Popular garden ornament.

Alternating Current.—Electricity with a wobble in it.

Atmospherics.—Valuable excuse for noises made by high-tension battery.

Battery.—See *Assault.*

Buzzer.—Appliance that makes a noise like an infuriated bluebottle. Used for finding ticklish spot in crystal's ribs.

Circuit.—Takes you back to where you started from. Ever tried arguing with the wife?

Faults, How to Prevent Recurrence of.—Try the coke-hammer.

Flux.—Messy compound that prevents solder from sticking.

Ground.—Term used by Americans, who are too modest to speak of "my Earth."

MHO.—An ohm turned inside out. Half a mho is the unit of expectation.

Oscillation.—Practice indulged in during broadcasting hours. Produces squeals. Not to be confounded with osculation, though times and results are similar.

Reluctance.—Feeling that comes over magnates when asked by income-tax man to part. Delay in handing over what they've got is called "hysteresis." As resistance is always anticipated, envelope containing demand note is tastefully marked O.H.M.S.

Spark Signals.—Iddy-umpties that ping when 2LO is working. See National Physics Laboratory.

Tight Coupling.—See *Jazz.*

Watt.—If you multiply volts by amperes, watt is the answer?

Wireless.—New hobby. So called because any receiving set contains several miles of wire.

A New Use.

I have often felt that it is a pity that we cannot find some employment for the aerial during the time that it is not in use for its legitimate purpose of "snatching random oscillations from the boundless ether" (I quote from that great organ, *The Little Puddleton Gazette*). Its mast can, of course, be employed as a flagstaff on such occasions of rejoicing as the anniversary of the Battle of Agincourt, or when the owner's better half presents him with triplets. But these are by no means everyday occurrences, and for at least nine-tenths of its time the average aerial is simply eating its head off. Another correspondent tells me that after months of painstaking search he has at last come upon an aerial that may be said really to earn its keep. He was travelling down into the hilly fastnesses of Wales. As the train slowed down outside Cardiff his eyes were gladdened by the sight of a graceful aerial that bore proudly the burden of the entire family washing hung out to dry.

This strikes me as an ideal arrangement. The lady of the house cannot cavil at the money lavished by her lord upon masts and wire if she is at the same time provided with the perfect clothes line. Nor do their interests clash. She wants the thing during the day whilst he is away toiling at the office, or (having slain a convenient aunt) backing losers on the racecourse. When he returns in the evening from his labours, there is the aerial waiting for him unencumbered by any burden of intimate garments and ready to turn at his will from clothes line to bringer in of Radiating Rupert's squeals and Dame Nature's atmospherics.

The Man who seemed Immune.

The last person that I would have expected to fall a victim to the assaults of the microbe, termed by Americans the radio bug, which produces the dread malady of radiocentric monomania, is my friend Septimus Wubblesby Blagg. During the early days of the epidemic which broke out in the autumn of last year, he strode about fearless and immune. Though he was constantly thrown into contact with some of the most violent and hopeless cases he developed none of the symptoms of the disease that was smiting down his large circle of friends as a hailstorm lays low a cornfield.

Whilst others raved deliriously of potential gradients and dielectric constants he kept his mind concentrated upon the market reports, and stuck firmly to his business. His was one of the most splendidly organised of offices. Everything ran on oiled wheels except perhaps the office boy, but even he ran on hob-nailed boots whenever he heard the three sharp rings on the bell which warned him that his presence was desired. It was through this self-same office boy that Blagg contracted the sickness that has left him a mere wreck of his former self.

How the Blow Fell.

One day the lad failed to respond to his master's thrice repeated touching of the bell push. Infuriated that such a lack of system could manifest itself in his office Septimus Wubblesby descended to the creature's lair and found him with his ears decorated with a pair of telephones which effectively prevented any outside sounds from reaching them. Before him on the table was a piece of curtain pole wound round with wire. There was also a safety pin whose point rested upon what looked like a small chunk of coke. On his face was an expression of rapture.

Reaching out a sinewy hand his employer got a firm grip of the scruff of his neck, then shook him till his teeth rattled and the 'phones fell from his ears. Followed a telling off that would have done credit to the fiercest kind of Battery Sergeant-Major. The lad was moved to tears. "And now," said Blagg, who always believes in being a father to his employees, "let me see the device that is sufficiently interesting to make you forget your work." Instantly the office boy became as one inspired. His face lit up, and with glowing words he preached the great gospel of wireless. Blagg donned the 'phones with a superior smile. Half an hour later he was still wearing them whilst young Albert Miggs worked hard at giving him his first lesson in the gentle art of tuning.

A Desperate Case.

Brought thus into the closest possible contact with an advanced case of radiomania not even Septimus Wubblesby Blagg could escape contagion. Within three days the first well-known symptoms had manifested themselves; he was observed furtively listening to the wireless shop talked by others as he travelled up on the 8.41 and home on the 5.36. Then he was seen with a certain journal, whose cover bears a striking design in blue and orange, tucked beneath his arm. Now he is the worst case that has been seen in the locality. Others have brief lucid intervals, in which they forsake radio and discuss racing, cricket, the Ruhr question, and even business. Not so Blagg. His subjection is now final and complete.

WIRELESS WAYFARER.

A TWO-VALVE CABINET RECEIVER

By PERCY W. HARRIS, Staff Editor.

An H.F. and detector set, introducing several novel features.

WHILST the number of two-valve sets that have been described and illustrated in wireless periodicals is legion, there are, I think, sufficient novel features about the set described herein to warrant a little space in this journal. In particular, the set is pre-eminently suitable for the country reader who wishes to listen-in on telephones for all the broadcasting stations. Selectivity and simplicity of handling have been specially considered in the design, so that it can be safely said that for the average man the set is as selective as any yet described, whilst its sensitiveness is sufficient with a good aerial to get signals from all of the broadcasting stations when conditions are normal.

The simple circuit, which is illustrated in Fig. 1, shows that the receiver consists of one high-frequency valve followed by a detecting valve with reaction on to the anode coil used for the high-frequency coupling. The wavelength range is determined by the coils plugged in, and it will be seen on examination of the circuit that the receiver is a loosely coupled one, although by means of a simple switch the set can be converted into a direct coupled set in which the secondary circuit is cut out. A second switch places the aerial tuning condenser either in series or in parallel with the inductance as required. Both of the switches are of the " anti-capacity " type. The general design of the set can be easily gathered from the photograph, Fig. 2. The set is built into a polished mahogany cabinet of a standard size purchased ready made from " Scientific Appliances," a London firm.

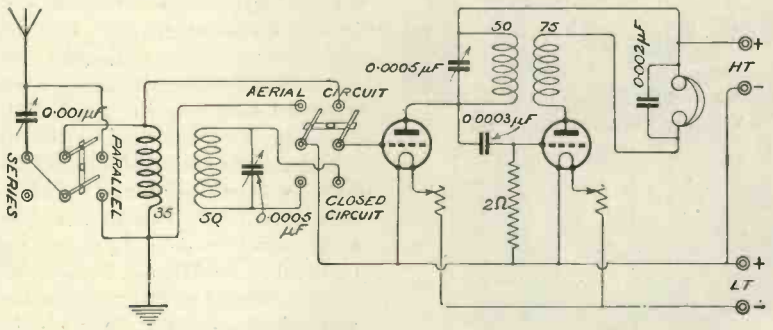


Fig. 1.—The theoretical circuit, showing switching.

The cabinet has a sloping front which carries an ebonite panel $\frac{1}{4}$in. thick, on which most, but not all, of the components are mounted. It is the fashion at the present time to mount all of the components on a panel, and when everything has been wired up to place this panel in a suitable case. In the receiver described, however, this fashion has been departed from, for in order to utilise the space in the cabinet to the best advantage, parts have been

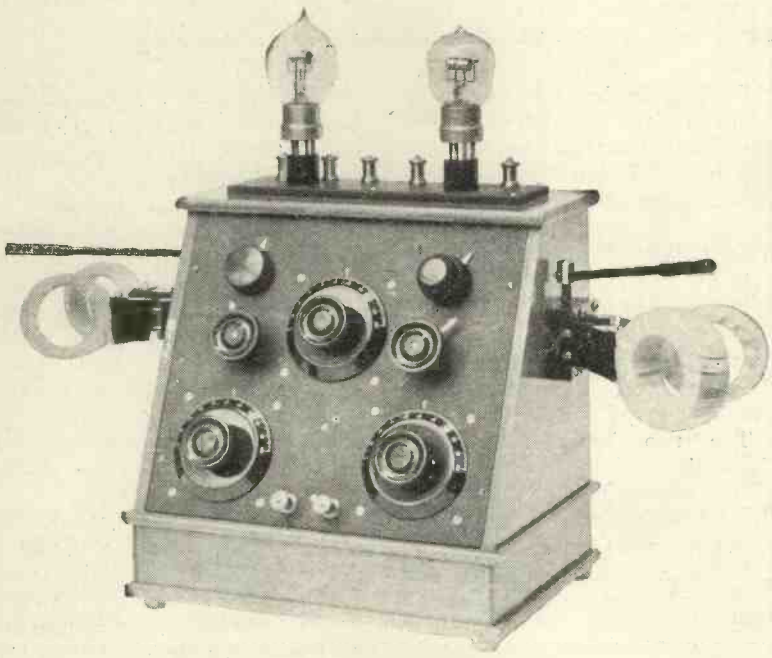


Fig. 2.—The complete instrument with coils in place.

attached, not only to the panel, but also to the sides and top of the cabinet. At first glance this might suggest that the wiring must be intricate and difficult, but, as will be seen from a detailed description to be given later, this difficulty is largely imaginary.

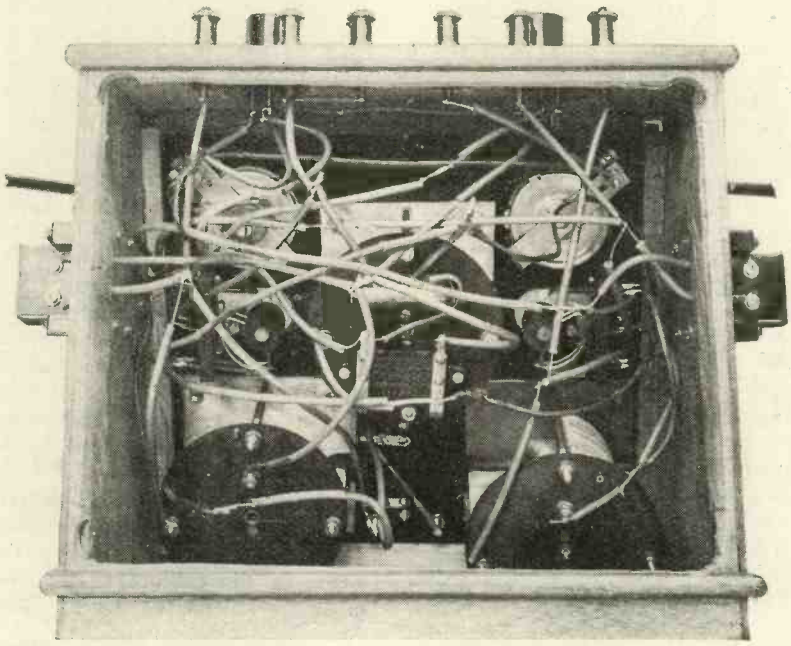


Fig. 3.—The receiver with back removed to show wiring.

Looking at the front of the instrument there will be seen three dials and four knobs, and two terminals. The three dials actuate three variable condensers, that on the left being the 0·001 μF aerial-tuning condenser, that on the right the anode condenser, and that in the middle of the upper part of the panel the closed circuit condenser. The anode condenser and the closed circuit condenser are both 0·0005 μF capacity.

The two knobs immediately above the aerial and anode condensers belong to the " anti-capacity " switches. That on the left places the aerial tuning condenser in series or in parallel, whilst that on the right changes the circuit over from a single circuit tuner to a loosely coupled tuner. Above these two switches are the two knobs of the filament-resistances, the right knob, controlling the current of the detector valve, being fitted with a vernier adjustment. The two valves are mounted on an ebonite strip on the top of the cabinet, this strip also carrying six terminals.

The terminals reading from the left to right are: Aerial, Earth, Low-tension negative, Low-tension positive, High-tension negative, High-tension positive. The telephone terminals are placed on the lower part of the front panel.

There are two two-coil holders fitted in this receiver, one on each side of the cabinet. That on the left carries the aerial and closed circuit coils, whilst that on the right bears the anode and reaction coils respectively. Both coil-holders are of the same pattern, with extension handles to facilitate adjustment.

The view of the back of the cabinet shows that the wiring is rather complicated, but this is unavoidable in all cases where switching is included in the apparatus. As the set was designed to fit into a particular cabinet, and not a cabinet built for the set, there has been some little trouble to arrange all of the components to fit, but after a little thought it becomes quite possible to include everything without losing electrical efficiency. In the endeavour to utilise all space to the best advantage, the gridleak and the grid-condenser were both mounted on the back of the closed circuit condenser.

Constructional Details

It should be said at once that a different size and shape cabinet can be used if necessary, but the present cabinet is quite suitable for a receiver of this type and is particularly convenient for handling the controls. Incidentally it may be mentioned that those readers who desire to work a loud-speaker in conjunction with this set will find in the August issue of *Modern Wireless* a complete and detailed description of a power-amplifier built into precisely the same type of cabinet by Mr. G. P. Kendall, B.Sc. The present set has been worked in conjunction with Mr. Kendall's power-amplifier, and gives admirable results. In a later issue of *Wireless Weekly* the present writer will give details of an amplifier with plug and jack control to go with the set being described.

List of Component Parts

One sloping cabinet to take an ebonite panel 10in. × 8¾in. (the writer's cabinet is 7½in. deep at the bottom and 4in. deep at the top. The cabinet should be so made that the back is removable, or it will not be possible to wire up the receiver in the manner to be described).

One ebonite panel of the size just named and ¼in. thick.

One ebonite panel, 9in. × 2½in. × ¼in.

Two two-coil holders.

Two valve sockets.

Eight terminals.

One variable condenser, for panel mounting 0·001 μF.

Two variable condensers for panel mounting, each 0·0005 μF.

Two filament resistances (one

with vernier adjustment if desired).

Two anti-capacity switches (the two used by the writer are known as the " Utility " pattern—Burndept pattern would do equally well).

One grid-condenser (0·0003 μF).

One grid-leak (two megohms) with clips.

One fixed condenser (0·002 μF). (Dubilier type is convenient for this.)

Quantity of No. 20 tinned copper wire for wiring up.

Quantity of systoflex or other insulating tubing for covering the wires.

How to Start Work

The first step is to remove the surface skin from the ebonite (both sides) with fine emery paper. The importance of removing the surface skin cannot be too strongly emphasised. Since writing last on this subject several more receivers have come to my notice in which trouble has been due to the neglect of this precaution. When the surfacing has been done the component parts which are mounted on the front panel should be taken and set on the panel so as to see exactly where they will come. It will be found that in the majority of cases the arrangement of component parts as shown in the photograph will suit well. The particular filament resistances used by the writer are of the Igranic pattern, but others would do equally well. The panel should be then carefully laid out and the positions of the holes marked on the back of the panel by means of a scriber. Lead pencil should never be used for marking out, as the markings are conducting and may cause undesirable leakage, and even complete loss of signals.

If the particular size of cabinet described in the article is used, it will probably be found that there is not room to mount a gridleak and grid-condenser on the panel itself. There are two other methods available for mounting. Firstly, they can be mounted on the back of, say, the closed circuit condenser, if this condenser has a back-plate of ebonite, or alternatively they can be mounted on one or other sides of the cabinet. The general arrangement of the parts is obvious, but it should be mentioned that the fixed condenser across the telephones is mounted on the panel immediately above and behind the telephone terminals shown.

Having mounted the components, the experimenter should next cut the ebonite panel which carries the valve sockets and terminals. This, as previously mentioned, measures 9in. × 2½in. A line is scratched on the back of this panel ½in. from the rear, and on this are marked out the positions for the six terminals. It will be found convenient to make a mark an inch from each end for the two end terminals and then to allow a space of 1½in. for the space between the aerial and earth terminals and the positive and negative high-tension terminals respectively. A space of 1¼in. should then be left between the two end and the two middle terminals, which latter should be placed 1½in. apart. The centres of the valve sockets are situated 2in. from each end and 1in. from the front. The *Modern Wireless* free template from the July issue will be found very useful in marking positions of these valve pins. It is, of course, just as essential to remove the surface skin from this panel as from the main panel.

The two-coil holders can now be mounted on the sides of the cabinet at a distance of about 2½in. from the top. As one coil plug on each of the two coil holders is movable the leads to this will need to be flexible. Flexible leads for this purpose can easily be made by taking ordinary double electric-lighting flex and untwisting it. The wire in this flex is stranded copper and is very suitable for such a purpose.

Method of Mounting Top Panel

When the terminals and valve sockets have been fitted to the top ebonite panel the wood underneath it should be marked with the centres of the screws and valve pins. Holes should now be cut through the wood so as to allow a clear space round each screw-shank. To do this a ¾in. auger bit in a brace will be found very convenient. The space underneath the valve sockets can be cut out with a keyhole saw.

The top panel should be secured in place by six wood screws, two at each end and two in the centre. The two coil holders mounted on the sides of the cabinet can be similarly secured by wood screws. When these latter have been secured in place four holes should be drilled in the sides of the cabinet to take the lead from the inside of the cabinet to the coil holders. The holes should be large enough to take the insulating tubing used.

It should be mentioned here that at least some of the efficiency of the set is due to the wide separation between the two two-coil holders, and to the fact that the earth-lead is connected to the *positive* of the low-tension battery. Even with very tight reaction on to the anode and with the aerial condenser *in series*, oscillations are not set up in the aerial circuit. For this reason the reader should not alter the relative positions of these coil-holders. For example, do not place the right-hand coil-holder on the top of the cabinet to enable you to stand an amplifying panel immediately alongside.

Full particulars of how to wire this receiver, together with a wiring diagram, will be published in next week's issue of *Wireless Weekly*. The next article will also contain a short description of some of the results obtained with this receiver, and notes regarding the coils required for various wavelengths.

News of the Week

WE understand that it is the intention of the Committee of the Radio Society of Great Britain to arrange during the next session for a number of informal meetings for those interested in transmitting. The purpose of the meetings will be to discuss the matter from various viewpoints.

We wonder how many of our readers would agree with the Justice of the Peace of Wombwell, who, on learning that it was desired to install a wireless set in a certain place of entertainment for the amusement of the people, said: "Do you call it amusement listening to a noise like a tin whistle? I listened-in once and was quite disgusted. However, we don't want to interfere with people who want this sort of pleasure, and the licence will be granted." This little episode is yet one more example of the harm which is being done by badly arranged demonstrations by persons who do not know how to get the best from receiving apparatus.

We understand that a Danish engineer, Arnold Christenson, has invented an apparatus by means of which it is claimed it is possible to carry on wireless telephone conversation without being overheard.

According to the *Times*, when asked if the Postal Department obtained any evidence, resulting from the thunderstorm which visited us recently, which would support the idea that it was due in some measure to the presence of the large number of aerials in the country, the Postmaster-General is reported to have stated, "There is no evidence which would in any way support this interesting suggestion."

The Berne International Bureau has been requested by the Department of Commerce of the United States that the coast stations of that country and all vessels communicating with them should henceforth use the wavelength of 706 metres. Broadcasting in the United States, the Department explains, is done on all wavelengths from 300 to 600 metres, and the use of similar wavelengths by vessels gives rise to trouble and delay in the exchange of messages. It would therefore be an advantage if vessels were equipped to use a wavelength of 706 metres, as this would facilitate communication with the United States Stations.

According to the *African World* the Capetown Fire Brigade has installed wireless apparatus on its engines; the innovation is at present in the experimental stage.

Our readers in Sheffield will be interested to learn that the Works Sub-committee of the Highway and Sewerage Committee has had under consideration aerials crossing highways. The Sub-committee recommends that the following principles be adopted with regard to application for permission to erect such aerials: "That provided the highway is not a tramway route, nor in contemplation as a tramway route, aerials be permitted subject to the by-laws governing overhead wires crossing highways, on conditions that a formal consent is entered to the Town Clerk providing (1) for the removal of the aerial if called upon, (2) for its being erected and maintained to the satisfaction of the Corporation, (3) to the owner accepting all liability in respect of accidents, etc., (4) to the payment of an initial fee of 1 guinea and subsequently an annual acknowledgment of 5s., and that the Town Clerk be authorised to sign the form on behalf of the Corporation."

We learn that the latest arrival in Wales is the Carmarthen and District Radio Society, which has become affiliated to the Radio Society of Great Britain, and of which the President is Colonel E. C. Jennings, the Vice-president Mr. W. E. Williams, and the Hon. Secretary Mr. W. T. Thomas, 9, Hall Street, Carmarthen.

The Sterling Social and Athletic Club's sports were held on July 14th on their own ground at Dagenham. A feature of the sports was the first public appearance of the new Sterling public announcing equipment in conjunction with the Magnavox loud-speakers. This equipment has been developed by Mr. Ward-Miller, the Chief Engineer of the Sterling Telephone Co., Ltd.

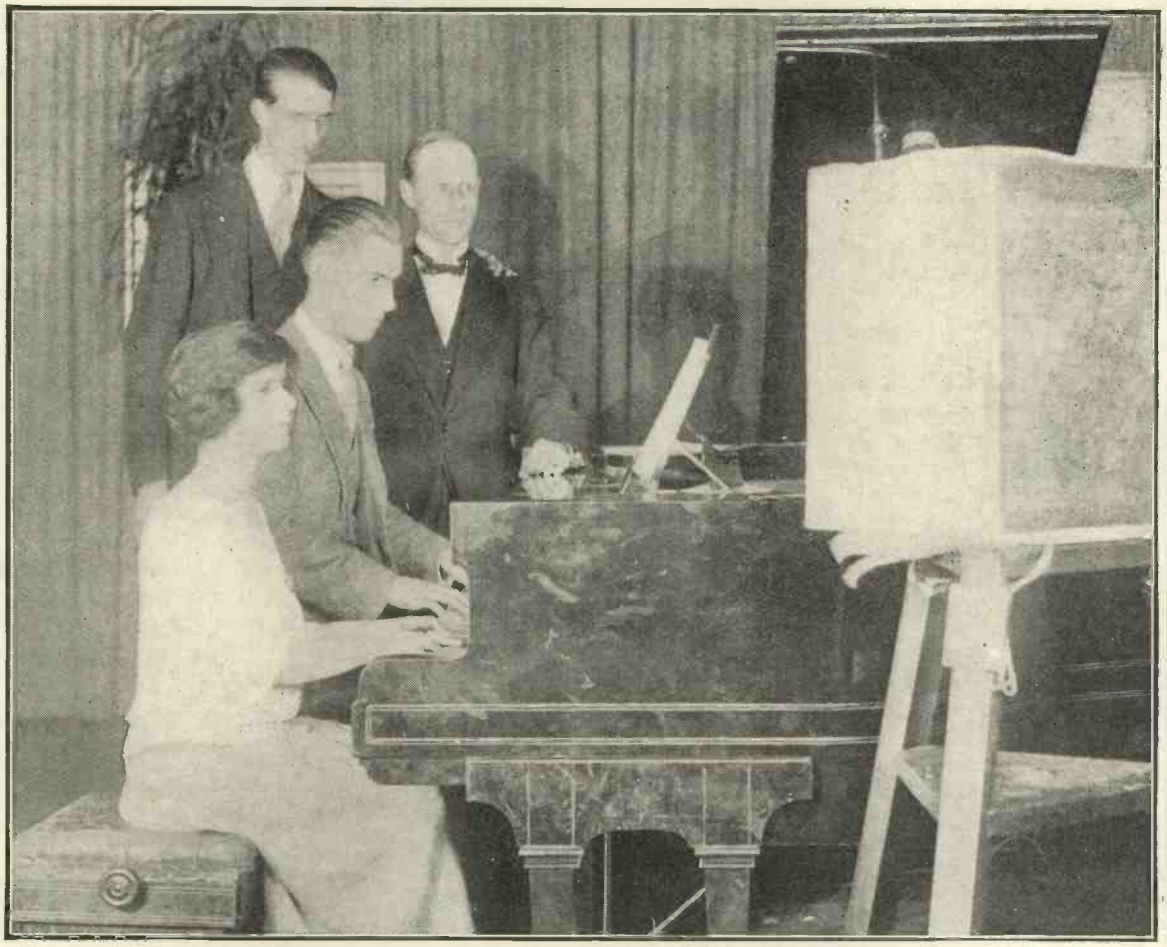
In the evening the input of the amplifying system was connected to one of the Sterling wireless receivers, and a large crowd was entertained with the concert and dance music from the London broadcasting station. The results were extraordinarily fine, and it

was reported that the announcements during the afternoon and the concert during the evening were clearly heard at a considerable distance.

We are informed by Reuter's that a committee consisting of the Directors of the British, French, and Italian Telegraphic Services was held at the London Office of the League of Nations on July 16th and 17th, in order to examine, in conformity with a request by the Council of the League, a proposal put forward by the Italian Government for an international conference on wireless telegraphy to be held next year.

The members of the Committee declared themselves unanimously in favour of a universal conference, at one and the same time telegraphic and radio telegraphic, which should be held during the first half of 1924. As negotiations have been in progress for some time between certain Governments for the holding of such a conference, the Committee proposes to meet in October next to re-examine the proposal of the Italian Government, that this conference should be held with the co-operation of the League of Nations.

The French newspaper *Excelsior* states that in addition to a new regulation whereby private owners of wireless receiving sets will be exempt from the present tax of ten francs annually, but will still be required to register their stations, there is to be a new decree which will contain various regulations with regard to the publication of incorrect news by wireless. The decree will provide that news transmitted by wireless will come under the control of the Posts and Telegraphs Department, and that the law of July 29th, 1881, may be applied to the transmission of news by wireless. The authors of the regulations consider that if the publication of false news involves the responsibility of the editor and publisher of a paper, it should with even greater reason render liable to rigorous penalties those who knowingly communicate such news to thousands of distant listeners.



Aunt Sophie and the Uncles sing the kiddies' good-night chorus from 2LO.

NOTES ON THE PHYSICS OF THE VALVE

By Dr. J. H. T. ROBERTS.

This article contains some very interesting information upon an aspect of the operation of the thermionic valve often not sufficiently considered by the experimenter.

EVERY wireless experimenter is aware that the wireless valve depends for its action upon the emission of electrons from a heated metal filament. I do not propose to deal with the employment of the valve in practical wireless circuits, as various aspects of that subject are from time to time clearly and ably dealt with by other writers in this journal.

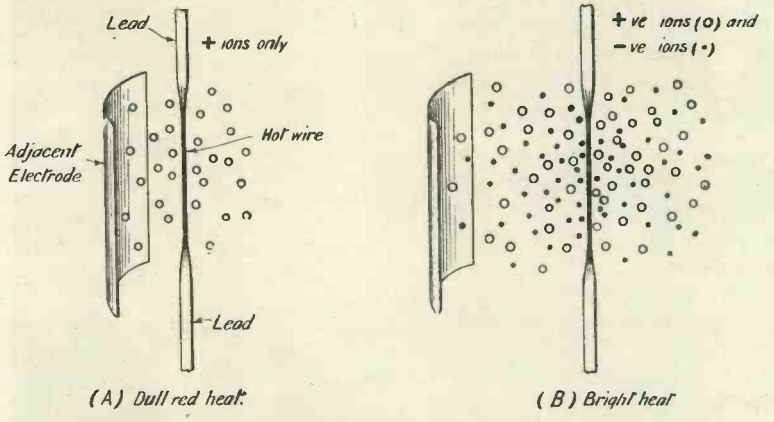


Fig. 1.—A fresh wire, before prolonged heating has driven out all traces of gas and impurities: (A) at dull-red heat only +ve ions emitted, (B) at bright heat +ve and −ve ions emitted.

There is, however, a great deal of information on the physics of the valve which is not commonly available, and which, as well as being extremely interesting, is important for the consideration of the future developments of this appliance. Probably the subject is most conveniently dealt with in the form of a series of questions and answers.

What is Meant by Thermionics?

It has been known for a very long time that heated bodies produce certain electrical effects in their immediate neighbourhood. It was known about 200 years ago that air that had been drawn from the neighbourhood of a red-hot body had the power of conducting electricity. During the past 20 or 30 years a considerable amount of research work has been devoted to the study of the electrification due to hot bodies, and for convenience in referring to the phenomena associated therewith, the term "thermionics" has been introduced. "Therm" has reference to heat, and "ionics" to the electrified particles of molecular (or less) dimensions, so that "thermionics" refers to "ions produced by the action of heat."

What causes the Electrification?

In order to answer this question it is necessary first of all to state that the electrification in the vicinity of a hot body may consist of a mixture of positive and negative ions, or it may consist of negative ions only. Let us suppose that the hot body is in the form of a metal wire maintained at a high temperature by the passage through it of an electric current from a battery. If the wire is surrounded by a gas—air, for example—and is maintained at a dull red heat, it will be found that an insulated body placed in the neighbourhood of the wire will gradually acquire a positive charge, showing that in the electrification produced round the wire, at any rate that which reaches the adjacent body, there is a preponderance of positive ions. If the temperature of the wire be considerably raised, the adjacent body will become discharged (whether it was originally charged positively or negatively). The phenomena show considerable variations, depending upon the

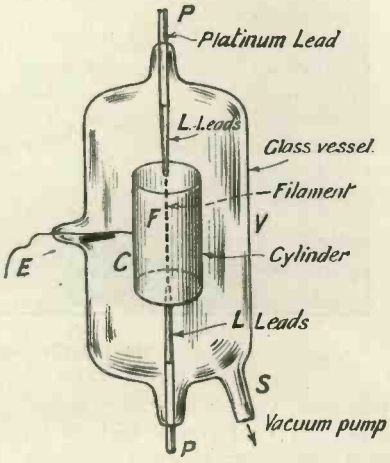


Fig. 2.—Simple arrangement for studying emission from a wire under various conditions.

nature and pressure of the gas and upon the temperature and material of the wire; they are now known to be due to the emission from the hot body, and the production in the gas, of positive and negative ions. For simplicity, let us take the case when the wire and the adjacent body or electrode are both enclosed in a vacuum, so that the complications due to the surrounding gas are avoided. Under these circumstances (unless the filament has been heated for a long time) the adjacent electrode will become positively charged when the wire is raised to a red heat and negatively charged when the temperature approaches a white heat. We are, of course, assuming that there is no applied electric field between the filament and the electrode. It has been found that under these conditions the positive ions arise principally from traces of metals (such as potassium and sodium) which are present as impurities in the surface of the hot body; this observation is supported by the fact that if the heating is continued, the positive emission gradually diminishes.

The negative ions are the elementary corpuscles of electricity known as electrons: they are discrete electrical charges, and are not associated with matter, in the ordinary sense, at all.

How may the Emission be Studied?

A representative type of apparatus by which a large amount of the earlier research on thermionic emission was carried out is shown in Fig. 2. The filament of the material whose thermionic properties are to be studied is indicated by F. This is welded to stouter leads of the same material, L L, and these again are welded or hard-soldered to platinum leads P P, which are sealed through the walls of the glass vessel V. C is a surrounding cylinder (the "adjacent electrode" referred to above), and is connected by means of the wire E to an electrometer, galvanometer, milliammeter, or other suitable instrument for indicating the emission current received from the hot wire. The side-tube S connects the apparatus to a vacuum pump, so as to permit of the exhaustion of the gas.

The arrangement by which the temperature of the filament may be controlled, and the emission measured, is shown in Fig. 3. The filament forms one arm of a Wheatstone bridge (described in "Electricity and Magnetism" series in No. 13), and is heated by the current from the battery. The thermionic emission current from the filament is measured by the galvanometer. The heating-current supplied by the battery can be regulated very accurately by means of rheostats R_1, R_2, and a very fine adjustment of R_2 is obtained by shunting it with a further rheostat R_3. The three arms of the Wheatstone bridge W_1, W_2, W_3, must contain resistances of the same order of magnitude as that of the filament. and they must be made of such material and must be of such current-carrying capacity that their resistance is not appreciably altered by a current equal to that which flows through the filament. It is well known that the resistance of a metal varies with temperature, and the arrangement indicated in Fig. 3 gives a convenient method of measuring the temperature of the filament (after the apparatus has been suitably calibrated) by balancing the resistance of the filament on the Wheatstone bridge for different filament currents. Thus the emission-current at different temperatures may be experimentally determined.

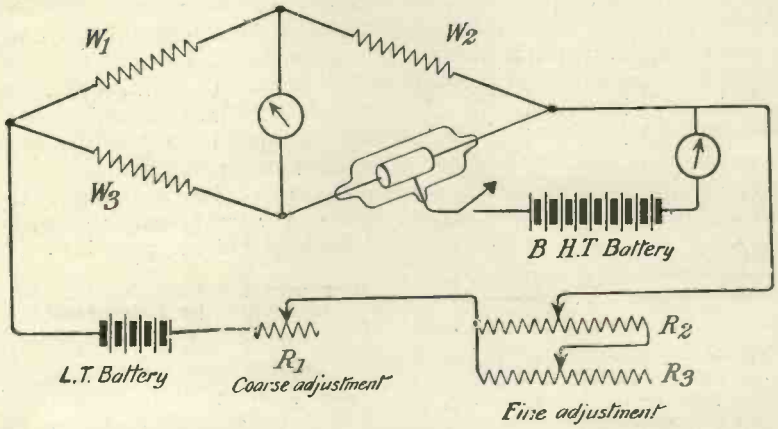


Fig. 3.—Arrangement for heating filament and Wheatstone bridge for accurate determination of temperature (by resistance). Emission current measured on galvanometer.

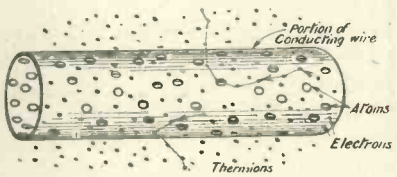


Fig. 4.—Electrons forming heating-current collide with atoms of metal of filament, and raise temperature, some electrons being ejected (thermions).

What causes Electrons to be Emitted?

An electric current through a wire consists of a stream of electrons. Electrons enter the wire at one end and electrons leave it at the other end. The electrons are driven through the wire by the electromotive force, or potential difference, existing between its ends. In their passage they come into collision with the atoms of the metal, and if the velocity of the electrons is sufficiently high and the thermal agitation of the atoms of the metal is sufficiently great, some electrons are thrown out laterally from the wire. These are the electrons which constitute the thermionic emission from a wire in a high vacuum.

Why must a Wire be Heated to make it emit Electrons?

In a metal wire the electrons are able to move through the spaces between the atoms with great facility, and consequently it requires a considerable potential difference to be applied to the ends of the wire, with a corresponding increase in the velocity of the electrons, before the collisions between the electrons and the atoms set up sufficient agitation of the latter to raise the temperature appreciably (see Fig. 4). Consequently, under ordinary conditions a stream of electrons may flow through a metal wire without any electrons being thrown out from the surface of the metal. It is necessary, as mentioned above, for the velocity of electrons and the agitation of the atoms to be very considerably increased before any of the electrons begin to be ejected.

Does the Filament Waste Away?

The electrons which are thermionically emitted are replaced by others from the stream of electrons which flows through the wire (the heating current), so that, for practical purposes, the wire is merely an agent in the emission and does not itself suffer any loss. It may be compared in some ways to a hose-pipe conveying water, the walls of the pipe being pierced by pin-holes through which the water escapes (see Fig. 5). In this case, the water which oozes through the walls of the pipe is obtained from the stream within and not from the material of the pipe itself. The analogy is, in some ways, not strictly accurate, but it is useful for the present purpose.

At the same time, owing to the presence of a minute trace of residual gas in the vacuum tube, to impurities in the filament, and to a number of other causes, a slight wastage of the filament does take place, with the result that after prolonged use the filament diameter is reduced and the resistance of the filament is increased.

How can the Filament Wastage be Ascertained?

Since the filament becomes thinner with prolonged use, its resistance is increased and a convenient method of ascertaining the reduction in the diameter is to determine either the change in the resistance or the extra electromotive force required to maintain

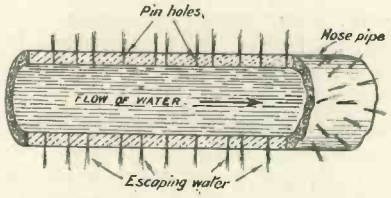


Fig. 5.—Water escaping through pinholes in hose-pipe, illustrating, in a rough way, emission of electrons from hot wire.

a constant current through the filament. This assumes that the resistivity of the metal has not suffered any change, but it is a method which is found convenient in the testing of the filaments of high-power transmitting valves.

Should the Filament be of Uniform Diameter?

If the diameter of the filament is not uniform, it will be obvious that the thinnest parts will be the hottest, since the current is the same for all parts. Thermionic emission depends upon the temperature, and as, for some purposes, the filament temperature requires to be accurately adjusted, it is evidently important that the temperature shall be the same at all parts of the filament.

If one part of the filament becomes thinner than the rest, from

Fig. 6.—A thin part of filament gets hottest: wastage is greater, so that difference is increased as time goes on, until filament burns out at the point.

any cause, the wastage at this part, owing to the higher temperature, will be greater than the wastage at the cooler parts. Consequently the difference in diameter between the thin part and the thicker parts will increase at an increasing rate, until finally the filament burns out at that point.

Does the Thermionic Emission depend upon the Material of the Filament?

Tungsten is commonly employed for the filaments of thermionic valves, on account of its high melting point and other refractory properties which permit of it being raised to a very high temperature. The emissive properties, however, depend upon the material and by treating tungsten wire in a special way with certain rare earths (thoria) its emissive power may be very greatly increased. A thoriated tungsten filament may be made to give a sufficient thermionic emission when raised only to a dull red heat. This allows a great saving in heating current, so that a valve may be operated by special dry batteries instead of accumulators.

What is the Emission Current from Tungsten?

Tungsten is the metal from which the filaments of wireless valves are usually made, and consequently its emissive properties have been very carefully studied. It has been found by one observer that at a temperature of about 800 deg. Cent. the emission from tungsten was about 2×10^{-13} amperes per sq. cm., whilst at 2,250 deg. Cent. it was 1.23 amperes per sq. cm. It will be seen that at a white heat (2,000 deg. Cent. represents a "white heat") the emission current from a tungsten filament is quite appreciable.

How may the Emission Current of a Valve be Measured?

If a suitably high voltage (say, 100 volts or more, which may be obtained from the electric light mains) be applied to the anode circuit, and a milliammeter be included, the emission current may be read off directly from the instrument. The arrangement is as shown in Fig. 3, except that the Wheatstone bridge and fine adjustments may be dispensed with, and the ordinary L.T battery and filament rheostat substituted.

RANDOM TECHNICALITIES

By PERCY W. HARRIS, Staff Editor.

Some interesting notes upon the problem of interference.

IT occurs to me that readers of *Wireless Weekly* may care to hear about a few experiments I have been conducting recently with the object of seeing what can be done to eliminate some of the jamming from the local broadcasting stations.

As I live only six miles from 2LO, with an aerial 35ft. high, I am naturally in a position to appreciate the difficulties of tuning out the local broadcasting station when endeavouring to receive those more distant, and in case the opening paragraph should suggest that I have found some perfect remedy, I hasten to add that so far I have yet to find the perfect method of eliminating London and getting Cardiff.

The real difficulty lies in the fact that to receive the distant broadcasting stations we must use considerable amplification, and this, of course, in a simple circuit, makes the local station far louder than we should ever desire it to be when listening to it alone. From this it follows that the only satisfactory method must be based on some method of selective amplification, that is to say, amplification of the distant stations in greater proportion than that of the nearer. This at once suggests that loose coupling should prove a considerable advantage.

* * * *

Now loose coupling to be used effectively must be used *very* loose. I have read many articles describing the construction of loose-coupled receivers using three-coil holders, one coil being used for the aerial, the second for the closed secondary circuit, and the third for reaction on to this closed circuit. Few, if any, of the writers of such articles mention that tuning with three coils used in this fashion is extremely difficult. First of all, any adjustment of the reaction alters the tuning of the other two circuits, and any altering of the tuning of either circuit equally affects reaction coupling. As a consequence, only the expert is able to adjust the reaction critically, at the same time getting perfect tuning in both circuits and a very loose coupling. I have tried various kinds of couplers, numerous types of coils, and various holders, and I have come to the conclusion that the only really satisfactory way of using loose couplings and reaction (at least for the beginner) is to use a pair of two-coil holders. The first coil holder should carry the aerial and the closed circuit coils, while the second, which should be so placed as to be well out of the magnetic fields of the first pair of coils, should bear the anode coil and the reaction coil, the value of which should be very carefully chosen.

* * * *

If possible the tuner should have a switch so that we may rapidly change from a direct coupled to a loosely coupled circuit. With such an arrangement the first operation is to tune the aerial, using the circuit as a simple one, and after we have obtained the best adjustment to change over to a closed circuit and, with very weak coupling, adjust till the best signals are received on the secondary tuning condenser. A further adjustment of the aerial condenser, which, for the purpose of greater selectivity, should be in *parallel*, will bring signals in at a good strength. The angle of coupling differs considerably with different makes of coil, as does the sharpness of tuning.

* * * *

One very good make of coil with very low self-capacity and resistance, which gives very good sharp tuning, has, owing to the method of winding, a very extended field, and with an ordinary two-coil holder it is very difficult to get a good minimum. The makers sell a special coil holder in which two movements are possible, and with this, of course,

one can get a much better effect. On the other hand, in the case of single layer plug-in coils on an ebonite former about 3in. diameter, it is much easier to obtain a minimum. Multi-layer coils will generally give very loose coupling with an ordinary holder. Each make has its advantages, and I am not suggesting that for this purpose any one make is better than any other, but I am simply pointing out that an angle between two coils which may be correct with one make will probably be incorrect with another.

* * * *

Once sharp and good signals have been obtained on the loose coupled circuit, we should experiment with tuning the anode circuits more accurately. Once the anode circuit has been tuned to the best advantage we must gradually bring up the reaction coil against the anode coil, adjusting the anode tuning at each new position of the reaction coil. It is best to choose a reaction coil which will only just make the set oscillate when tightly coupled to the anode coil. I cannot give figures for the best reaction coils, as the values will depend upon many varying factors, such as the make of valve, filament adjustment, voltage of high-tension battery, etc. Once the best adjustments of the anode tuning condenser and the reaction coil have been obtained it may be necessary to make a slight readjustment of the secondary circuit.

* * * *

A three-valve set with one high-frequency, detector, and one note magnifier used in this fashion with the aerial tuning condenser *in parallel*, and with critical setting of coupling and reaction, enables me to eliminate London entirely when receiving Birmingham, Newcastle and Glasgow. With a great deal of trouble I have found it possible to understand everything that Manchester is saying while London is working, although London strength is equal to that of Manchester. Cardiff is the most difficult of all, and only on one occasion, and that after spending nearly half an hour in the adjustment, have I been able to hear what the announcer has been saying while London has been working.

* * * *

The most successful arrangement I have yet tried, and one which I can cordially recommend to all who are troubled by such interference, has been the combination of a three-coil holder and a two-coil holder. Two coils of the three-coil holder are used as aerial and secondary, as described, and the third is used for a coil of the same value as the secondary shunted by a variable condenser. The anode coil and reaction coil are used in the other holder as before. With the third coil thrown at right angles, so as not to interfere with the aerial and secondary coils, the set is firstly tuned for the best possible signals from the distant station, regardless of interference from London. Next the third coil is brought towards the aerial coil, so as to be within its field, and its variable condenser turned until a considerable reduction in the strength of London indicates that this third circuit is becoming in tune with the London wavelength. When accurately tuned to the London wavelength and suitably coupled (the best position is found by trial), it was found to absorb a great deal of the London interference without reducing the strength of signals from the distant stations. In this way I have been able to hear Cardiff quite well without very great interference from London.

* * * *

The additional circuit acts, of course, as an "acceptor" circuit. Its function is to absorb the wavelength we do not require in a circuit which is doing no work, leaving the signals we need, to operate the detector in the usual way. The adjustment of this arrangement of three coils is a little tricky, but with experience it will be found possible to reduce interference to a much greater degree than is normally possible with the ordinary arrangement of circuit, even with very loose coupling.

* * * *

Of course, the higher the aerial the more is one susceptible to local jamming, and readers who are using multi-valve sets with fairly low aerials will have less difficulty than I have in eliminating this local disturbance. Incidentally, it is a method which can be highly recommended to those listeners-in who are so situated on the coast that their broadcast reception is greatly interfered with by the Morse signals from ships. The "acceptor" circuit can be permanently set for 600 metres and left there.

THE FINE ADJUSTMENT OF REACTION

By G. P. KENDALL, B.Sc., Staff Editor.

Useful notes for experimental licence holders.

TO obtain long-distance reception of telephony with sets employing reaction, it is essential to be able to adjust them easily to their most sensitive condition, that is, to be able to increase the reaction almost, but not quite, to the point of oscillation.

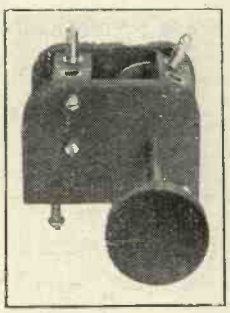


Fig. 1.—A coil holder giving fine adjustment.

All those who have attempted the somewhat difficult feat of the reception of American broadcasting stations will appreciate the truth of this statement. To make this adjustment with ease and certainty, it is necessary firstly to choose such values of plate voltage and filament current as to ensure freedom from "overlap," and secondly, to provide some device for making very minute and accurate changes in the amount of reaction; mere rough mechanical movement of the reaction coil is not sufficiently delicate. A great variety of methods of obtaining the required fine adjustment have been devised, and it is proposed to deal with some of the most useful of them in this contribution.

Before dealing in detail with the various methods, it will be as well to give the reader a fairly definite idea of the features which constitute a good fine adjustment of reaction. Firstly, of course, it must be capable of producing the necessary very minute changes of reaction coupling. Secondly, it must be capable of producing the required small changes without upsetting to an appreciable extent any of the other adjustments of the circuit, such, for example, as the tuning of the aerial circuit. This matter is most important, for, as will be seen later in this article, quite a number of otherwise satisfactory methods are impracticable from the actual operator's point of view, simply because in altering the degree of reaction they also make quite large changes in the wavelength of the tuned circuit. Thirdly, the device must be free from hand-capacity effects, that is, it must be possible to set the reaction to the desired value and then remove one's hand from the control knob or handle without making any alteration in the adjustment which has been obtained.

Geared Coil Holders and Similar Devices

A fairly successful method of securing fine adjustment of reaction is that which depends upon the use of some sort of reduction gearing for the movement of the reaction coil. A number of well designed coil holders are upon the market in which a gearing is introduced between the adjusting handle and the spindle upon which the movable coils turn, so that there is a reduction ratio of, perhaps, five to one between them. A good example of this type of coil holder is illustrated in Fig. 1. In this type there is the advantage of both rough and fine adjustments which are obtained from the one control knob by an ingenious cam mechanism. This method, although giving extremely fine adjustment, suffers from the disadvantage that it also causes some alteration in the tuning of the circuit which is reacted upon, as a result of the changes of capacity between the two coils when one of them is moved.

Vernier Filament Resistance

A method which has a considerable vogue in the United States, consists in the employment of a filament resistance with some sort of vernier attachment capable of giving very small changes of the resistance in circuit.

This device, in the writer's experience, does not appear to be one of the most successful. Although it does not produce very serious changes in the wavelength adjustments, it does not seem capable of giving sufficiently smooth and delicate adjustment of the reaction.

Reaction Condenser

This method is probably the one in most common use among English experimenters. It consists in the connection of a small variable condenser in parallel with the reaction coil, and it has certain advantages. It undoubtedly gives very fine adjustment of reaction coupling and does not introduce troubles from "overlap" in the way that certain other devices do. Its use, however, cannot be advised, for the reason that it produces relatively large changes in the wavelength adjustments of the circuit, and also because it is very difficult to eliminate hand-capacity effects when making use of it. For

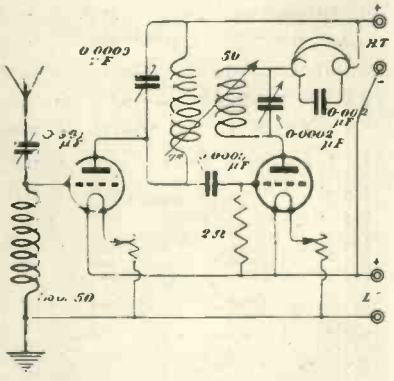


Fig 2.—Method of controlling reaction by a variable condenser shunted across the reaction coil. Numbers indicate suitable sizes of Igranic coils for broadcast reception.

those who may care to try it, its connections are shown in Fig. 2.

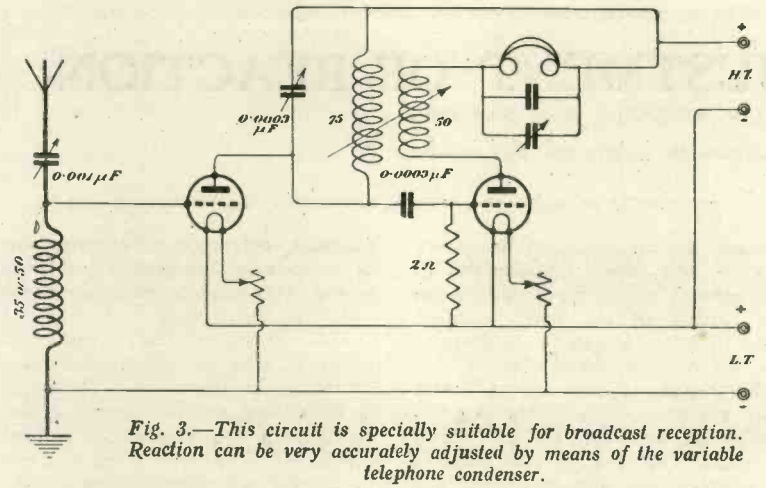


Fig. 3.—This circuit is specially suitable for broadcast reception. Reaction can be very accurately adjusted by means of the variable telephone condenser.

Potentiometer Control

One of the best methods of fine adjustment known to the present writer is that illustrated in Fig. 5. As will be seen, the method is simply the provision of a potentiometer across the filament of one of the valves and the connection of the grid of the valve (through the grid circuit) to the slider of the potentiometer.

This method gives extremely fine adjustment and remarkable freedom from hand-capacity effects and undesired alterations in the wavelength adjustment of the circuit. To secure the maximum freedom from such changes resulting from the operation of the potentiometer, it is desirable to connect two fixed condensers of a capacity of 0.002 μF in the positions shown (C_1 and C_2 in Fig. 5).

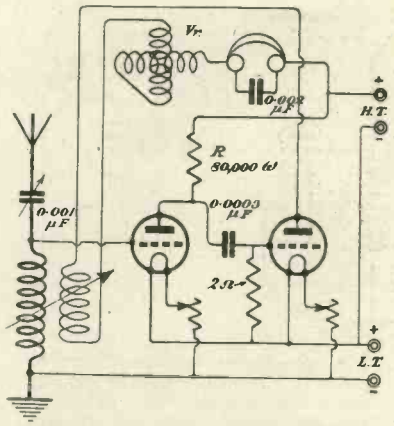


Fig. 4.—Another good circuit for long-wave telephony. Intervalve coupling is provided by resistance R, while the variometer Vr controls the reaction.

Variable Telephone Condenser

Fig. 3 illustrates a device for securing fine adjustment which is not nearly so widely known as its merits entitle it to be. This method is the one which the writer prefers above all others for his own use. It consists simply of a variable condenser of suitable capacity connected across the telephones, or across the primary of the first intervalve low-frequency transformer in the case of sets employing low-frequency amplification.

This arrangement gives extremely fine adjustment of reaction, so fine, indeed, that it is quite easy to adjust the set so that it exhibits the phenomenon known as "flickering" when tuned to the carrier-wave of a telephony station, that is, the carrier-wave beat note is heard in a flickering, broken fashion, resulting from the set oscillating momentarily in response to incoming atmospherics.

An objection which may be raised against this device is its expense, since it would seem to necessitate a large variable condenser of at least 0.001 μF capacity. This, however, is a difficulty which is easily overcome, since perfectly satisfactory results can be obtained by the use of a fixed condenser of 0.0007 μF and in parallel with this a variable condenser of 0.0005 μF capacity, since this gives, if anything, a finer adjustment even than the variable condenser of 0.001 μF capacity. This latter arrangement is shown in Fig. 3, which also indicates suitable numbers of turns for the coils and capacities for the condensers for broadcast reception.

A further advantage of this method, besides the extreme fineness of adjustment which it renders possible, is that it produces only negligible changes in the wavelength adjustment of the tuned circuit.

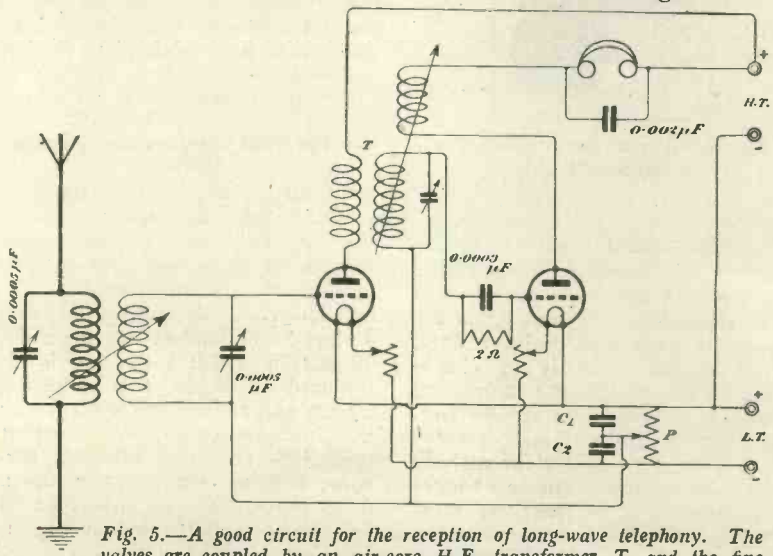


Fig. 5.—A good circuit for the reception of long-wave telephony. The valves are coupled by an air-core H.F. transformer, T, and the fine adjustment of reaction is provided by the potentiometer P.

Plate Circuit Variometer

Another little-known method is shown in Fig. 4. This method, which makes use of a variometer connected in series with the reaction coil in the plate circuit of the rectifying valve, has certain advantages which entitle it to be regarded as one of the better type of fine adjustments of reaction. It

certainly produces a very smooth adjustment, and it is not altogether unsatisfactory when considered from the point of view of wavelength changes and hand capacity effects, although it cannot compare with the previous method in this respect.

Variable Grid Condenser

This method, which one sometimes sees employed, is only included for consideration in this contribution to give the writer an opportunity of stating his entire disapproval of the device. The disadvantages of this arrangement are so numerous and serious that it would seem that they have only to be realised to cause its use to be discontinued. Some of the more serious of these drawbacks are as follows: Firstly, it is extremely difficult to eliminate hand-capacity effects from a variable grid condenser. Secondly, small changes in the capacity of the grid condenser produce, as a rule, quite large changes of the wavelength adjustment of the set, and consequently every slight adjustment of reaction throws the tuning completely out. Finally, the capacity of the grid condenser should be adjusted to secure efficient rectification, and should not be altered to other values to vary the degree of reaction.

This concludes our consideration of the various methods of procuring fine adjustment, and it is hoped that the experimenter will now be in a position to choose a satisfactory device to meet his own particular needs.

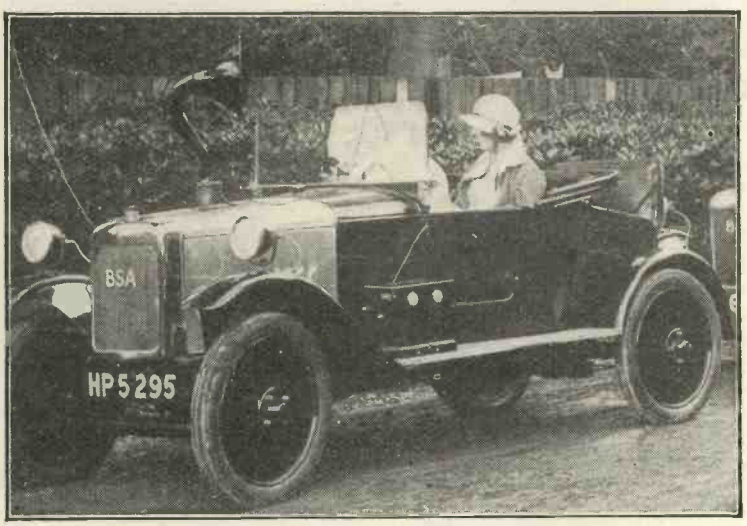
OPEN-AIR RECEPTION

The following brief article will be of interest to those readers who possess small cars.

TWELVE months ago, long before the British Broadcasting Company came into force, the Daimler Company and the Marconi Company co-operated in the development of wireless apparatus which would enable motorists to get reception while travelling in Daimler cars.

It will be remembered that at the last Olympia Show, the first specimen of the Daimler landaulette so equipped was exhibited, and Daimler carriages were the first motor vehicles to be so equipped.

Since that time the development of wireless on Daimler cars has been rapid, and to-day a Daimler motorist can listen-in to a broadcast concert while travelling in a car in which there is no visible aerial. With the exception of the telephone headpiece and a very small box attached to the inside of the car, the apparatus is invisible.



One of the B.S.A. cars fitted with receiving apparatus.

It must not be thought that the results were reached without a deal of trouble. After prolonged experiments on the range of cars manufactured by the Birmingham Small Arms Company good reception has been successfully accomplished.

In the case of open cars, it was found that for many reasons it was both unnecessary and undesirable to arrange the equipment so that listening-in could be done while the car was running. The most important reason, perhaps, which led to the decision not to do this was that the cost of the apparatus necessary to make it satisfactory was greater than the owner of the average small car would be willing to bear.

In the B.S.A. cars a metal reel containing a portable aerial which has an insulated weight attached to one end is in the back of the car. This can conveniently be thrown over the bough of a tree.

The apparatus is fitted on a baseboard which forms the cover of the battery-case, and the whole is enclosed with a solidly made leather cover, rendering it weatherproof.

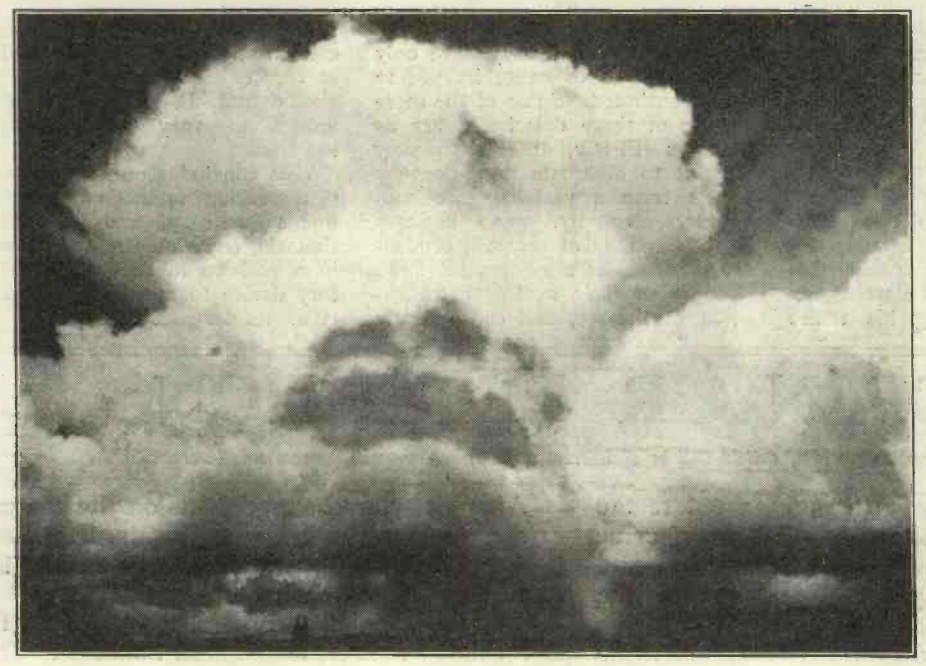


Fig. 1.—A thunder-cloud.

THE ELECT
LIGHT

By E. H. CHAPMAN, M
Staff E

An article, dealing with some of which is of particular interest

DURING the recent spell of hot weather many listeners-in have had their attention drawn in no uncertain manner to the electrical disturbances in the atmosphere which invariably accompany a thunderstorm. The persistent crackling noises which have been of late so prevalent in the telephones of wireless receiving sets have been undoubtedly caused by those discharges of electricity which we see as lightning and hear as thunder.

Lightning flashes are usually divided into three classes: forked, sheet, and globe. Forked lightning, which takes a curiously zigzag path across the sky, is only different in point of size from the spark which can be obtained from an induction coil. As with most natural phenomena, forked lightning takes the line of least resistance—electrical resistance in this case. The structure of the atmosphere is so very varied that the line of least electrical resistance is never straight. Hence it is that a lightning flash travelling along the line of least resistance takes such a noticeably zigzag path.

Photographs of forked lightning taken with a moving camera often show that two or three or even more flashes of lightning take the same path. It is easy to understand how that happens. The first flash increases the conductivity of the air so much all along its path that subsequent flashes tending to follow the line of least electrical resistance take the path of increased conductivity made by the first flash. A point of great interest to the wireless scientist is that photographs of lightning flashes taken with a moving camera appear to show that the lightning discharge is of an oscillatory nature travelling backwards and forwards between cloud and earth or between cloud and cloud.

Sheet lightning is usually the reflection of distant forked lightning,

Fig. 3.—A hitherto unpublished photograph o Sept., 1901, the lightning being two miles dis Brennan, Esq., and is reproduced by kind per

RICITY OF NING

A., D.Sc., F.R.Met.Soc.,
ditor.

the peculiarities of lightning, during these summer months.

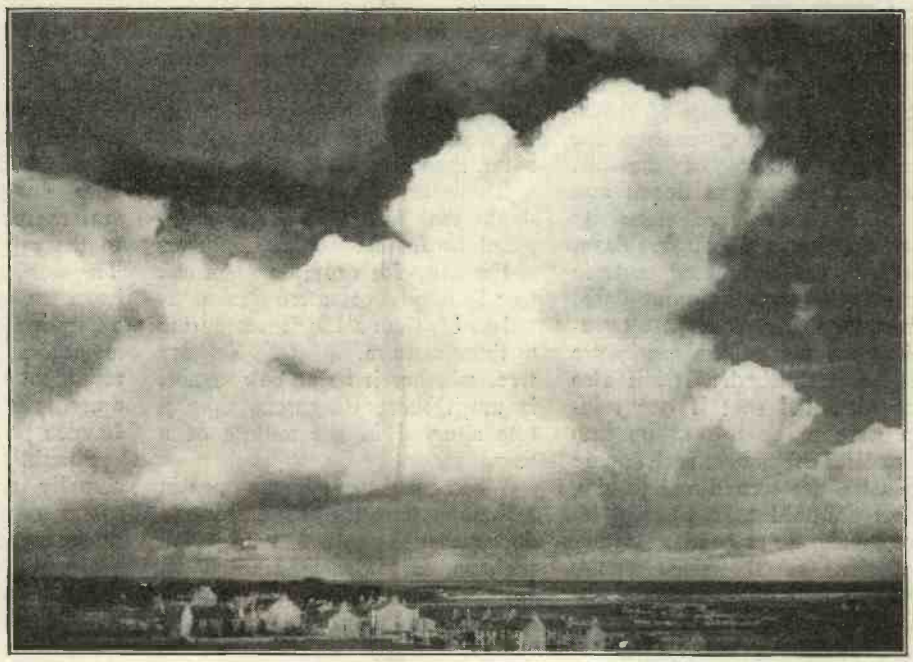


Fig. 2.—The approach of a thunderstorm. The photographs in Figures 1 and 2 are by G. A. Clarke Esq., of Aberdeen Observatory.

f a lightning discharge, taken in Jamaica, land. The photograph was taken by J. F. mission of the Royal Meteorological Society.

and is seldom accompanied by thunder.

Globe lightning is the mystery amongst lightning discharges. The evidence with respect to globe lightning is of a very conflicting nature. Some observers claim that they have seen globe lightning as a ball of fire moving slowly through the air, and that the ball has finally exploded.

The explanation of the manner in which the air can be brought into such an electrical state as to make a discharge of lightning possible lies in a simple experiment which may be performed in a scientific laboratory. The experiment referred to is one by which it can be shown that, when falling drops of water are broken up by a jet of air, the drops acquire a positive charge, and the air acquires a negative charge, of electricity. Thunderstorms are always associated with strong ascending currents of air. Photographs of thunderclouds invariably show that there must be gigantic upheavals of air near the cloud. These ascending currents of air break up any raindrops which happen to be falling and so give those raindrops a positive charge and the air a negative charge just as in the laboratory experiment referred to. During the process of formation of a thunderstorm the ascending air currents become so strong that no raindrops can fall through those air currents to the ground. Instead, the strong ascending air currents break up the waterdrops and carry them upwards. At some height or other the upward air currents begin to spread out horizontally, and when the raindrops eventually get out of the sphere of influence of the ascending air currents they fall to the ground as the heavy rain of the thunderstorm. Before they fall to the ground, however, they may have repeatedly fallen hundreds of feet in the air, only to be broken up and whirled upwards again by the ascending currents.

This breaking up of raindrops which goes on so rapidly in a thunderstorm gives rise to a great difference in electric potential. When this difference of potential reaches a value of tens of thousands of volts per centimetre, the electrical resistance of the air, great as it is, breaks down, and we get a discharge of electricity which constitutes a lightning flash.

It has been calculated that, in order to produce a lightning flash, a charge density of eight electrostatic units per square centimetre must be established. It has also been calculated that if one raindrop were to be broken up into two smaller drops over each square centimetre per second a lightning discharge would take place after 26 minutes 40 seconds. Other calculations of the same nature show that it is easily possible for raindrops to be broken up so rapidly that a lightning flash becomes possible every seven or eight minutes.

Perhaps it is interesting enough to note that as long ago as 1749 Benjamin Franklin came to the conclusion that lightning was an electrical phenomenon and that lightning conductors first devised by Franklin have been used for the protection of buildings from damage by lightning ever since 1752.

Franklin's famous outdoor experiment was to raise a kite with a conducting string close under a thunder-cloud. From the lower end of the string Franklin took sparks and even charged a Leyden jar. What happened, however, in this experiment was not quite what Franklin thought. The positive charge on the thunder-cloud induced a negative charge on the kite and caused an equal positive charge to appear at the lower end of the conducting string. If Franklin had obtained a direct discharge of lightning he would not have survived his experiment. The voltages of electricity associated with the discharge of lightning are so great as to make attempts to experiment with lightning a very dangerous proceeding.

During a thunderstorm personal danger from lightning is much greater in the open country than in the town. Buildings, especially those with lightning conductors, telephone wires, and power lines, all help to make the town safer than the country.

There is scarcely any room to doubt that lightning shows a decided preference for certain trees —the oak, for example. An oak tree is fifty times more dangerous to be near than a beech tree during a thunderstorm. One solitary tree, whether it be an oak or not, is much more dangerous than a tree situated in the middle of a wood.

When caught out in the open in a thunderstorm the safest thing to do, although rather undignified perhaps, is to lie in a ditch or, failing a ditch, to lie on the ground. A line of overhead wires makes a fairly safe area underneath.

One of the most difficult modern problems with regard to lightning is the protection of aeroplanes and airships when in the air. It is an extremely dangerous thing indeed for an aeroplane or an airship to be in the air anywhere in the vicinity of a thunderstorm or even a thundercloud.

Lightning Conductors

Before considering the actual part an outside aerial may play during a thunderstorm, it is necessary to get some idea as to the way in which a lightning conductor is supposed to afford protection.

A lightning conductor consists of one or more pointed metal rods projecting vertically upwards at prominent points of the building to be protected, the lower ends of the rods being connected to earth. The space between a thundercloud and the earth below it is one of great electrical stress, and it is rather curious to note that the sharp metal points of a lightning conductor tend to increase that stress. This increase in intensity of electrical stress, however, causes silent brush discharges to take place from the points of the lightning conductor. The electrical stress is in this way reduced to a value at which a discharge of lightning becomes impossible.

Brush discharges of this kind actually occur in nature. They are occasionally seen taking place from the masts and yards of a ship during squally weather at sea, the phenomenon being known to the sailor as St. Elmo's Fire. The same type of brush discharge has been seen to take place from an ice-axe on a high snow-covered mountain. An experimental imitation may be made by bringing a needle gradually up to a charged Leyden jar.

Should a lightning discharge actually occur near a lightning conductor it is supposed that the discharge would show a decided preference for the metallic points of the lightning conductor and allow itself to be conducted harmlessly to earth *via* the conductor.

Clearly, then, the efficiency of a lightning conductor depends primarily on the number of metallic points from which brush discharges can take place and to which a discharge of lightning would pass should a discharge occur in the neighbourhood of the conductor. Modern ideas on the subject of protection from lightning demand that a building should be provided with a pointed conductor at every salient point and that all these pointed conductors should be connected up and the system earthed at numerous points.

The Aerial and Lightning

From what has been said on the subject of lightning conductors, it will be clear that an outside aerial, since it does not possess sharp projecting metallic points, cannot be looked upon as an efficient type of lightning conductor. Moreover, ordinary aerial wire has nothing like the thickness of lightning conductor rods. Again, iron rods are better than copper rods for lightning protectors, and when in position the rods of a lightning conductor should not be insulated from the walls of a building as an aerial wire is.

Granted that an aerial cannot be looked upon as a good type of lightning conductor, are we to look upon an aerial as a source of danger from lightning? This question is perhaps best answered by asking another question. Do we look upon the gutters and rain-pipes of a house as a source of danger from lightning? Such a mass of metal is not usually earthed; it is actually on the house, and it presents a far greater target for a lightning discharge than a small aerial.

As a precaution against damage by lightning, it is considered good practice to connect all pipe and wire systems inside a house to earth and to connect all large masses of metal to earth. In the same way it is good practice to connect an aerial to earth when a thunderstorm is imminent.

The possible effect of a discharge of lightning on scientific instruments may be judged from the following authentic account of the damage done inside an observatory which was struck by lightning. During the afternoon of July 21st, 1909, the tower of Manila Observatory, in the Phillipine Islands, was struck by lightning. The discharge missed the lightning conductor which projected upwards from a mast on the top of the tower and struck the metal shaft of an anemometer. A telegraph line running from the tower was broken, the self-recording meteorological instruments in the tower had their electric circuits burned out, and a mercury contact had its mercury scattered. Some of these instruments were connected to external points of the building, others were not.

As to what may happen when lightning scores a direct hit on an aerial, we may refer to the article "Struck by Lightning" which appeared in *Wireless Weekly*, No. 7, page 438. The writer, Mr. S. G. Rattee, was actually present on the occasion described. After reading such an account as this, it is impossible to come to any other conclusion than that lightning *may* strike an aerial, but, since the incident described by Mr. Rattee is unique, the chances that any particular aerial will be hit during a thunderstorm are exceedingly remote.

On the occasion of the thunderstorm in the early hours of July 10th, a large elm tree near the writer's house was struck by lightning. A deep slashing cut was made down the lower part of the tree trunk, and the noise of the discharge was deafening. There were not less than four aerials in the vicinity of the tree that was struck, one being immediately across the road from the tree. In view of this and many other such cases, we can safely conclude that an aerial does not attract lightning, using the word "attract" in the popular rather than in the scientific sense.

From the account given of the damage done to the scientific instruments in Manila Observatory when the tower of the Observatory was struck by lightning, and also from Mr. Rattee's account of the damage done to the wireless installation at Cape d'Aguilar, Hong-Kong, when the aerial there was hit by lightning, it would appear that, during a thunderstorm, no wireless receiving set should be connected to the aerial or earth lead-ins. Wise as it may be to connect an aerial to earth, it seems even wiser to disconnect a receiving set from any external point of the building in which the set is located.

No matter what we do to protect ourselves and our wireless sets from lightning, our greatest protection lies in the fact that, in our islands, thunderstorms are of rare occurrence and that, when they do occur, they are seldom of the severity experienced in other parts of the world, which, to say the least, is a fact with which we may be justly pleased.

WHAT A SOCIETY CAN DO IN SUMMER

The following report, received from the Paddington Wireless and Scientific Society, will be of interest to other societies who contemplate outdoor activities.

THE members recently proceeded to Stanmore and erected their apparatus before lunch. An "inverted-L" aerial was supported between 30ft. portable masts, and a 200ft. aerial was attached to a 6ft. kite. A 3ft. portable frame aerial and a set comprising 2 H.F., detector, and 2 L.F. valves were mounted on a motor cycle and sidecar, whilst for D.F. work a Bellini-Tosi aerial and radio-goniometer were erected.

In addition to the above receiver, members provided sets comprising detector and 2 L.F. valves, 2 H.F., detector, and 1 L.F., also units for demonstration to junior members. Lunch and tea were provided at The Vine, Stanmore, and this part of the programme proved very popular. After lunch Mr. Beak was able to receive telephony from many of the London amateurs on a Brown loud-speaker, using his three-valve set, which comprised detector and 2 L.F. valves. Mr. Turton received amateur telephony and British and Continental air stations, using both the kite and L aerials. Mr. Beak operated the Bellini-Tosi D.F. equipment and received signals from several well-known London amateurs, the "directions" being checked by means of a compass and map.

Mr. Bland Flagg (hon. secretary) received amateur telephony on a loud-speaker, using his portable set mounted on a sidecar. Much valuable experience was gained, especially by juniors, in the operation of multi-valve receivers, and the day was voted a complete success, and is likely to arouse a desire for a repetition.

THE BRITISH WIRELESS RELAY LEAGUE

The following letter is in reply to our Editorial appearing in Vol. 2, No. 1.

TO THE EDITOR, *Wireless Weekly*.

DEAR SIR,—I have read your Editorial in Vol. 2, No. 1, of *Wireless Weekly*, and as I am unfortunate enough to be the organiser of the League in question, I beg leave to answer the criticism which you have given at length.

You will readily agree that in wireless as in all things we must "walk before we attempt to run," and wishing to bring the transmission section of the amateurs into closer touch with one another, I attempted the task of forming a League much the same as the American Radio Relay League.

It was quite obvious from the beginning that merely to relay messages up and down the country in the Morse code would lead to nothing more than a lot of wireless "gossip," and certainly the idea of such work was not intended as the primary object.

A few messages of such a nature were necessary in order to get the League in motion, but the more serious side would eventually be evolved as the membership increased, and although the available mileage in this country is comparatively small compared with the United States, there is plenty of space, and room to spare, for low-power transmissions of telephony considered from the point of view of loop transmissions and incidentally of directional work.

The possibility of an International Relay League was also in my mind at the same time, and I am still confident that this will eventually materialise, but such undertakings require capital and publicity, which I had hoped would have been forthcoming, only to find that the movement was not received so favourably as might have been expected.

The co-operation of the *Wireless World and Radio Review* was assured, but this was of little use without the active assistance of the gentlemen who carried out the British arrangements of the trans-Atlantic tests, and this I could not get, and the suggestion was made that the bulk of the officials should have been in London instead of Manchester.

This immediately gave me the impression that unless I carried out this suggestion the League, as far as trans-ocean tests were concerned, would be a non-participant, and therefore it was decided to refer the whole matter to the Radio Society of Great Britain.

This our Hon. Secretary had already done before your article was published, and I have intimated that if it is preferable for the traffic manager to be situate in London I am quite willing to stand down and leave the organisation entirely in the hands of the amateur transmitters of this country, who should have the support of the Radio Society of Great Britain, with possibly Mr. Phillip Coursey as President.

I consider that the criticism of the parent society is grossly unfair, and due consideration has not been given to the immense difficulties they have been up against, both in government and broadcasting circles, which, as a late member of the Committee, you must admit have been very great.

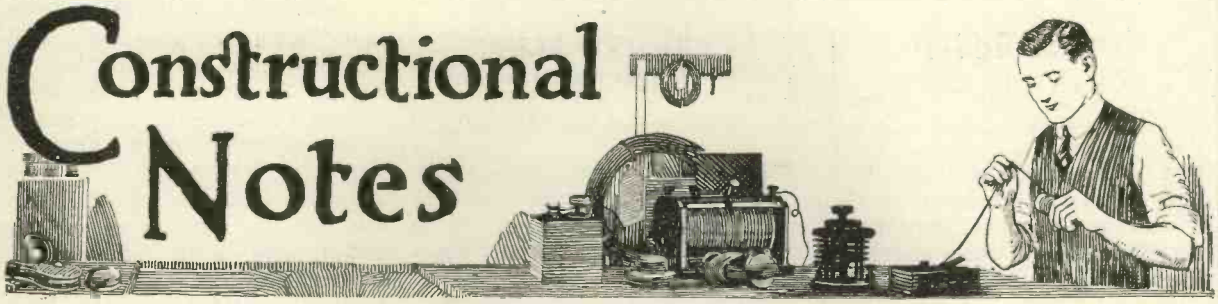
I have a great respect for your publications, but I would suggest that both sides of the question be considered in all cases, and not attempt to picture the future of wireless as being composed of a separate society for crystal users, two-valve people, etc., etc. The natural tendency of all experimenters in this country is opposed to this view, and although the Radio Society of Great Britain is, in your opinion, lacking in energy and initiative, a glance through its list of officials precludes the idea of any number of movements shaking its solidarity.

I shall be pleased to hear your views either privately or through your valuable columns, but would impress upon you that I am in no way disregarding the principles underlying your very candid expressions, and to that end I shall always be pleased to further the interests of the amateur, well knowing that you have these interests at heart.

Yours faithfully,
(Signed) Y. W. P. EVANS,
A.M.Inst.R.E.
(Traffic Manager, B.W.R.L.)

[This letter is commented upon in our Editorial.—EDITOR.]

Constructional Notes



HOME-MADE POTENTIOMETER

MOST of those who conduct serious experimental work with crystal detectors swear by carborundum for general use on account of its stability. Though this crystal will give respectable results when used with a carbon contact without any applied E.M.F., it is at its best when a steel contact is used and a steady voltage of from 1 to 3 volts is applied.

For detector work there is nothing to beat the centre connected

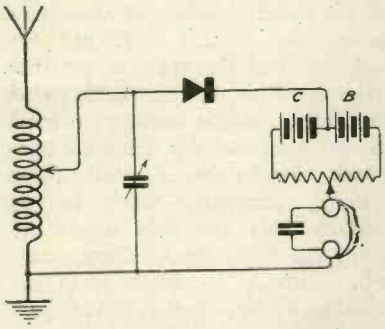


Fig. 1.—A simple potentiometer circuit.

battery and potentiometer circuit shown in Fig. 1. For this two flashlamp batteries may be used joined in series, the connection being made by soldering a lead to the long strip of one battery, which is bent back and soldered to the short strip of the other.

As current flows from the negative pole to the positive it will be seen that when the slider is moved to the right-hand end of the resistance an E.M.F. of 4½ volts will be applied to the crystal, current flowing in a clockwise direction from battery B round the circuit consisting of 'phones, tuning inductance and detector. If the slider is at the opposite end of the potentiometer the flow of current will be from battery C in the reverse direction. The voltage will be decreased in either case by moving the slider towards the middle of its travel; at

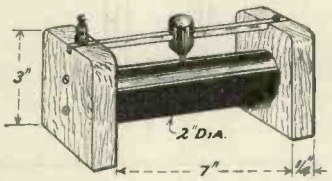


Fig. 2.—The finished potentiometer.

this point it will be zero, since the batteries are now in opposition.

A potentiometer to be suitable for use with flashlamp batteries must have a very high resistance, of the order of, say, 500 to 600 ohms, otherwise they will not last long if much work is done with the set.

Fig. 2 shows how such a potentiometer may be made. A hard wood cylinder 2 inches in diameter is mounted by means of screws between two 3-inch square ebonite end pieces each ¼in. thick. On to the wooden roller we wind 1½ ounces of No. 32 enamelled resistance wire, the ends of which are passed through very small holes drilled in the ebonite. A slider moving on a square rod is fitted as shown and provided with a terminal.

The instrument is now mounted on a polished wood base on which are two terminals to which the ends of the windings are secured. A small cut-out switch should be fitted between one terminal and the lead running to it so that when the set is not in use the battery current may be switched off.

This potentiometer has a resistance of about 600 ohms, and as the E.M.F. of the two batteries in series is 9 volts the current flowing will be only 15 milliamperes, which should mean a fairly long life for them, provided that the switch is used.

R. W. H.

A CONDENSER TIP

THE true experimenter is constantly needing fixed condensers of various values, but does not need a large collection. An excellent semi-permanent fixed condenser can be made up between two brass plates drilled at the four corners with holes to take tightening screws. (The top holes should be bushed with ebonite.) The tinfoil or copper tabs can then be bent under the top plate at one end and the bottom plate at the other, and the whole tightened up. Positive connection is then possible to the two plates without soldering; the capacity is constant and the value can be changed rapidly without wasting foil or mica.

P. W. H.

DOUBLE TERMINALS

MANY experimenters would make use of double terminals if they were acquainted with their advantages. When two or more wires have to be taken to one terminal, the changing of one wire is generally awkward, as all the wires drop off. Double terminals having two milled nuts are readily obtainable, and enable the permanent wires to be held fast when the others are changed.

P. W. H.

AN IMPROVED CRYSTAL CUP

IT is surprising that so little thought has been given by the makers of wireless apparatus to the crystal cup, when one considers how unsuitable the usual pattern is. Crystal cups are generally far too shallow, with the result that when the crystal is placed in position and the clamping screw tightened up the crystal is either forced out of the cup or the crystal is broken. Another fault is that only the top of the crystal can be utilised.

A glance at Fig. 3 (which is self-explanatory) shows that the

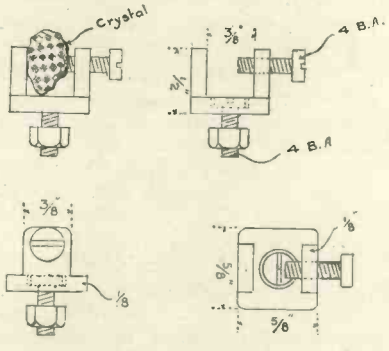


Fig. 3.—Details of the cup.

crystal has a flat surface to butt against and is held in position by a substantial screw. Another point that will be noticed is that two sides of the cup have been cut away exposing as large an area as possible to the contact wire. The cup can be readily made by placing a short length of ⅝in. square brass rod in the vice, then cut to the shape shown in Fig. 3, a hack-saw being used for the purpose. A coarse file of square section with one smooth side should be used to remove the metal in the centre.

This cup has been a great success, and I think it is unfortunate that no manufacturer has placed a crystal cup of this type on the market. A. A. M.

RESISTANCE ADAPTER

THE popular tuned-anode coupling, shunted with a small variable condenser, is extremely efficient on all wave-

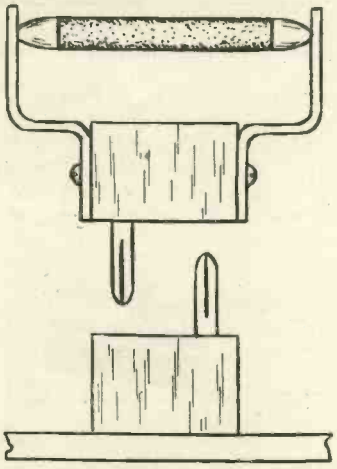


Fig. 4.—Method of mounting anode resistances.

lengths, but for higher wavelengths the resistance-capacity coupling is preferable. The resistance, which is non-inductive, usually has a value of about 70,000 ohms, and this little component can be easily adapted

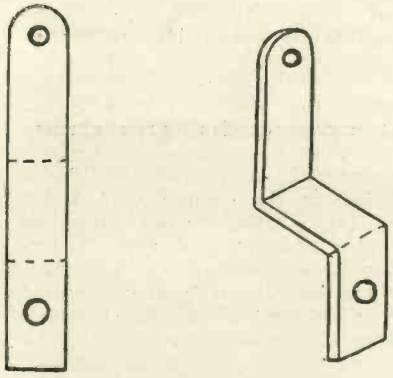


Fig. 5.—Showing how to bend the clips.

to the existing coil socket, in the manner shown in Fig. 4, so that it is not necessary to alter the internal wiring of the receiver. Two strips of spring brass, of the same width as the ebonite coil plug, are drilled and bent to the shape indicated in Fig. 5, and attached to the sides of a standard coil plug by means of the two screws which make contact with the metal plug and socket, as shown in Fig. 4. The holes in the top portion of the strips should be just large enough to accommodate the pointed metal ends of the resistance, and these should be slightly countersunk on the insides, to ensure a perfectly clean contact. The exact length of the brass strips, will, of course, depend on the length of the resistance. O. J. R.

FIBRE FOR INSULATION

"IF only there was something just as good as ebonite, but much cheaper!" Most of us have said this at one time or another when we were making up apparatus and found that the cost of the panels needed ran into quite unexpected figures. Except for bakelite and the coal-tar product often used for making the bases of rheostats, there is nothing so good as an insulator for wireless purposes. Presspahn is excellent for making inductance tubes, but as usually only the thin sheets are sold, the thick sheets being somewhat difficult to obtain from the average wireless dealer, it is of little use for panels. Some constructors have tried slate, which has many advantages: it is cheap, it can be drilled and sawn in the ordinary way, and it takes a good-looking finish. Slate, however, has one serious drawback: it frequently contains metallic veins, and if they are present it is absolutely useless. If you intend to use this material, have it tested with a Megger *before* you start to work it, for nothing is more annoying than to find, after a panel has been finished up, that it cannot be used on account of its poor insulating qualities.

The only remaining substitute

for ebonite is fibre, which has become rather discredited by wireless men. Fibre consists of practically pure cellulose. It is made by a special process from a cotton or flax basis. During manufacture it is enormously condensed, so that quite a small sheet represents a large amount of the original material. The one great drawback in the use of fibre as an insulator is its hygroscopic nature. Oils will not sink into it, but it readily absorbs water up to 5 per cent. or more of its own weight. When it is damp the insulation that it provides is so poor as to be quite useless for high-frequency work.

Though fibre is not recommended for use as the material of entire panels which have to deal even with the less rapid oscillations of speech frequencies, it can be employed in various parts of the set if it is properly treated, and its use will result in a certain saving, for it is a good deal less expensive than ebonite.

Fibre will do quite well for the bases of rheostats, for the formers of potentiometers, for extension handles to inductances or condensers, and for mounting battery switches. There are also various other places where high insulation is not required in which it can be used without detracting from the set's efficiency.

The best method of counteracting its hygroscopic tendencies is to dry it for five or six hours in an oven whose temperature is not allowed to rise above boiling point and then to give it two or three coats of thin shellac varnish. As it is apt to shrink when dried, it is advisable to give it a preliminary "cooking" before it is trimmed and drilled, and then to give it a final spell in the oven.

It can be drilled, tapped, sawn, or turned in the lathe, but as it is apt to heat up whilst being worked, oil should be used as a lubricant. For lathe work, diamond-pointed tools are to be recommended. Owing to the way in which it shrinks and swells it cannot be finished with extreme accuracy. Thus a 2in. disc suitable for the base of a rheostat might measure a little later from 2.01 to 1.99 in., according to the dampness and dryness of the air. Most of the parts, however, for which it is suitable do not call for even such accuracy as this.

If fibre is used for potentiometers, care should be taken to select resistance wire of a gauge stout enough to ensure that excessive overheating shall not take place. Fibre is unaffected by temperatures up to 100° C.; but if subjected to a heat of 150° C. for prolonged periods it loses strength. At 200° C. it begins to break up, at 250° C. it smokes, and at rather less than 300° C. it catches fire.

R. W. H.

CONVERTING CRYSTAL DETECTORS

MANY readers possessing cat-whisker detectors have discovered the advantages of a Perikon detector. A highly efficient detector of this latter type can be made from old or existing parts of the former type. A detector built on the lines described herein has been used by the writer

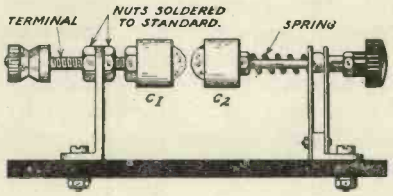


Fig. 6.—The converted Perikon detector.

with very satisfactory results. The diagram, Fig. 6, shows how it is built up. It will be seen that from its variety of movements it has many advantages over the existing types now on the market, which have practically only one radial movement. Cup 1 has a complete circular and a backward and forward movement, whilst cup 2 has a similar movement with the addition of a ball-joint movement. The cups are screwed on and can easily be removed to allow other cups to be replaced. Cup 1 is supported by a plain angle piece to which two terminal nuts are soldered as shown. The terminal is screwed through these nuts and into the cup, a further nut being used to tighten the cup.

Cup 2 is supported by an ordinary type of ball-socket standard, the end of the adjusting arm being screwed into the cup as before. Between the standard and the cup a spring is placed. On the other side of the standard arm a nut is forced so that the position may be altered if desired. The adjusting arm should be a sliding fit in the ball-socket. To adjust, cup 1 is screwed forward to a suitable position, while cup 2 is pulled back. Cup 2 is then allowed to come forward by means of the spring until it sits on cup 1. If the tension is too great, cup 1 is simply screwed back a turn. The adjustment is quite permanent when obtained.

H. B.

SECURING LEAD-IN WIRES

MOST lead-in insulators are fitted at the outer end with a nut to secure the wires, and frequently its size is really too small satisfactorily to hold a pair of thick aerial wires of a two-wire aerial. In such cases, it will be found very convenient to cut a strip of brass about ½in. wide and 4in. long, of such a thickness as will not easily bend. In this drill three holes—the centre one of such a size as will slip over the end of the brass rod in the insulator. The other two holes are intended to hold two terminals of the type with a central hole. The shanks of these terminals are passed through the holes and secured by nuts. The two aerial wires can then be secured firmly and easily, and if necessary adjusted for length.

P. W. H.

A 'PHONE SAFEGUARD

THE beginner is often puzzled as to the respective merits of high- and low-resistance telephones. "Is it better," he asks, "to use the L.R. type in conjunction with a telephone transformer, or does one get better results with the H.R. type?"

High-resistance telephones have a very large number of turns of wire crowded into a very small space, and the wire is so fine that it does not require a great current to burn out the windings or to develop a fault in their insulation,

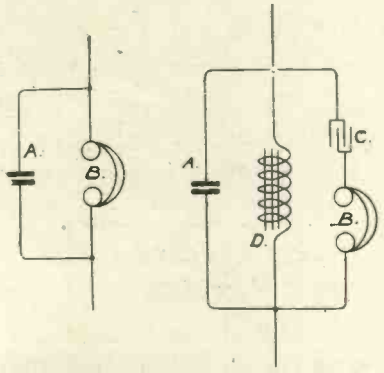


Fig. 7.—Showing the shunt device.

for it must be remembered that the whole plate current of the last amplifying valve flows through them. Crystal receivers, of course, are not subject to this disadvantage, and H.R. telephones are always to be recommended for them. During the war a very large number of telephones were wound with so many turns of fine wire that their resistance was 8,000 ohms, and they have since come upon the market through the Disposals Board. Although they are certainly the most sensitive telephones obtainable, these telephones have the annoying and expensive habit of burning out if carelessly used.

Low-resistance telephones, on the other hand, are quite free from this disadvantage. The steady plate current flows through the primary of the telephone transformer, and the telephone windings are relieved from this strain. Nevertheless, the very fact of using an extra transformer tends to introduce more distortion and always causes some weakening of signal strength. High-resistance telephones are, therefore, greatly to be preferred if they can be freed from their disadvantages, and this can be done quite simply.

Fig. 7 shows the way in which the telephones are usually arranged in the plate circuit of the last valve, shunted by a blocking condenser A if this should be the detector valve. The improvement is shown on the right. In place of the telephones a large iron-cored choke coil, D, is inserted into the circuit. The secondary of a disused Ford ignition coil is ideal for the purpose, and these coils may be picked up at almost any large garage A is the blocking condenser, as before, having a value of about 0.002 μF, whilst C is a 2 μF Mansbridge condenser.

The action of the device is as follows: The steady plate current passes freely through the choke coil D and is quite unable to pass through the telephones because of the large condenser C. Radio frequency impulses that may be present pass through A, but are prevented by the high inductance of D and B from taking any other path. Audio-frequency impulses which are to record the signals find that A and D have a very high impedance for their frequency and therefore take the easier path through B and C. If C is made large enough, no difference will be found between the signal strength of the arrangements shown on the right and on the left of Fig. 7.

A further advantage of the device is that in many cases it improves the quality of the reproduction of strong signals. This is especially noticeable in the case of high-resistance loud-speakers which are heavily loaded.

L. A. S.

A VARIABLE HIGH RESISTANCE

IN experimental work a variable resistance of high value which will pass a few milliamperes is frequently required. Such resistances are required in experimenting with grid-leaks, anode resistances for resistance amplifiers, and so forth. Many simple ways of making fixed grid-leaks for reception purposes have been described, but most of them are not adapted to variable adjustment or else will not pass a current

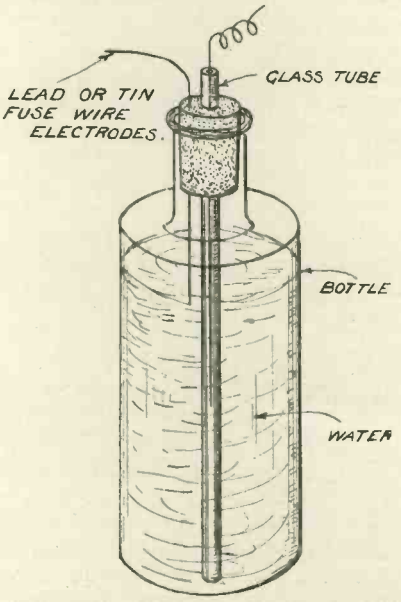


Fig. 8.—The completed resistance.

greater than a fraction of a milliampere without becoming noisy or erratic. The simple resistance here described was evolved by the writer when in need of an adjustable grid-leak for a 10 watt transmitter. Leaks of the pencil line type were first tried, but were found to be unsatisfactory, as they sparked along the graphite surface and were very irregular in their action.

The accompanying diagram, Fig. 8, is almost self-explanatory. A bottle is filled with water and a glass tube is introduced

which should be long enough to reach the bottom and project about an inch out of the neck. Two wires are introduced so as to make contact with the water, the other passing through the neck of the bottle outside the tube and passing into the tube itself. As most of the resistance lies in the narrow column of water within the glass tube the diameter of this tube is of some importance; the bore should not be too small, as bubbles of gas produced by electrolysis of the water tend to accumulate and increase the resistance unduly. For the same reason the wire should not fit tightly in the tube. A tube of 2 or 3 millimetres bore is convenient. If ordinary tap water is used the wires may be of copper, but it is much better to use lead or tin fuse wire which shows much less tendency to form soluble salts with impurities in the water. Rough adjustment of resistance may be obtained by pushing the wire up or down in its tube, while small final variations may be effected by altering the depth of the wire outside the tube.

Ordinary tap water gives about the right range of resistances for many purposes, but if necessary the resistance may be reduced by adding a few drops of sulphuric acid or a small quantity of common salt, copper sulphate, or any other metallic salt that happens to be handy. If, on the other hand, the resistance of the tap water is too low in the first place it may be increased by mixing with methylated spirit. In this way a resistance of anything from a few thousand ohms to several megohms may be obtained in a few moments at an outlay of practically nothing.

The uses of such simply made variable high resistances are so numerous that their construction is strongly recommended to the serious experimenter.

As variable gridleaks used in conjunction with similar anode resistances they open up a field of research otherwise closed to the experimenter of limited means.

E. H. R.

BLOCKING CONDENSERS

THE usual method of constructing a blocking condenser is rather a fiddling job when making a condenser of fairly large capacity. An easier

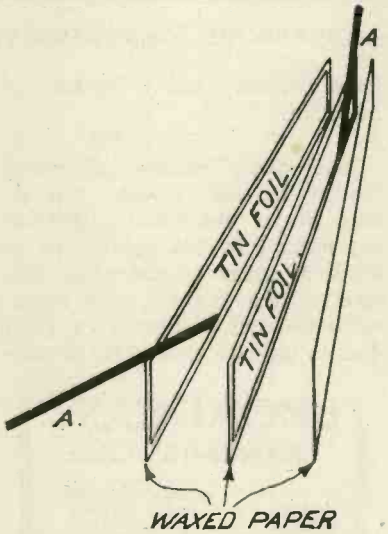


Fig. 9.—The assembly of the foils.

and quicker method is to cut the tinfoil into two long strips the size required, and rolling them up together, using as the dielectric good quality paper previously soaked in paraffin wax. The strips of paper should be ½in. larger all round than the sheets of foil. Before rolling the strips of tinfoil and paper together lay a strip of

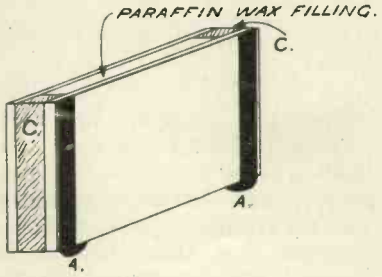


Fig. 10.—Finished condenser.

copper foil ¼in. wide on each piece of tinfoil for connecting purposes, as shown at A, Fig. 9. When the condenser is rolled up press it with a hot iron. This re-melts the paraffin wax on the paper and

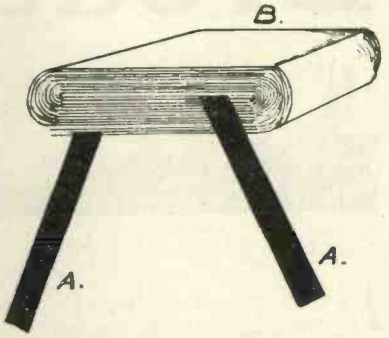


Fig. 11.—Condenser after pressing.

binds the whole together as at B (Fig. 11). The condenser should then be put between two ⅛in. ebonite sheets, turning the copper foil connecting strips up the side of the ebonite as at A, Fig. 10. A piece of ebonite should be let in at each end to take up the space between the sheets of ebonite as at C. Make two clips of thin sheet brass and bolt them to each end, firmly

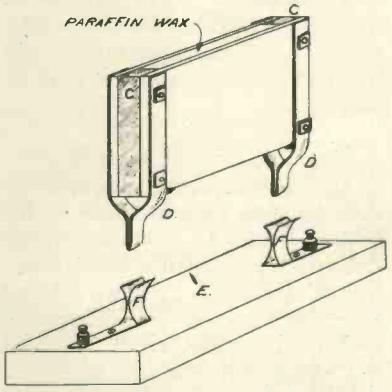


Fig. 12.—An interchangeable mounting for the condensers.

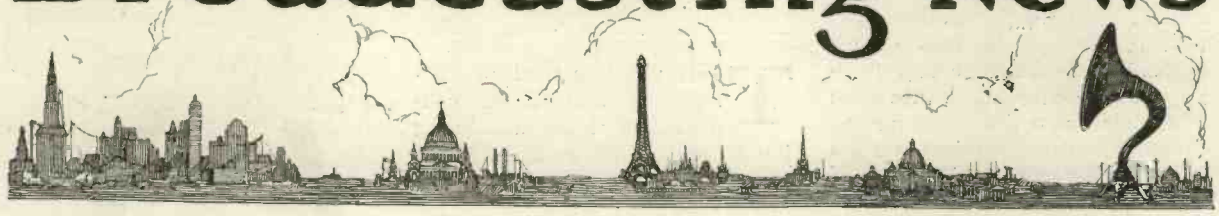
clamping the copper foil strips beneath them as shown at D. Melted paraffin wax poured round the edges of the condenser will make it damp proof.

A convenient holder for this condenser is shown at E, Fig. 12. The clips F are made from thin sheet brass, and the base is of ⅜in. ebonite.

This type of condenser and holder is ideal for the experimenter.

A. W. B.

Broadcasting News



By OUR SPECIAL CORRESPONDENTS

LONDON.—The B.B.C. receive many strange communications, and of late they have had some pathetic letters from poor neurotic women who imagine that they are human wireless sets. One lady wrote a few days ago that she had been hearing voices for the last six months, and she "naturally believed it to be wireless or Marconi." Note the subtle distinction.

◇ ◇ ◇

The poor lady was reassured as much as possible, but the probability is that she will still go on hearing wireless or Marconi voices. It is to be hoped that they will whisper messages of comfort to her.

◇ ◇ ◇

There are some of us, however—though not neurotic women—who have had our ears so much on the ground listening for that long-delayed report of the Parliamentary Committee that we *dream* about wireless voices. However, by the time these words are read the report may be common property, and then the fat will be in the fire. Whatever the report, it is pretty certain to rekindle the interest in wireless, and perhaps set the industry on its feet again.

◇ ◇ ◇

Major P. F. Anderson, the Secretary of the B.B.C., has resigned his position in order to take up business on his own account. He has had an extremely arduous task, as he was almost the first official of the Company to be appointed. Major Anderson's health has not been very good of late, and he is anxious to be relieved from the very heavy burdens of his office.

◇ ◇ ◇

The good wishes of many readers of this journal will go with Major Anderson. He has not figured in the public eye as much as many of the other officials of the B.B.C. must necessarily do, but he has had a great deal to do with setting the Broadcasting Company on its foundations.

BROADCAST TRANSMISSIONS

	Call-Sign	Wavelength
CARDIFF	5WA	353 metres
*LONDON	2LO	369 ,,
MANCHESTER	2ZY	385 ,,
NEWCASTLE	5NO	400 ,,
GLASGOW	5SC	415 ,,
BIRMINGHAM	5IT	420 ,,

TIMES OF WORKING.

Weekdays ....3.30 to 4.30 p.m. and 5.30 to 11.0 p.m. B.S.T.

*London 11.30 a.m. to 12.30 instead of 3.30 to 4.30 p.m.

Sundays....8.30 to 10.30 p.m. B.S.T.
2LO 3.0 p.m. to 5.0 p.m. also.

SILENT PERIODS.

CARDIFF	8.0 to	8.30
LONDON	7.30 ,,	8.0
MANCHESTER	7.45 ,,	8.15
NEWCASTLE	9.0 ,,	9.30
GLASGOW	6.0 ,,	8.15
BIRMINGHAM	8.15 ,,	8.45

◇ ◇ ◇

The announcement by Lord Gainford, the Chairman of the B.B.C., to the effect that the company is most anxious to go ahead with the erection of relay stations, provided Post Office sanction is obtained and the wave band alloted, is interesting, but it is not altogether news to the readers of this journal, as the subject has often been referred to in these columns.

Captain Eckersley has been hammering away at the topic since March last, and it has been on the tapis ever since the inception of broadcasting. Amongst the towns which are mentioned as possible relay stations are Liverpool, Sheffield, Leeds, Bristol, Hull, Bradford, Nottingham, Portsmouth, Leicester, Plymouth, and Edinburgh.

◇ ◇ ◇

At the present time about 30,000,000 of the population are within thirty miles of the broadcasting stations which are contemplated or in existence. The relay stations would rope in another five millions of the people, so that practically 75 per cent. of the population of the country would be in a position to listen-in if they were anxious to and had access to sets.

◇ ◇ ◇

It is in a place like Shetland that broadcasting is really appreciated to the full. Sometimes in the winter the islanders are without news of the outer world for weeks, and during this last winter the news bulletins of the broadcasting stations were tremendously appreciated.

Forthcoming Events

AUGUST.

1st (WED.).—7.15 p.m., Mr. G. A. Atkinson on "Cinema Criticism." 9 p.m., Professor Ireland: "English History."

2nd (THURS.).—6.40 p.m., Lady Baden-Powell to the Girl Guides. 7.15 p.m., Mr. Percy Scholes on "Musical Criticism." 9 p.m., Major Harry Barnes on "Modern London Buildings."

3rd (FRI.).—6.45 p.m., Mr. Ernest Esdaile on "Elocution." 7.15 p.m., Sir A. K. Yapp on the Y.M.C.A. 9 p.m., Mr. Cecil Hallett on the "Babylonian and Assyrian Collections in the British Museum."

4th (SAT.).—7.15 p.m., open at present. 9 p.m., Mr. Allen S. Walker on the Guildhall.

Mr. Burrows is endeavouring to get the Earl of Ypres and/or Mr. Asquith to speak on the anniversary of the outbreak of the Great War.

6th (MON.).—7.15 p.m., Major W. L. Meade on "Persia" (humorous). 9 p.m., Mr. E. Kay Robinson on "Nature Questions."

7th (TUES.).—7.15 p.m., an appeal on behalf of the Charing Cross Hospital. 9 p.m., Sir John Russell on "What Science is Doing for Farming."

8th (WED.).—6.45 p.m., "Topical Empire Chat," by Mr. Edward Salmon. 7.15 p.m., Mr. Archibald Haddon on "Dramatic Criticism." 7.45 p.m., Mr. Colin J. Campbell on "August Shooting Stars" (topical). 9 p.m., Mr. W. S. Crawford on "His Impressions of Business in America."

◇ ◇ ◇

BELFAST.—When the Northern Ireland broadcasting station comes into operation it will have the advantage of several vocalists of some wireless experience. Among these is the pleasing Belfast tenor, Mr. R. M. Kent, who made his radio *début* at Glasgow some months ago. Moreover, with such success, too, that he has been engaged by the B.B.C. for several of their stations. Many Belfast listeners-in were charmed during a recent afternoon to hear their talented townsman's voice in "Here in the Quiet Hills" at Newcastle-on-Tyne. Mr. Kent is, apart from the concert platform, associated with the world-renowned shipbuilders, Harland & Wolff.

◇ ◇ ◇

BIRMINGHAM.—Mr. Joseph Lewis, the new musical director of 5IT, has already donned harness, so to speak, and it is fairly safe to say that his appointment will combine with the installation of the new studio, to make a new era in broadcasting in the Midlands. Mr. Lewis has some interesting things in store, and if present indications count for anything he will certainly make his programmes as lively and as full of variety as possible.

◇ ◇ ◇

A feature of 5IT's programmes which has been particularly pleasing of late is the "General interest" talks.

◇ ◇ ◇

It is understood that when the new transmitting plant at Summer Lane is working, the power will be increased and a bigger aerial used, two high chimney stacks supporting the spreaders.

Forthcoming Events

AUGUST.

1st (WED.).—Mr. Moses Bonitz will lecture on Tannhäuser, illustrated by selections from the opera.

◇ ◇ ◇

GLASGOW. — The British National Opera Company from Covent Garden will visit 5SC, it is expected, at the end of August. The vocalists include William Michael, Doris Lemon, William Anderson, Frederick Parker, Beatrice Miranda, and Walter Hyde.

◇ ◇ ◇

Mr. Carruthers, the station director, has made arrangements with a well-known local producer for the broadcasting of Shakespearean plays.

◇ ◇ ◇

The series of "one-composer" nights has been so successful that a further list has been compiled. The Tschaïkowsky night is to be repeated, and will be followed by others devoted to Mozart, Saint-Saëns and Gounod. A development of the present system of talks is also taking place. Many prominent men in Scotland have been invited to deliver addresses from Glasgow on a wide variety of subjects.

Forthcoming Events

AUGUST.

1st (WED.).—All Mozart night.

4th (SAT.).—All Scotch night (Gaelic songs, by Miss Phemie Marquis).

◇ ◇ ◇

MANCHESTER.—2ZY's first Shakespearean evening was very successful, but the actors did not always speak loud enough. This fault was especially noticeable in the scene where Malvolio opens and reads the letter. The second fault was that the music which was played during the prologues was played far too softly—so softly, in fact, that at times it was almost inaudible. Of course these are very small matters which can easily be put right in the next play broadcast, and which did not, to any great extent, spoil the enjoyment of one of Shakespeare's best comedies.

◇ ◇ ◇

It is with conflicting feelings that we have said good-bye to Mr. Wright, and whilst offering him our best wishes and congratulations on his new appointment at the London station, we would like, on behalf of 2ZY's vast unseen audience, to tender to him our thanks for his wholehearted efforts on behalf of broadcasting from this city.

◇ ◇ ◇

To his successor, Mr. Dan Godfrey, jun., we extend a very hearty welcome. Musicians all over England regard the name of Dan Godfrey as a household word in matters musical, and we are therefore anticipating good things emanating from the new studio.

◇ ◇ ◇

Regarding the new station, work has been proceeding quietly but steadily, and the opening night is definitely fixed for Aug. 3rd, and as a grand *finale* at the old station a "stunt" programme is to be arranged. The exact nature of the "stunts," beyond the fact that they will be reminiscent of the earlier days of 2ZY, has not at the time of writing been formulated,

but we know 2ZY well enough to expect something good.

Forthcoming Events

AUGUST.

1st (WED.).—This night will not be the opening night for the new studio as originally announced. Doris Kloet and John Proctor, vocalists. The Radio Orchestra.

2nd (THURS.).—The last programme broadcast from the old studio, and from 6.45 to 7.15 transmission reminiscent of the early 2ZY days, when the cheery staff did so much to liven the programme, will be given. The studio ghost will enter the deserted studio at 11 p.m. Joseph Shore, Joseph Lingard, and Pat Ryan, pianist, flautist and clarinettist respectively, also Hugh Spencer, who will sing Somervell's "Maud" cycle.

3rd (FRI.).—The opening night at the new station. Band of the Irish Guards. Speeches by Lord Gainford and Mr. J. C. W. Reith. Individual artistes this night are Florence Holding and Lee Thistlethwaite and Victor Smythe.

4th (SAT.).—The afternoon transmission will be given by the Revilo Syncopated Orchestra. The evening programme will be by the Radio Orchestra and the popular Melody Four.

5th (SUN.).—Gladys Hulse, contralto; Fred Brough and Daisy Shorrocks, violinists; Arnold Perry, pianist; and Harold Brown, baritone.

6th (MON.).—Tennyson's birthday. Mr. J. Phythian, M.A., will give a chat on the famous poet. Mr. Albert Etchells, the blind pianist, and George Harris, the Newcastle tenor, are the artistes, with the Radio Orchestra.

7th (TUES.).—A special modern programme, during which Max Reger's beautiful composition for violin, flute, and piano will be played by Messrs. Hirsch, Lingard and Widdop. Mr. Stansfield and Miss Emily Seddon are the artistes, and the entire programme will consist of modern works.

8th (WED.).—The Radio Orchestra.

◇ ◇ ◇

NEWCASTLE-ON-TYNE. — Mr. R. E. Richardson, of Gateshead, Chairman of the Newcastle and District Beekeepers' Association, during the course of one of his recent lectures made an interesting experiment. He had brought with him a number of bees, and these were released and allowed to settle on the gauze of the microphone in order to test whether their hum would be transmitted satisfactorily. For the benefit of the listeners-in the lecturer translated the hum of the bees as follows:—

"Unhand me, you rough biped. If you had brains in proportion to your bulk you would not let tons of ungathered honey waste on the countryside when millions of willing workers only ask house-room for gathering it. But you cannot solve the problem of housing men, so no wonder hives for bees are beyond you. Take my advice, sir; make things hum, and don't leave foreigners and colonials to supply the most delicious and perfect food Nature has provided. Come, get a move on, and let us buzz off."

◇ ◇ ◇

Later Mr. Simpson gave the notes of the bees as identified by Mr. W. A. Crosse, conductor of the Newcastle Wireless Orchestra, and asked for reports as to the reception of the bees' humming. He had not long to wait, for a telegram arrived from the Shetland Islands next morning saying:—

"Last night's Richardson's talk perfect reception. Bees like aeroplane drone overhead."

◇ ◇ ◇

SHEFFIELD. — For several reasons, aerial difficulties being one, the Sheffield station has had to seek a new home. This it has found at the house of Mr. H. Lloyd, the local society president, and there it will stay until the B.B.C. locate a permanent site in a few weeks' time.

◇ ◇ ◇

The house in Ventnor Place—it is perhaps unique in broadcasting that the programme should issue from a private drawing-room—has been turned almost "upside down." The drawing-room has become a studio draped with horse-cloths and army blankets, and here an electric piano and electric gramophone took first turns, until there came a spate of volunteers to figure before the microphone. There is no lack of speakers and performers up to the present, with the result that already the listeners are getting good pianoforte and orchestral music, breezy chats and informative addresses.

◇ ◇ ◇

There is great jubilation abroad in Sheffield and district, for the crystal set users are listening to broadcast programmes that improve with every transmission. Transmissions take place on Mondays and Thursdays from 8 p.m. for an hour and a half, and on other evenings experimental transmissions may be heard.

◇ ◇ ◇

Success is practically assured even with this temporary expedient of direct broadcasting, for letters have poured in from large numbers of crystal set users all over the district congratulating the experts on the fine transmissions. These have now been altered to a wavelength of 350 metres, to avoid interference with direct listening-in to Paris and other places.

◇ ◇ ◇

An enthusiastic letter came from four miles beyond Chesterfield, fourteen miles from the transmitting station, saying that Sheffield was being received beautifully on a seven and sixpenny crystal set.

◇ ◇ ◇

The correspondence received shows that without doubt the innovation has increased the popularity of wireless enormously in Sheffield and district, and there are apparently hundreds of recent converts anxious to pay their congratulations for such instant success.

◇ ◇ ◇

The relay experiments are proceeding satisfactorily, and there is a confidence at headquarters that not many weeks will see the crowning of the experts' patient efforts with success. Every local experimenter is looking forward with anxiety and expectation.

THE BRENTWOOD RECEIVING STATION

This article gives a brief description of a high-speed wireless telegraph receiving station.

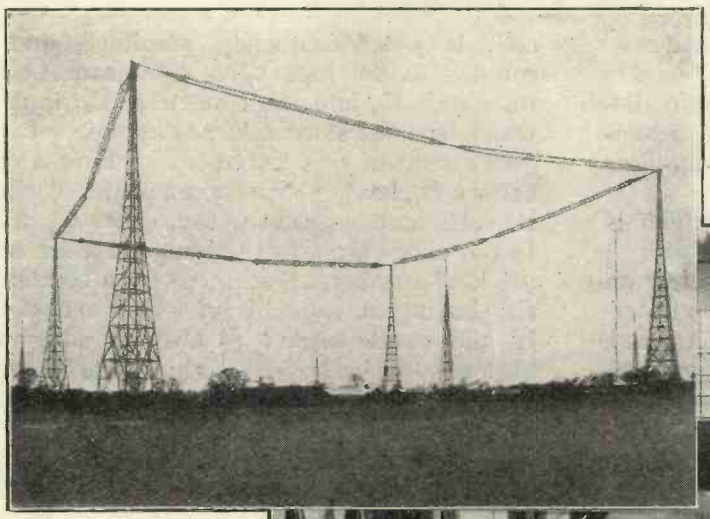
THE receiving station at Brentwood is less imposing in appearance than the Ongar transmitting station because it is possible to carry on reception with much smaller aerials than are required for efficient transmission.

The circuits are so arranged that simultaneous reception can be carried on from four continental stations and from six trans-atlantic stations.

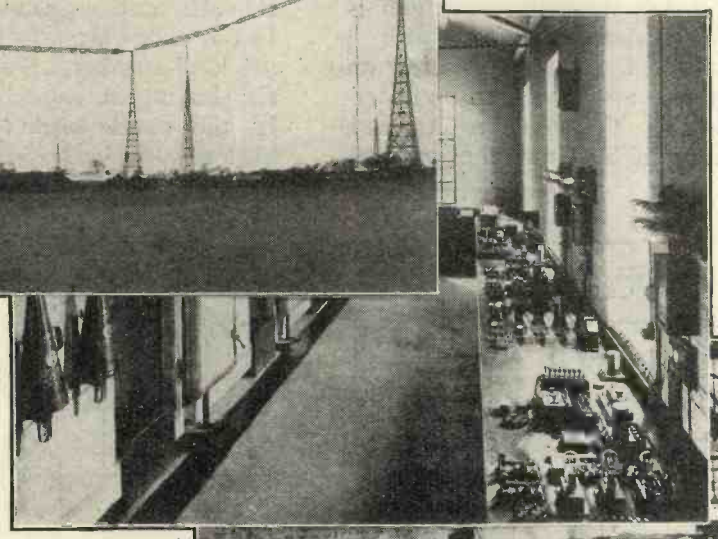
The latest devices for filtering out atmospherics are in successful operation in a new type of receiving apparatus.

Special attention has been paid in the design of the apparatus to its operation under adverse atmospheric conditions, and to the maintenance of adjustment with the minimum of attention. Here again there is no need for telegraphists, owing to an automatic linking device, and the duty of the attendant in charge of each set is merely to adjust and maintain it in such condition that clear signals of maximum strength are passed to the land lines for operating the recorders installed at the central control office in London.

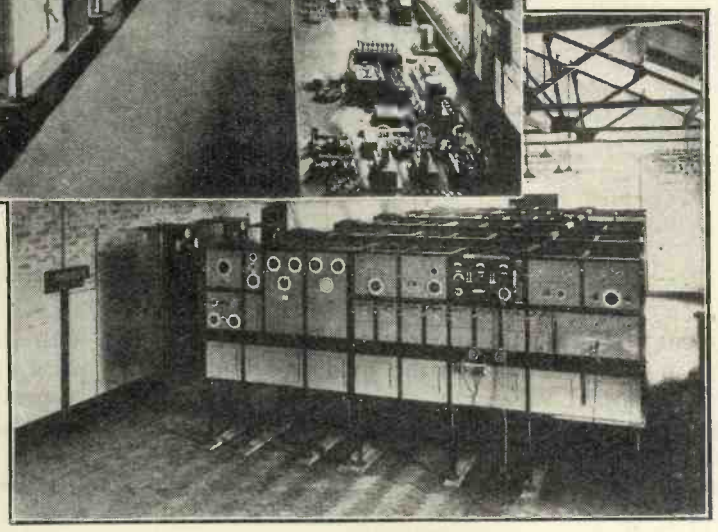
The receivers are very compactly constructed on a unit system. They make use of directional selectivity on the Marconi-Bellini system, and the six trans-Atlantic receivers, each tuned to a different transmitting station, are operated simultaneously from one aerial system. Seven underground telegraph circuits and seven underground telephone circuits connect Brentwood and Radio House, and there are extensions to the transmitting centre at Ongar.



The trans-Atlantic aerial system.



The land-line circuits connecting Brentwood with Radio House and the Ongar station.



The six trans-Atlantic receivers used on six separate circuits from one aerial system.

Mainly about Valves

Our weekly causerie written by the Editor.

Low-Frequency Resistance-Coupled Amplifiers

THOSE who are anxious to obtain distortionless amplification will find resistance-coupled low-frequency amplifiers very effective.

Fig. 1 shows a five-valve circuit which is suitable for giving demonstrations with a loud-speaker. The ST34 circuit is used on the first two valves, and the step-up inter-valve transformer T_1 T_2 serves to separate the high-frequency side from the low-frequency side of the circuit. The secondary T_2 is connected across the grid and filament of the third valve, in the anode circuit of which is an anode resistance R_2 having a value of about 50,000 to 70,000 ohms. The anode of the third valve is connected through the grid condenser C_5 to the grid of the fourth valve, the condenser C_5 having a capacity of about 0.005 μF; the gridleaks R_4 and R_5 have a value of about 2 megohms.

The low-frequency current variations through R_2 set up potentials across it, these being then communicated to the grid of the fourth valve. This valve, like the preceding one, is a low-frequency amplifier, and is coupled to the fifth valve by means of the resistance R_3 and the condenser C_6, both of which have the same values as before. In the grid circuit of this last valve we have a grid battery B_3, having a maximum value of about 20 volts, and tapped at, say, every $4\frac{1}{2}$ volts. In the anode circuit of the last valve we have the loud-speaker LS shunted by a condenser C_7, having a capacity of about 0.005 μF. In the anode circuit is also an additional high-tension battery, B_4, which acts in series with the high-tension battery B_2 which supplies the other valves. The last valve, V_5, is preferably a loud-speaker valve, such as the Mullard P.A. or the Marconi valve of similar size.

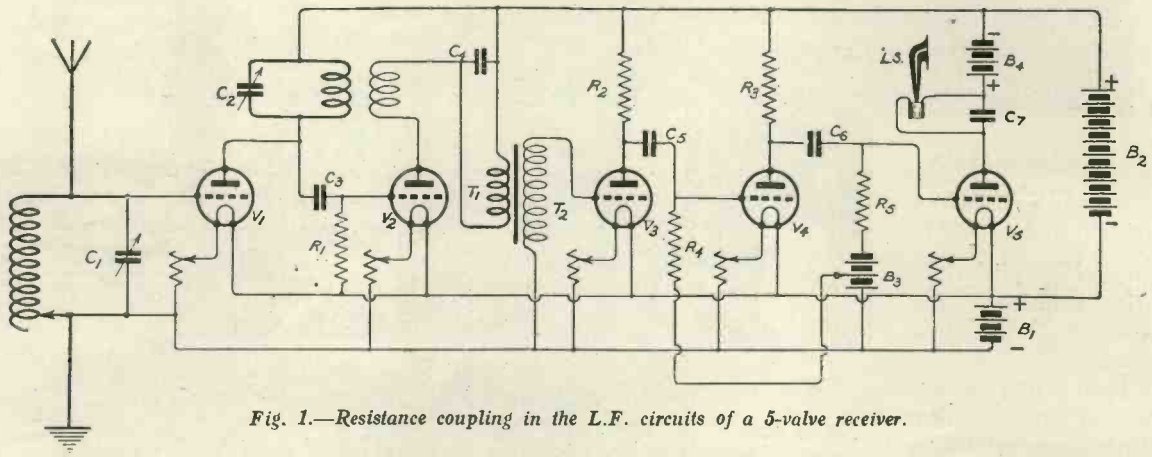


Fig. 1.—Resistance coupling in the L.F. circuits of a 5-valve receiver.

It will be seen that a tapping is taken off the battery B_3 to work the grid of the fourth valve at a negative potential.

A Point in Connection with Resistance Amplifiers

Many experimenters are under the impression that leaky grid condensers are bound up with rectification, and that whenever a

grid condenser and gridleak are provided in a circuit, rectification is bound to take place. This, of course, is not so.

A leaky grid condenser is certainly used to enable a valve to rectify, but although the condenser and resistance may appear in similar positions, they do not always act in the same capacity. Fig. 1 is an excellent example of leaky grid condensers acting in entirely different ways. Attention should be directed to the second and fourth valves in Fig. 1. Grid condensers and gridleaks are, in both cases, shown. In the latter case, the grid condenser has a capacity of 0.005 μF, while, in the case of the valve V_2, the grid condenser C_3 has a capacity of 0.0003 μF. The large capacity is required later on in the circuit to enable the low-frequency pulses to be communicated through it.

If we examine the function of the condenser C_3 in Fig. 1, we will see that it really serves a double purpose. Its chief purpose is to insulate the grid of V_2 from the high-tension battery. The positive terminal of the high-tension battery would otherwise be connected through the tuned anode circuit to the grid, and give it a high positive potential. The condenser C_3 is, therefore, inserted between the two. This condenser still allows the high-frequency potentials to be communicated to the grid. The leak R_1 is connected across grid and filament because, if it were connected across C_3, a portion of the high-tension voltage would be communicated to the grid through the resistance.

As the second valve is intended to act as a detector, the condenser C_3 also serves as a grid condenser, the surplus of electrons which accumulate on the grid leaking away to the filament through the resistance R_1. It does not matter where the leak is connected as long as the electrons can leak away.

When we come to the grid circuit of the fourth valve, the condenser C_5 now acts, as before, as a blocking condenser, to prevent the high-tension voltage from being communicated to the grid of the fourth valve. The resistance R_4 is now not used for the purpose of allowing electrons to leak off the grid, but is a means of impressing on the grid of the fourth valve a suitable negative potential, supplied by the battery B_3. As there is no grid current, a negative potential is impressed on the grid even through the very high resistance R_4. This resistance needs to be very high, as otherwise it would short-circuit the low-frequency potentials across R_2.

As the grid of the fourth valve is at a negative potential, there will never be any grid current even when large potential variations are applied to the grid.

As there are never any grid currents, there can be no question of any rectification effect taking place in the fourth valve, and it is therefore clear that the action of the grid condenser and gridleak is, in this case, entirely different from its action in the case of the second valve.

FORTHCOMING EVENTS

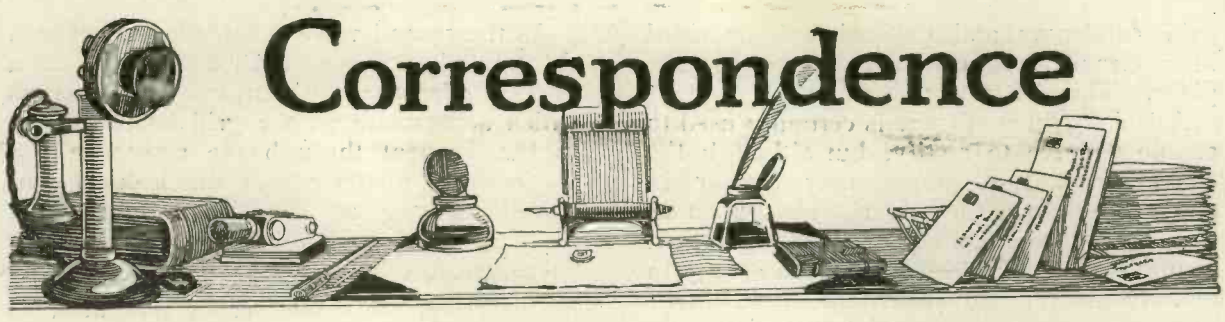
AUGUST.

2nd (THURS.).—Hackney and District Radio Society. Mr. Wall will lecture on "Accumulators and Care of Same" at the Y.M.C.A., Mare Street, Hackney.

3rd (FRI.).—Hull and District Wireless Society. At 7.30 p.m. this Society will hold "Questions and Answers" and a Buzzer Practice at the Co-operative Social Institute, Jarratt Street.

Battersea and District Radio Society. Mr. A. J. Thompson will lecture on "Amplification" in the Board Room of the Latchmere Road Baths.

4th (SAT.).—Ipswich and District Radio Society. Field day with Felixstowe Wireless Club, Levington Bridge.



5NO

To the Editor, *Wireless Weekly*.

Sir,—I wish to inform you of the great success of *Wireless Weekly* in this district, and I am fully convinced that if you keep it to the same standard as at present you will undoubtedly head the list as "the best wireless weekly paper." I see there is a little controversy over the broadcasting programmes, and already three letters have appeared in your weekly on the subject. I may state that I can only share part of my views with Mr. Tucker whose letter is published in your No. 6.

Being only about 80 miles from Newcastle and with a reliable, home-made, 2-valve set, I receive 5NO very clearly, but the music transmitted is terrible, and the singers ditto. The announcer trying to speak like a foreigner does not help matters.

With skill and care, 5NO could be made an excellent station. What did most critics say about Mr. Crosse's orchestra, which commenced playing immediately after the Eastbourne Band had been transmitted recently from the Town Hall? That is what I term "bad management" or "bad arrangement of programme."

My idea of a well-arranged programme is as follows:—

(1) Orchestra—light music.
(2) Song or quartet.
(3) Violin or 'cello.
(4) Entertainment, jokes, etc.
(5) Orchestra—lively music.
(6) Pianoforte solo.

and so on.

Lastly, why not try some Gilbert & Sullivan light operas, namely, "The Mikado," "Patience," "Tom Jones," and others.

Wishing you every success with *Wireless Weekly*, I am, etc.,

"A Would-Be Helper."

Brotton, near Saltburn.

ST100

To the Editor, *Wireless Weekly*.

Sir,—Having read *Wireless Weekly*, and having assembled an ST100 set, I have made a few brief experiments, and find it well up to my expectations.

I have, to-night, been using a 35ft. aerial about 35ft. above ground level but only about 6 feet from the roof, and I was able to tune in the Dutch concert quite well. I think that is quite good for an inland town. I am, etc.,

H. Wistgarth Taylor.

Leicester.

CRYSTAL RECEPTION

To the Editor, *Wireless Weekly*.

Sir,—I think I might offer an explanation to Mr. Jersey, of Battersea, with regard to reception of 2LO without any crystal in the cup of his detector. When the crystal is removed, minute particles are left in the cup. These come into contact with the cat's-whisker, and thereby rectify the signals in the usual way.

I am, etc.,

D. E. Osman.

Leigh-on-Sea.

EXPERIMENTAL TRANSMITTERS

To the Editor, *Wireless Weekly*.

Sir,—I have been interested for some time past in the wonderful progress made by the amateur transmitters who regularly carry out experiments after the evening concerts have terminated.

Such experimenters as 2OM, 2QQ, 5VD, and 6IM, are among the powerful stations, so far as my reception can determine, but there is another station, 5VR, which has been operating recently, and appears to be the most powerful and makes perhaps the most interesting musical and other tests; yet you do not appear to publish any correspondence regarding this station, and I cannot find any mention of it in the lists from time to time.

Perhaps some of your readers will be able to enlighten me.

I am, etc.,

S.W.12. C. F. Ottley.

ST100 AGAIN

To the Editor, *Wireless Weekly*.

Sir,—The following facts may be of interest to your readers with regard to ST100.

Situated in West Somerset and badly screened by North Hill, 1,000ft. high, I get all the British stations using a coil of 60 turns on the A.T.I., and 75 on the reaction.

Cardiff is, of course, very loud; Manchester, Birmingham, London, and Newcastle are quite loud enough on 'phones; Glasgow is difficult, and not loud; Eiffel Tower concerts as loud as Cardiff on 300 and 500 coils or on two 300's; Radiola on 250 and 300; Posts and Telegraphs on 60 and 75; the Hague fairly loud on 150 and 200; Croydon talking to aircraft loud and clear on 100 and

150. Condenser C_1 in series, I find this much better than in parallel. I use 6 volts on the grid battery, L.T. 4 volts, H.T. 60 volts, Ora valves. The circuit I use is Fig. 4, page 427, July issue of *Modern Wireless*, with this alteration, I reverse the leads of the low-tension battery and double the strength of signals.

I also use a vernier condenser in parallel with C_1. My aerial is a double one, two wires 7ft. spread pointing 8° north of London, and two wires 6ft. spread pointing to Newcastle, each 98ft. long and about 36ft. high, on sloping ground. Two earths, water-pipe, and a large galvanised tank in ground. Marconite crystal with Tordinodium wire.

I am, etc.,
J. ACLAND.

Lynch Mead, Allerford,
Somerset.

DRILLING EBONITE

TO THE EDITOR, *Wireless Weekly*.

SIR,—Some readers may not care to spend 10s. on a breast drill. The chuck of an ordinary carpenter's brace may be taken off, and, if the jaws inside are substituted by a pair of crocodile jaws, which can be had at any tool shop for 1s., they will take any twist drill from 6B.A. clearance to the largest size necessary for switch arms. If a small piece of emery-cloth is placed round the drill, it stops the jaws marking, and keeps size marks clear. Personally, I prefer to take a $\frac{1}{32}$in. twist drill through the hole, as it stops any chance of choking. This I use in a Hobbies archimedian drill. If ebonite is placed on a board and another thin strip of wood nailed each side of the panel it will not swing, and the fact of the drill going in the wooden base keeps a clear hole. With thanks for much knowledge obtained in *Wireless Weekly*.

I am, etc.,
W. J. RAWLINSON.

Teddington, Middlesex.

CONGRATULATIONS

TO THE EDITOR, *Wireless Weekly*.

SIR,—I have received one of the first copies of *Wireless Weekly*, and feel that I must congratulate you upon producing such a paper.

Out here in Australia, where material is so expensive, we appreciate any paper that suggests to us a cheaper way of making our sets, and the numerous "Hook-ups" published in Vol. I., No. 2 issue, are quite a boon to us.

Wishing you every success in the future with such a grand paper. I am, etc.,
T. D. ATHEY.

W. Australia.

DUAL AMPLIFICATION

TO THE EDITOR, *Wireless Weekly*.

SIR,—With the circuit as described in No. 5, *Modern Wireless*, page 329, but adding reaction in the plate circuit, it might interest you to know that I heard Koenigwusterhausen LP quite distinctly on July 1st, at 12.30, audibility about equal to 2LO on a crystal.

I must add that the block condenser between the 'phone and H.T. was much larger than indicated on the circuit shown.

I am, etc.,
Ealing, W.5. G. J. P.

INTERFERENCE

TO THE EDITOR, *Wireless Weekly*.

SIR,—May I, as the writer of the paragraphs on Cullercoats, trespass on your valuable space to reply to the letter you published from Mr. D. Aird. The two hours' unceasing operation of this station was observed by myself, and however "far-fetched" Mr. Aird may think it, it is perfectly true.

No sensible person would maintain that commercial and official messages should be shelved for the benefit of broadcasting, and there was nothing in the paragraph to suggest such a contention; neither was any reflection cast upon the Cullercoats staff, who doubtless carry out their duties most efficiently.

Rather was it the purpose of the paragraph (as Mr. Aird may note if he re-reads it) to suggest that the remedy lies in the securing of increased selectivity.

I am, etc.,
E. J. WILLIAMS.

Newcastle-upon-Tyne.

P.S.—Surely at South Shields Mr. Aird should not need three note magnifiers to get 5NO on a small loud-speaker. Why not ST100?

RESULTS!

TO THE EDITOR, *Wireless Weekly*.

SIR,—As an experimenter for a number of years I have tried many circuits, but have never come across one to touch ST100. With two Igranic transformers and one Marconi-Osram, one Mullard valve, and Hertzite detector I can get all British broadcasting stations; also FL, Ecole Superieure des Postes, Telegraphes et Telephones de Paris, London amateurs and Liverpool amateurs, Bar lightship, the Hague, 5IT, 2ZY, 2LO loud-speaker results. 5NO, 5WA, 5SC can be heard with 'phones on table. I am using three Igranic coils, No. 75 as reactance, Nos. 35 and 50 as coupler.

I am, etc.,
H. E. PLANT.

Burton-on-Trent.

FUSIBLE METAL

TO THE EDITOR, *Wireless Weekly*.

SIR,—It has been stated that an improvement can be obtained in crystal and valve crystal sets by mounting the crystal in a cup filled with mercury, which I find to be the case, but the mercury has a nasty habit of getting spilt.

To obviate this, a paste metal, equally efficient, can be made by amalgamating the mercury with a quantity of lead foil. This I did by gradually adding the foil until the right consistency was obtained. I can now reverse the crystal without the filling coming out of the cup. I am, etc.,
H. E. WHEELER.

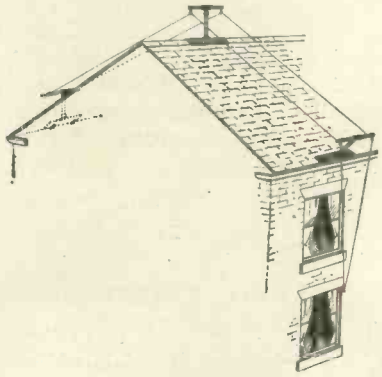
Forest Gate, E.7.

Conducted by A. D. COWPER, B.Sc. (London), M.Sc.

The "Roofaffix" Aerial

MANY would-be listeners-in find the erection of an effective aerial one of the hardest problems, especially in congested areas. One solution of the difficulty is offered by the "Roofaffix" aerial made by Messrs. B. Byron & Co., which has been submitted to us for practical test.

This aerial consists of three quite substantial brackets with a T-shaped top provided with insulators, one bracket being arranged to fit on the ridge and the other two to be placed at the edge of the slanting roof, in such a manner as to provide support for a double aerial, the wire for which is supplied with the set.



The "Roofaffix" aerial.

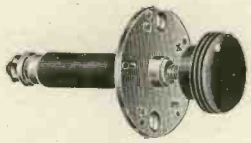
Means of fixing these brackets are designed so as to avoid serious interference with or damage to the roof. The device proved to be impressively sturdy, and, when once installed, unlikely to be disturbed by anything short of a hurricane, while the work of fixing the brackets is simple enough. Although the electrical capacity of such an arrangement is bound to be fairly high, with the aerial wire so close to the roof, this device offers a solution of the aerial problem in many difficult places, and certainly gives the maximum elevation possible.

A Variable Gridleak

Messrs. Watmel Wireless Co. have submitted for test a variable gridleak, for panel mounting, in which the resistance of the leak is continuously variable over the required range. A fine screw plunger acts through an intermediary spring plunger on a column of several carbon pellets $\frac{3}{16}$in. diameter enclosed in an ebonite tube, the variation of resistance being obtained by varying the pressure on this column by a few turns of the plunger knob. A single $\frac{3}{8}$in. hole is required for mounting the instrument in the panel, with two small fixing screws through the flange, and the depth below the flange is $2\frac{1}{2}$in., so that it is decidedly convenient in this respect, taking up little room.

On practical trial it was found to be exceedingly handy, giving a useful range of resistances to suit various types of valves and conditions, and perfectly silent in use, even while adjusting the value of the resistance. Extremely critical regulation of different detector valves became possible; on single valve reception, in high-frequency reactance capacity couplings, etc., it left nothing to be desired, while in the ST100 circuit, as an anti-howling device it proved to be most satisfactory, enabling one to obtain the maximum amplification combined with perfect steadiness.

This little fitting is neat in appearance, well finished and



The Watmel gridleak.

mechanically sound, although the price is extremely moderate, and can be thoroughly recommended both for general experimental work and for incorporation in more permanent sets.

"Panelite"

Messrs. Clar-O-Phon Radio Co. have submitted for examination and test samples of "Panelite," an insulating material of the ebonite type. This is made in two degrees of hardness, 1 and 1A. The samples had a handsome appearance, with a uniform, dull matt black surface. The electrical resistance, both from face to face of a panel and across a narrow strip of one surface, was too high to measure. We were particularly impressed by the physical properties displayed. Holes could be drilled right through without any of that chipping at the back edges, which has spoilt many a panel; with saw, file, tap and drill, etc., it was a pleasure to work, and a neat finish was readily obtained. Wood screws could be used to fix small fittings without either tapping the hole first or alternatively wringing the neck of the screw.

Information Department

Conducted by J. H. T. ROBERTS, D.Sc., F.Inst.P., assisted by A. L. M. DOUGLAS.

In this section will appear only selected replies to queries of general interest or arising from articles in "Wireless Weekly," "Modern Wireless" or from any Radio Press Handbook.

All queries will be replied to by post, as promptly as possible, providing the following conditions are complied with.

1. A Postal Order to the value of 1s. for each question must be enclosed, together with the Coupon from the current issue, and a stamped addressed envelope.

2. Not more than three questions will be answered at once.

3. Queries should be forwarded in an envelope marked "Query" in the top left-hand corner and addressed to Information Dept., Radio Press, Limited, Devereux Court, Strand, London, W.C.2.

J. C. (BURLEIGH) asks for a diagram showing the switching of a L.F. amplifier.

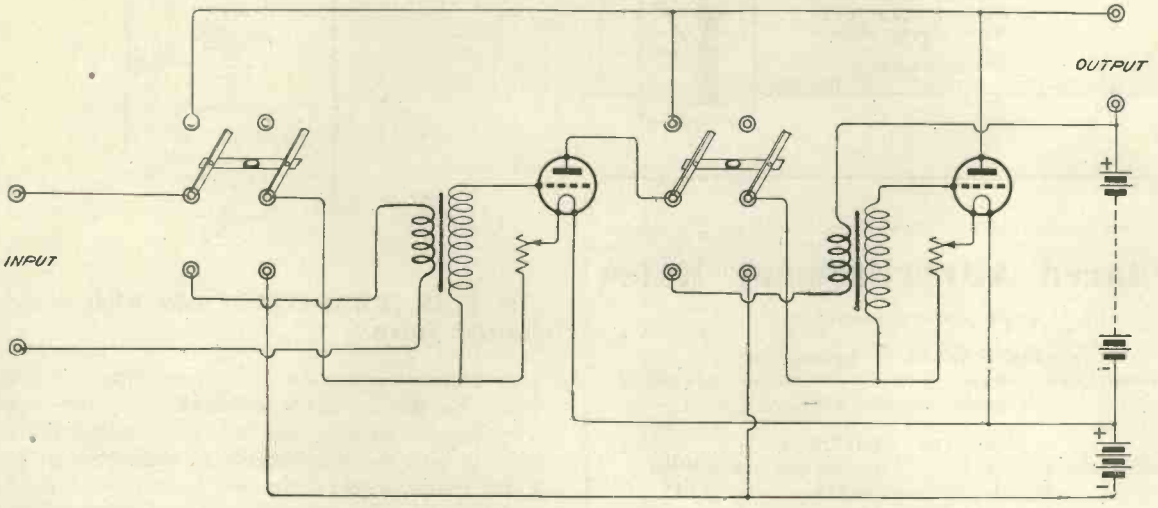
A diagram of a suitable method of switching is given on this page.

F. R. H. (STAMFORD HILL) asks (1) whether old gramophone records are a satisfactory substitute for ebonite. (2) Questions about an Armstrong regenerative circuit.

(1) Gramophone records have quite good insulating properties and have a considerable range of usefulness for wireless purposes. Being rather thin and consequently fragile, they must not be used for large panels, but for small pieces, such as terminal strips, they are quite suitable. The material can be easily cut by means of a hot knife, and may be drilled in the ordinary way. (2) We think that you would find the use of a variable grid leak of a good make a distinct advantage in your Armstrong receiver.

E. W. (WALLINGTON) asks whether a tapped honeycomb coil might be used instead of the cylindrical inductances for the 200 to 5,000 metre set described in "MODERN WIRELESS" No. 3.

We think tapped honeycomb coils would be fairly satisfactory, but we should warn you that "dead-



A 51

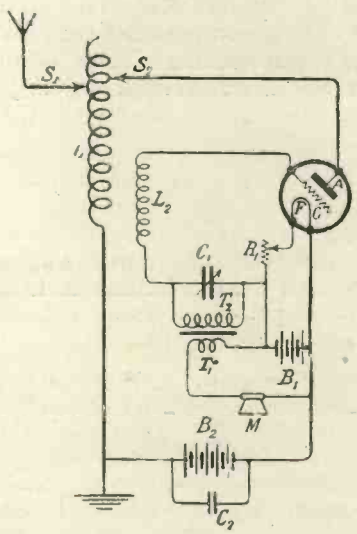
end" effects are much more liable to occur in honeycomb coils than in the single layer type when tappings are used. The coils should be wound with a similar number of turns to those specified in the article and with the heaviest gauge of wire which is possible under the circumstances—that is to say, within reasonable limits of space.

A. F. B. (MANCHESTER) has made a 2-valve receiver which he uses with a small frame but only obtains weak results from 2ZY, and no signals from the other Stations. He asks whether we can help him.

Since you are using only two valves, and of these one is a rectifier and the second a low-frequency amplifier, we are not surprised that you only receive the local station, since to obtain distant stations with a frame aerial it is necessary to use at least two high-frequency valves. We should recommend you to try circuit ST40 ("Practical Wireless Valve Circuits," Radio Press, Ltd.)

B. L. S. (LEEDS) asks for a diagram of a single-valve transmitter.

We give below a suitable circuit employing grid control and using the components which you mention.



H. F. H. (BRADFORD) asks what is a dull emitter valve.

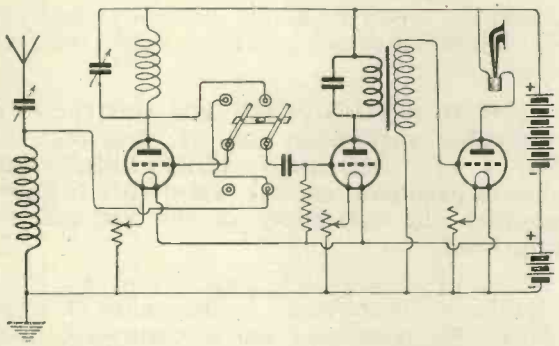
Dull emitter valves are a fairly recently introduced type, having a filament which is often coated with certain metallic oxides which enable the filament to give the required electron emission at quite a low temperature, commonly a dull red. A great economy of filament current is thereby effected, and there are valves upon the market which work with as little as 0.18 of an ampere filament current.

A. W. B. (CATFORD) has constructed a tuned anode coil of which he submits particulars, but does not get satisfactory results. He asks our advice.

We think that you have far too many turns of wire on the former that you mention. For broadcasting purposes the coil might be wound upon a 3in. diameter tube with eighty turns, tapped at sixty and seventy turns. This in conjunction with a variable condenser of 0.0003 μF will cover the broadcast wavelength easily. A suitable wire for winding this coil would be No. 22 double cotton covered.

H. P. W. (BLACKBURN) asks for a 3-valve circuit with a switch to cut out the H.F. valve.

See the accompanying figure.



G. A. D. (ESSEX) asks how many condenser vanes having a radius of 1¼in. and spaced ⅛in. apart will be necessary to construct a variable condenser having a capacity of 0.0002 μF.

Thirteen vanes will be required—seven fixed and six moving.

A. B. (DUNDEE) submits a specimen piece of fibre and asks whether it is suitable for constructing panels upon which to mount wireless receiving apparatus.

The fibre which you submit is not a very good quality, and we should not recommend its use for wireless purposes. Fibre in general is extremely liable to give trouble in wireless instruments on account of its propensity for absorbing moisture and becoming of very poor insulation.

J. F. (WELLINGBOROUGH) has made a power amplifier and gets extremely unsatisfactory results, being very much troubled with " howling " and other unpleasant effects. He asks the reason and mentions that he is using a soft Dutch valve.

Soft valves are quite unsuitable for this purpose, and their use entirely accounts for the trouble which you have been experiencing. You should use the hardest possible receiving valves and apply to them a voltage of about 200 on the plate, and a

negative bias of up to *minus* 10 volts upon their grid. You may be interested to hear that a constructional article giving useful details for making a good power amplifier appears in the August number of *Modern Wireless*.

F. E. C. (PLUMSTEAD) has a receiver which he has built from circuit ST44 of "Practical Wireless Valve Circuits," and asks what sizes of coils should be used in various positions to cover the British Broadcasting band of wavelengths.

Coil L_1 might have thirty-five, fifty, or seventy-five turns, depending upon the size of the aerial with which it is used; coils L_2 and L_3 may be of fifty or seventy-five turns. If you are winding these coils yourself you would probably obtain better results by making L_2 and L_3 of ninety turns. With careful adjustment and under favourable circumstances we think you should be able to hear all the British broadcasting stations with this receiver.

G. H. H. (STOCKPORT) has constructed a two-valve variometer set as described in No. 1 of "MODERN WIRELESS," and obtains excellent results. He wishes to know whether the selectivity of the set can be improved.

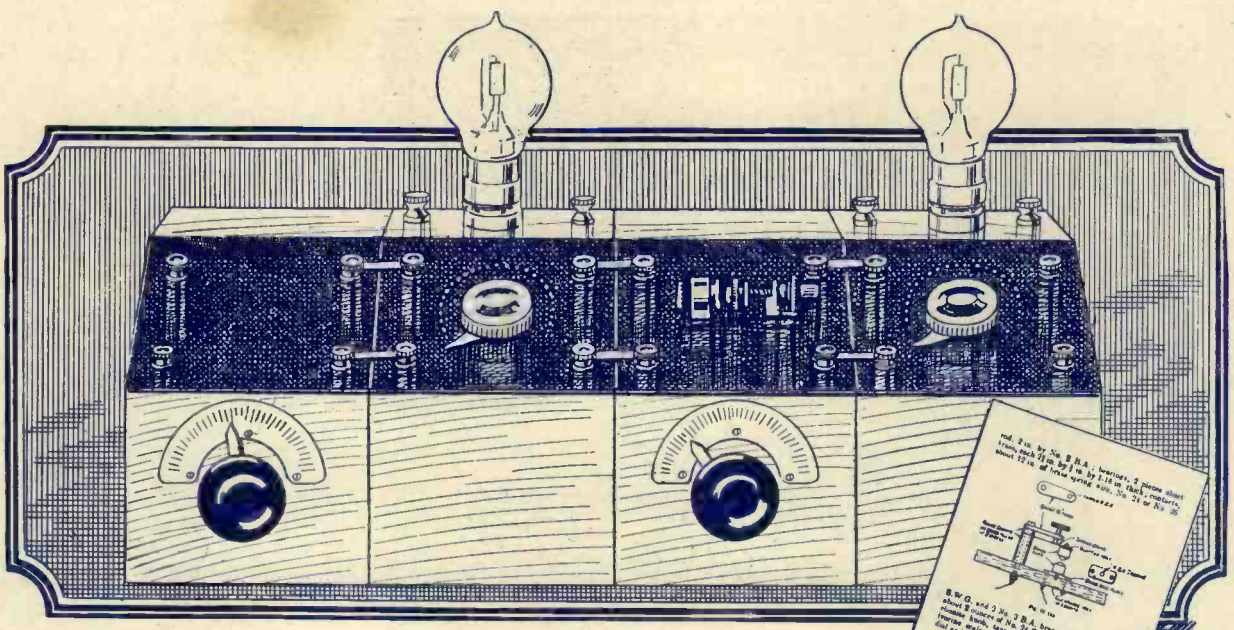
The use of an inductively coupled tuner will effect considerable improvement in the matter of selectivity. We recommend you to construct a tuner along the lines of that described in WIRELESS WEEKLY, No. 5, omitting, of course, the crystal detector. The secondary coil of the inductively coupled tuner would then take the place of the first variometer in your present set. We are pleased to learn that you are obtaining good results so far.

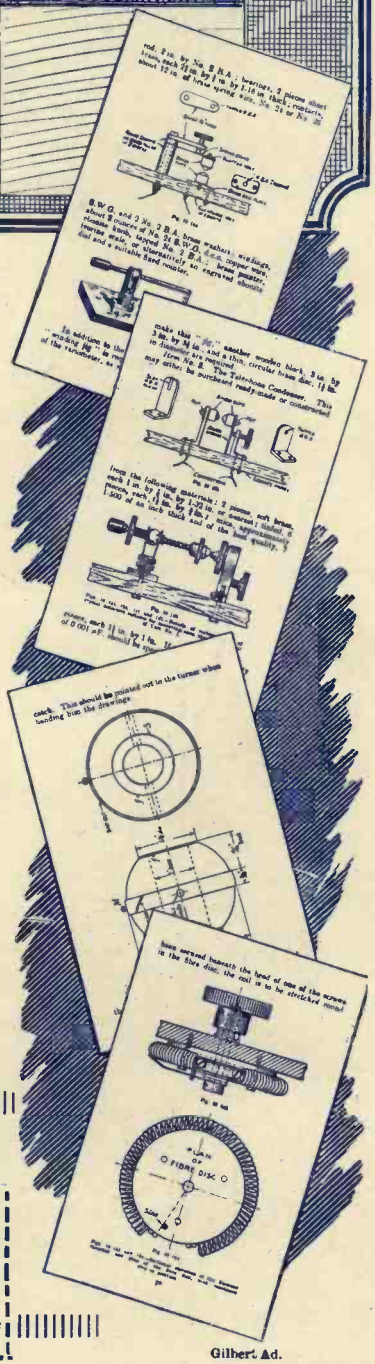
M. J. B. (RUTLAND) has constructed a set which provides for dual amplification but finds that self oscillation occurs. He enquires as to the best means of preventing this.

The addition of a potentiometer in the manner suggested would, no doubt, have the desired effect, but a more economical method is to introduce a fixed high resistance, value about 100,000 ohms, between the grid of the first valve and the positive side of its filament. A variable resistance, specially suitable for this purpose, is now on the market. It is made by the Watmel Wireless Company, and its price is 3s. 6d.

W. T. (LOUGHTON) has installed a wireless receiving set and is requested by his landlord to install an external lightning arrester together with a two-way earthing switch. He asks our opinion on the matter.

We consider the request quite reasonable and compliance with it mutually advantageous to you and the landlord. The inclusion of the arrester and switch will not detract from the efficiency of your apparatus and will afford protection in the event of a thunderstorm.





Such clear instructions enable anyone to build this excellent 4-Unit Set

ONE special feature of this new Book is that it does not presume any knowledge of Wireless at all on the part of the purchaser.

Constructional articles in *"Wireless Weekly"* and *"Modern Wireless"* necessarily anticipate that the reader has some knowledge of Wireless—if only of the most elementary kind.

Even if you don't know one end of the Receiving Set from the other, and have never even "listened in," you can buy this Book confident that you can build your own Set—one which will give you particularly good results over long distances.

The Receiving Set described in this Book is quite different from any yet placed on the market. It is particularly neat and efficient, and as an economical Set it is certainly without parallel. For, at an original outlay of a few shillings, it is possible to construct the Detector Unit (which uses a crystal) and to enjoy the pleasures of "listening in" right from the very beginning. Later on—and at your convenience—you can add valves which will enable you to pick up Broadcasting stations further away, or to use a Loud Speaker instead of head-phones.

The whole Instrument has been carefully designed and tested for reception over long distances

Get a copy Now—and start Wireless economically

Radio Press Ltd., Devereux Court, Strand, W.C.2

How to make a "Unit" Wireless Receiver

by E. REDPATH (*Assistant Editor of "Wireless Weekly."*)

RADIO PRESS
Wireless Library
No. 7.

2/6

or 2/8 post free

Gilbert Ad.

Printed for the Proprietors, RADIO PRESS, LTD., Devereux Court, Strand, W.C.2, by THE CORNWALL PRESS, LTD., Paris Garden, Stamford Street, London, S.E.1. Published on Wednesday of each week at 3, Bolt Court, Fleet Street, London, E.C.4. Address for Subscriptions and Editorial communications:—Devereux Court, Strand, London, W.C.2. Advertisement Managers:—THE SCHEFF PUBLICITY ORGANISATION, LTD., 125, Pall Mall, London, S.W.1. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates:—32/6 per annum, 16/3 for six months, post free. Sole Agents for Australasia:—GORDON & GOTCH (Australasia), LTD. For Canada:—IMPERIAL NEWS, LTD. For South Africa:—CENTRAL NEWS AGENCY, LTD.

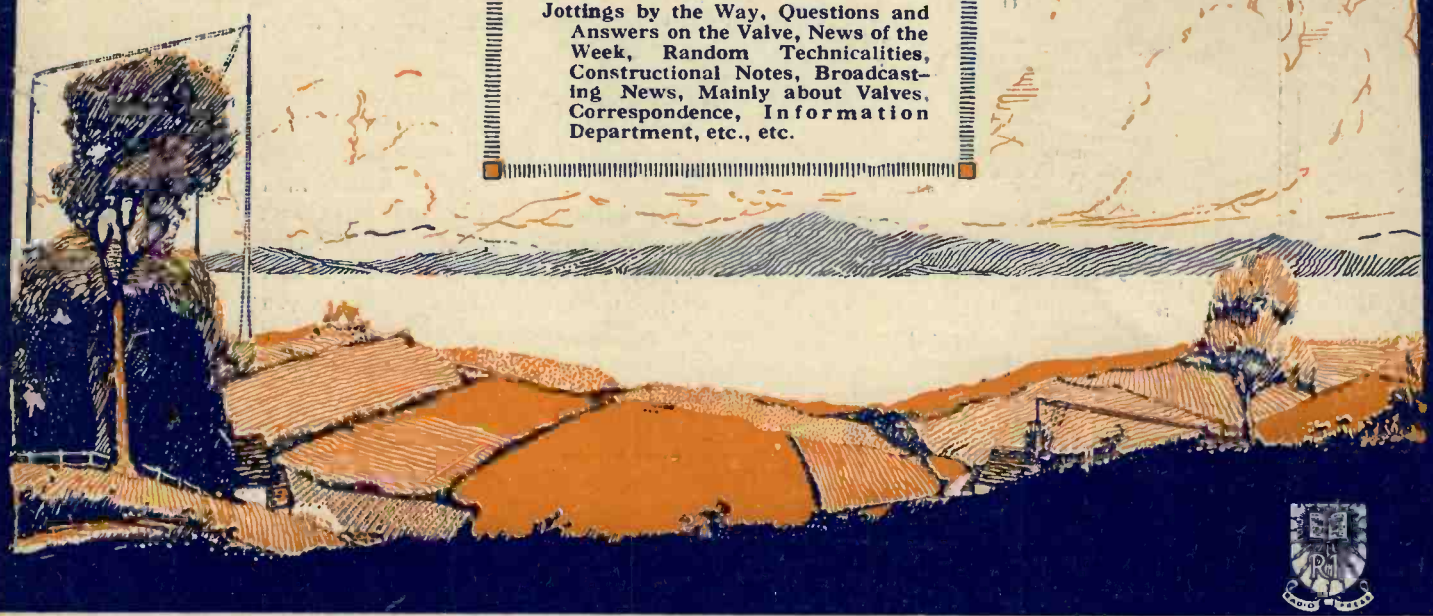
Wednesday, 6d. Net. Vol. 2 No. 4. August 8th, 1923.

Wireless Weekly

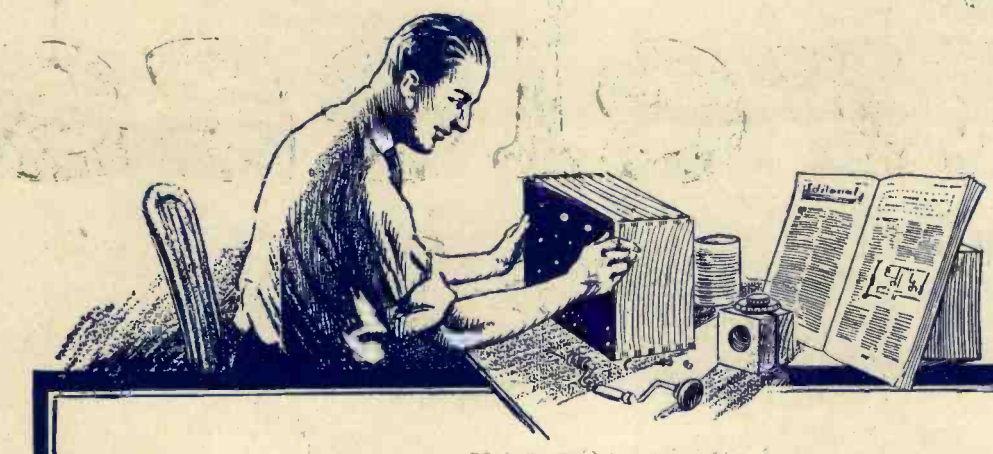
and The Wireless Constructor.

Vol. 2.
No. 4.

CONTENTS



Notes on Telephony Control Circuits—By P. P. Eckersley.



Radio Press Books give him all the information he needs

Complete List

	Price.	Post Free
1. Wireless for All .... John Scott-Taggart, F.Inst.P.	-/6	-/7½
2. Simplified Wireless.. John Scott-Taggart, F.Inst.P.	1/-	1/1½
3. How to Make Your Broadcast Receiver . John Scott-Taggart, F.Inst.P.	1/6	1/7½
4. How to Erect Your Wireless Aerial .... B. Mittell, A.M.I.E.E.	1/-	1/1½
5. The Construction of Wireless Receiving Apparatus ..... P. D. Tyers.	1/6	1/7½
7 How to Make a "Unit" Wireless Receiver ..... E. Redpath.	2/6	2/8
9. Wireless Valves Simply Explained .. John Scott-Taggart, F.Inst.P.	2/6	2/8
10. Practical Wireless Valve Circuits..... John Scott-Taggart, F.Inst.P.	2/6	2/8
11. Wireless Licences and How to Obtain Them ..... E. Redpath.	1/-	1/1½
Elementary Text-book on Wireless Vacuum Tubes ..... John Scott-Taggart, F.Inst.P.	10/-	(Post free)

¶ Those printed in heavy type have been published recently.

HOW many turns for a Coil to reach the Paris Wavelength—the type of circuit to operate a Loud Speaker using only an indoor Aerial—Crystal or Valve rectification in a multi-valve Set? These are a few of the questions which confront the amateur constructor.

Some will find out the correct answers by expensive experiment—others, more wisely, will benefit by the experience of those who have trodden the thorny paths of Radio before them.

The concentrated experience of some of the best known Wireless engineers and experimenters is available for all readers of Radio Press Books. You cannot do better than purchase the complete Library—one Book at a time. Each Book covers a different phase of Wireless and none overlap. Get one or two to-day and keep them by you for ready reference—they are sure to save their cost many times over. From all Booksellers.

RADIO PRESS LTD.,
Devereux Court, STRAND, W.C.2.

Radio Press Books
—a complete Wireless Library

Gilbert Ad.

Wireless Weekly

Vol. 2, No. 4
Aug. 8, 1923

CONTENTS

Editor: JOHN SCOTT-TAGGART, F.Inst.P.
Assistant Editor: E. REDPATH.

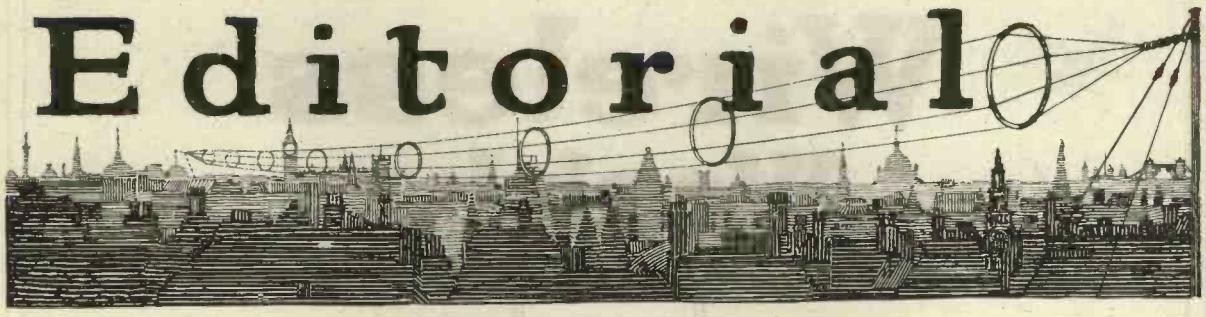
Radio Press, Ltd.
Publishers of Authoritative Wireless Literature
DEVEREUX COURT, STRAND, W.C.2
Tel.—Central 3763.

Advertisement Managers: SCHEFF PUBLICITY ORGANIZATION LTD., 125 Pall Mall, London, S.W.1. *Tel.—Regent* 2440.

All correspondence relating to contributions is to be addressed to the Editor of "Wireless Weekly."

Nothing contained herein is to be regarded as permission or encouragement to infringe any patent rights.

Editorial



Yes, We Have No Report

NEVER has there been such exasperation about a forthcoming decision as in the case of the Broadcasting Committee's report. The country is more than disgusted at the continual procrastination of a decision regarding licences for those who wish to experiment or make their own listening-in sets. Any decision would be better than none. Most of the trouble is that no one knows where he stands; not only are would-be listeners-in perplexed, but the industry as a whole is wondering how things will work out.

Now, at last, the Broadcasting Committee have completed their report. True, they have done it leisurely; but this is hardly unexpected, because three-quarters of the Committee probably did not know the difference between a gramophone and a wireless set, and did not care very much what happened so long as they got out a nice long report covering every phase of the subject and every possible eventuality. No doubt the report, when we see it, will be pages and pages long.

The wireless members of the Committee and the Post Office endeavoured to get an interim report issued, but their anxiety to settle the licence problem was effectively calmed by the decision of the other members of the Committee to deal with everything at once and keep everyone waiting.

By the time this appears the report may be published, but we doubt it. Months, and almost years, of this sort of thing have hardened us; not only are our own consciences failing to show their usual agility, but we have almost got to the stage when every rumour and every suggestion that the report will be published is treated with scorn.

Nevertheless, we know that the Committee has actually arrived at their conclusion. Let us assure our readers at once that provisions will be made for the home constructor; also that the licence fee will be 10s. The procedure is for the Committee's report to be handed to the Postmaster-General, who, in view of the extraordinary dilly-dallying about the licence position, should publish it forthwith. On enquiry of the Intelligence Officer of the General Post Office we are informed that it is quite possible that the Postmaster-General will not publish the report, and that in any case it will become a sort of Blue Book issued by the Stationery Office. We hope that "Worthy" will live up to his name, and not only make public the important document in his hands, but issue licences forthwith. Ninety-nine per cent. of the Broadcasting Committee's report may be held over, but the licence position must be decided.

Meanwhile, our readers may rest assured that the right to make their own sets will be established. This decision will give new confidence and hope to both the public and the industry.

NOTES ON TELEPHONY CONTROL CIRCUITS

By P. P. ECKERSLEY.

An explanatory article dealing with the theory of control.

BEFORE entering into a discussion of telephony control circuits it would be as well to repeat the essential theory of wireless telephony, though to some it may be as "tedious as a twice-told tale." To others it may fill a long-felt want—basic knowledge.

When an aerial is made to oscillate an

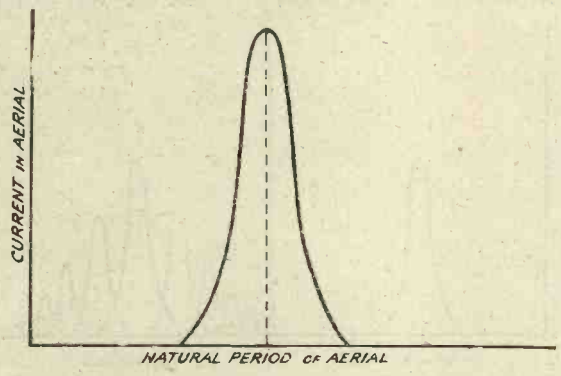


Fig. 1.—Showing the effect of aerial resistance on an imposed H.F. current.

alternating current is set up in it, and we have created a wave motion in the ether. The wavelength and the frequency are connected by $n\lambda = c$, n being the frequency of the alternating current in the aerial, λ the wavelength, and c a constant. (In the case of wireless c is the velocity of light, and equals 3×10^8 metres per second.)

Now if we create this alternating current in an aerial and erect a receiving aerial somewhere in the vicinity, and if we gradually alter the natural time period or tune of this receiving aerial we get a curve something like that shown in Fig. 1, where the natural frequency of the *receiving* aerial is plotted against the current set up in it. The shape of the curve is influenced by the resistance of the receiving aerial. The greater the resistance of the aerial the flatter the curve.

Now suppose that the aerial is oscillating at a frequency of a million a second (300 metres, about), and by some means or other (by using, in fact, a telephone modulating system, perhaps the choke control arrangement shown in Vol. 2, No. 2, "Methods of Telephony Control") a frequency of 1,000 a second is superimposed on top of the million a second. Now let us plot the resonance curve. What do we find? Two little extra peaks appear, and the frequency of the top of one peak is 1,000,000 – 1,000 = 999,000 cycles per second, and the frequency of the other is 1,001,000. The height of the small peaks compared with the height of the main peak is determined by *the depth of modulation.* The more the modulation the greater the height of the peak. Now it is the beating together and heterodyning of the two frequencies that allows us to hear the thousand note that we are applying at the transmitting station.

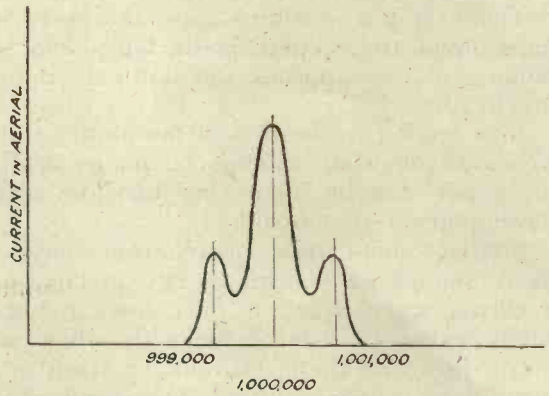


Fig. 2.—What happens when a steady low frequency is imposed on a H.F. current.

If we talk on the transmitters there are hundreds of small peaks, each one of them representing the various *low* frequencies of the voice.

A rather conventional diagram is shown in Fig. 3 to give a mental picture of what telephony really means.

Tune the receiving aerial to the pure carrier wave and then the picture is as in Fig. 3a. Now modulate at the transmitting end and thousands (I've only drawn a few) of small peaks appear (Fig. 3b) on either side of the carrier wave and produce sounds similar to those applied to the carrier wave.

The small undulations are produced by the piccolo in the 2LO orchestra, the tall ones close to the carrier wave represent the grunts of the double bass or the thump of the drums. The smallest undulations are the higher harmonics of violins.

Thus we can arrive at some fundamental conclusions. I have heard people say, "Oh! he's got such a badly tuned transmitter; his transmission is so broad." (This refers to his tuning as received, not his remarks.) This is nonsense; it simply means that he is using a good deal of power or that his microphone is taking in the higher harmonics of his voice, orchestra, or whatever he is broadcasting.

Note, again, to get theoretically good quality a flatly-tuned receiver is essential, and the application of reaction to a receiving circuit is bad if the receiver is being built for *quality*. Why? Because reaction tends to accentuate the drum, the bass viol, the bassoon, and leaves the piccolo, the consonant sounds of spoken voices and higher harmonics out in the cold.

There is not enough bass, however, in most broadcasts, so perhaps the fault is not so heinous as first appears, but don't do it too much, please!

Now having to the best of my ability tried to show you what wireless telephony really means, it may be interesting to show what developments are possible.

Firstly, non-carrier wave transmission. Why should we expend energy in creating a carrier wave which is only there for the small waves to heterodyne with when we might just send these, introducing them to a heterodyne at the receiver? Of course, after the small waves have been sent a hundred miles they are much weaker, and therefore the carrier wave can be much weaker; in fact, the whole object of the method is to do away with the wasteful method of making the carrier wave 10 ampères at a distance of 100 miles when it can produce exactly the same effect at 1-100th of an ampère at a few inches.

To understand this effect the reader must follow a somewhat complicated mathematical analysis, but if anyone is interested may I refer them to a paper by the author on "Duplex Telephony," read before the Institution of Electrical Engineers (March 17th, 1920).

To receive non-carrier wave transmissions a heterodyne or really homodyne must be introduced at the receiving end to replace the missing carrier wave. Another economy can be effected. In Fig. 3b it will be seen that the carrier wave has smaller waves on each side of it. In an age of standardisation and economy this is unnecessary, because each small wave on the right corresponds to one on the left, and therefore one or the other

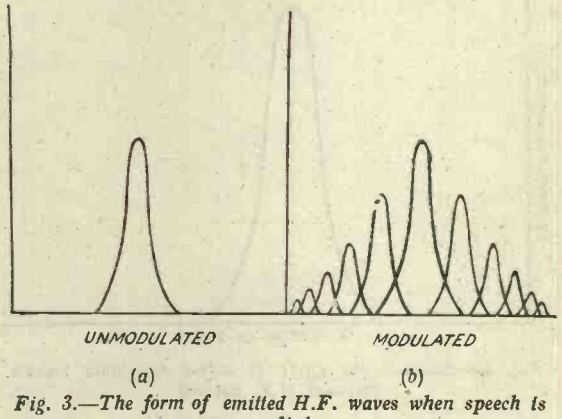


Fig. 3.—The form of emitted H.F. waves when speech is applied.

can be eliminated. Thus our further economy is to eliminate one of them by means of certain filter circuits.

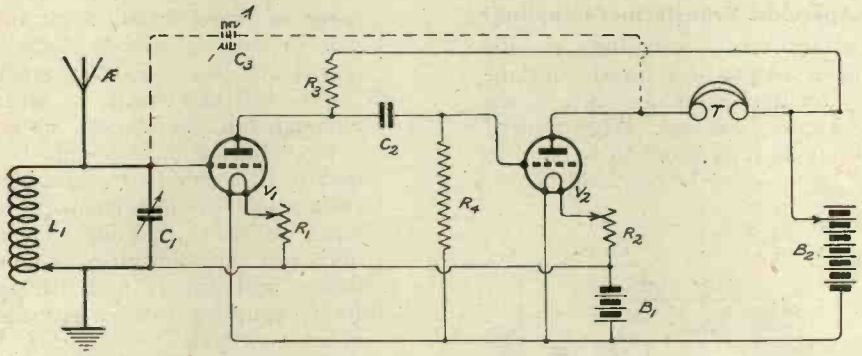
Once this is done, from the point of view of speech, a very economical method of telephony is achieved—economy of energy, a narrow wave band, less jamming. The reader may indignantly ask, "Then why don't you use it for broadcasting and introduce heterodynes at the receiving end?" Unfortunately, it is impossible to give faithful reproduction of music by this means, and so this also rules it out of court.

For Transatlantic telephony for commercial services the method will come in more and more. It would make an interesting line of research for an amateur to tackle.

Wireless Weekly Circuits

No. 17.

A Two Valve Resistance-coupled Receiver

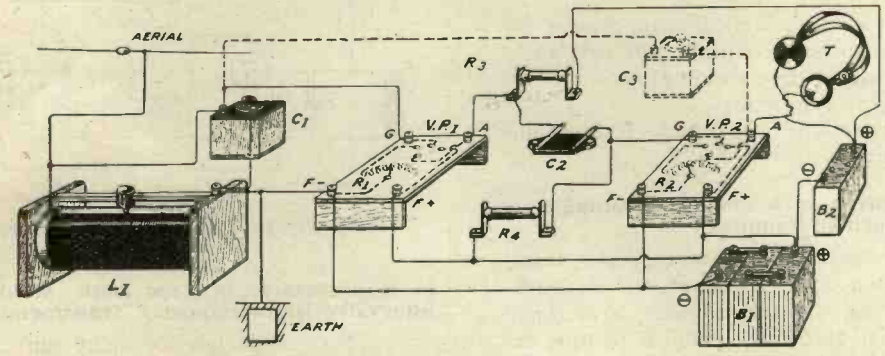


COMPONENTS REQUIRED

L_1 : Variable inductance.
C_1 : Variable condenser of 0.0005 μF or 0.001 μF capacity.
R_3 : A high non-inductive resistance of about 70,000 ohms.
C_2 : Fixed grid condenser of 0.0003 μF capacity.
R_1 : Gridleak of 2 megohms resistance.
T : High-resistance telephone receivers.
B_1 : 6-volt accumulator.
B_2 : 100-volt high-tension battery.
C_3 : Small variable condenser, preferably a vernier condenser.

GENERAL REMARKS.

This is a resistance coupled receiving circuit with reaction from the anode circuit of the second valve to the grid circuit of the first. This circuit may be used for the reception of signals having a wavelength over 1,000 metres, but it is not particularly good for the reception of continuous waves, although the latter may be received by increasing the capacity of the coupling condenser, C_3. The telephones, T, should not be shunted by a condenser.



Questions & Answers on the Valve

A COMPLETE COURSE ON THERMIONIC VALVES

By JOHN SCOTT-TAGGART, F.Inst.P., Member I.R.E., Author of "Thermionic Tubes in Radio Telegraphy and Telephony," "Elementary Text-book on Wireless Vacuum Tubes," "Wireless Valves Simply Explained," "Practical Wireless Valve Circuits," etc., etc.

PART XV

(Continued from Vol. 2, No. 3, page 106.)

What is meant by Aperiodic Transformer Coupling?

Aperiodic transformer coupling is the method sometimes adopted for transferring the high-frequency oscillations of one valve to the grid circuit of a subsequent one. When a tuned transformer is used, it is usual to be able to vary the coupling between the two inductances,

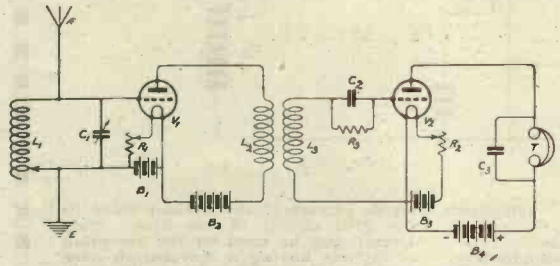


Fig. 1.—Two valves coupled by an aperiodic transformer.

but when an aperiodic transformer is used, the inductances are not shunted by variable condensers, nor are they usually movable relatively to each other.

Fig. 1 shows a theoretical arrangement for aperiodic transformer coupling, the first valve acting as a high-frequency amplifier, and the second acting as a detector.

In Fig. 2 we have a practical form of the Fig. 1 circuit.

What are the advantages and disadvantages of Aperiodic Transformer Coupling?

The chief disadvantage is that the transformers are not equally efficient for all wavelengths. When the transformers have tuned windings it is, of course, possible to tune exactly to the incoming waves, but in the case of an aperiodic transformer the windings, although they are intended to act effectively over a wide range of wavelengths, never do so in actual practice, and it will be found that the best results are obtained on a certain given wavelength, and that results on other wavelengths, although fair, do not come up to the maximum point. Except on a specified wavelength, or near to it, aperiodic transformers are not very efficient and do not compare with the tuned anode method of coupling. Their design, moreover, is a very difficult matter, and the experimenter will usually find that aperiodic transformer coupling does not give such good results as other methods.

The great advantage of this method of coupling is that adjustments are considerably simplified, and no tuning of the transformer complicates the operation of the receiver. Sometimes, however, the intervalve high-frequency transformer has tappings on one, or both, windings, in which case the transformer will be found more efficient if the right tapping is employed.

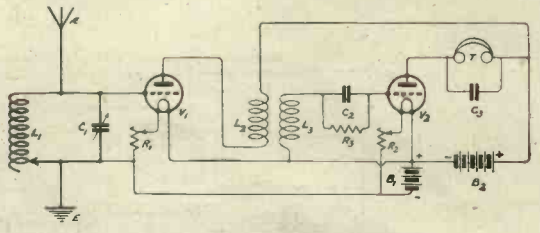


Fig. 2.—The practical form of Fig. 1.

Is it necessary to tune both windings of an Intervalve High-frequency Transformer?

No. Although for many purposes it is desirable to have the coupling between the two windings variable and to tune each of these windings, yet, if the coupling is fairly tight,

good results may be obtained by tuning either the primary or the secondary. The most usual arrangement is to tune the coil in the anode circuit of the first valve, as shown in Fig. 3. This is a practical circuit, and it was thought unnecessary to show the theoretical arrangement.

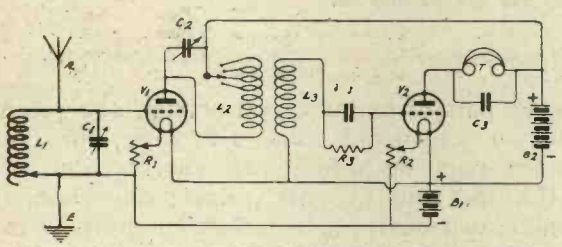


Fig. 3.—A tuned transformer coupling.

Adjustment is made by carefully tuning the primary L_2 of the intervalve transformer L_2 L_3, by means of the variable condenser C_2. Tappings are frequently provided on the primary of the transformer, in order to enable the latter to cover as wide a range as possible.

This method of coupling is certainly no better than the tuned anode method, and in general is less simple and effective. The coupling between the two transformer windings is almost invariably fixed. The method, however, is frequently employed where more than two valves are used as high-frequency amplifiers.

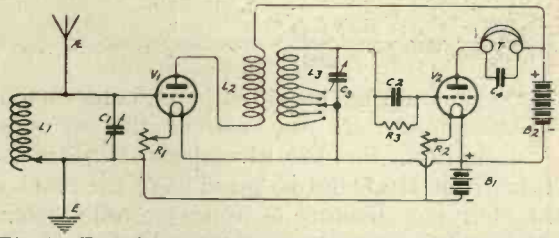


Fig. 4.—Transformer with a tuned secondary (compare with Fig. 3).

Draw a Circuit in which the Secondary of the Intervalve High-frequency Transformer is Tuned.

Fig. 4 shows such a circuit. It will be seen that the winding L_3 of the transformer L_2 L_3 has tappings and is shunted by the variable condenser C_3.

ATMOSPHERICS

A short note dealing with the theory of atmospherical interference.

THE causes of atmospherics are many and various, and a great variety of ingenious theories have been put forward in explanation. In the discussion recently of a paper on "The Study of Radio-Telegraphic Atmospherics in Relation to Meteorology," by C. J. P. Cave and R. A. W. Watt, the latter author was asked whether he could explain the origin of certain peculiar atmospherics which were experienced at Eskdalemuir on the telephone which was connected to an overhead wire across a lonely valley. In addition to the ordinary clicks, there was a "swishing" sound, and the frequency of the vibrations diminished as the sound went on, the sound resembling that of a shell passing high overhead. It was suggested by Mr. L. F. Richardson, who made the inquiry, that this swishing sound might be produced by a meteorite. In a letter to *Nature*, Mr. R. M. Deeley states that he has heard many atmospherics of this character, and he considers the theory that they are due to small meteorites is quite a possible one. In the higher atmosphere there may be a considerable electrical potential gradient, and if a meteorite entered this region and ionised a path through it, it is quite possible that this ionised path might open the way, as it were, for an electric discharge sufficiently strong to cause wireless disturbances. This theory is supported by the fact (or at any rate by the belief, for which there is a good deal of evidence) that the direction from which the atmospherics come is influenced by variations in the sun's position.

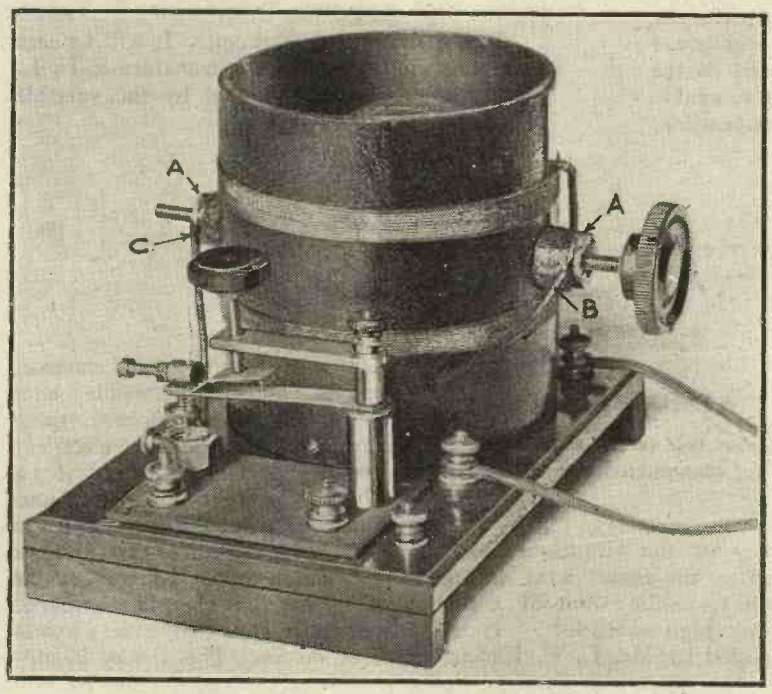
J. H. T. R.

A VARIOMETER CRYSTAL RECEIVER

By A. K. JACKSON.

Full instructions for making a neat and effective little set.

THIS simple little set was constructed primarily for the use of the writer's children for the Broadcast Children's Hour from 2LO, but so good were the results obtained at a distance of about 12 miles from the London station, on a standard P.M.G. aerial, that it was thought the simple construction of the set might interest that section of the wireless community who delight in making up their own apparatus.



Photograph of the completed receiver.

It will be seen from the photograph and drawing that tuning is effected by means of a variometer and rectification by a simple detector fitted with either a crystal and cat-whisker or two crystals, as desired.

The materials required for making the set are as follows:—One piece of cardboard tube, 4in. in diameter by 4in. long, for the outer part or stator of variometer, one piece of 3in. cardboard tube, 2in. long, for the inner part or rotor; two short pieces of 2BA rod and five 2BA nuts; one ebonite knob; two small brass bushes, the purpose of which will be described later; 2oz. 22 double cotton covered wire for windings; one 0.002 μF fixed condenser; four terminals; one detector, which may be bought complete; a piece of hardwood for the base, 7in. by 4¾in.; wire and systoflex insulating sleeving for wiring up.

The first part to be taken in hand is the inner 3in. tube or rotor of the variometer: this should have two holes made in the sides, exactly opposite to each other and midway between top and bottom in height. On each side of the tube, inside and out, a 2BA nut should secure the short pieces of 2BA rod inserted in these holes.

The rotor may now be wound: start by making three small holes at one edge in which to secure the wire at start of winding, leaving an end inside the tube, which is to be bared and soldered to one of the nuts or secured between two nuts; wind 15 turns of the 22 double cotton covered wire above, then cross over and wind 15 turns below the screwed rod spindles securing the end of the winding in three holes as before, leaving the end inside and finishing by soldering to the nut on the opposite side to the start.

The outer 4in. cardboard tube is to have two holes exactly opposite bored in it 2in. down from the top and then formed into slots with a penknife, to enable the rotor to be dropped into place; before doing this a short brass wire spring and a flat washer should be

slipped on each end of the spindles to centralise the rotor.

Two short pieces of wooden roller are now prepared by drilling a hole through endwise in which are secured the brass bushes, previously mentioned and marked A in the photograph, and which should just slip comfortably over the screwed rod spindles. The whole unit is then put on each spindle and secured to the cardboard tube with glue or seccotine; when set these bushes form the bearings to the spindles, and the finishing end of the winding at B of the large tube is to be soldered to the brass bush, so forming an efficient electrical connection between the outer and inner windings.

The connection C is soldered to the other bush and carried down through the baseboard and connected to the earth terminal.

The large cardboard tube can now be wound, starting at a hole 1in. down from the top, leaving an end about 6in. long for connecting. Wind on 10 turns of 22 double cotton covered wire above the spindle, then cross over to below and wind on another 10 turns, securing in a hole in the cardboard tube and leaving an end, which is the one marked B, to be soldered to the brass bush as previously mentioned. The whole of the windings and the cardboard tubes should be given a good coat of shellac varnish after winding. The ebonite knob and lock-nut can now be put on one of the spindles, so completing the variometer.

Next prepare the baseboard, drilling for the terminals and the connections to the variometer, etc., and fix the crystal detector, drilling as required for wiring to the crystal cup and detector arm. Having prepared the baseboard, which should have two small fillets of wood nailed or screwed at each end to raise it off the table, the variometer may be fixed in place: this is easily done by glueing two small blocks of wood on to the baseboard and screwing or glueing the variometer in place.

The condenser is secured underneath the baseboard with screws.

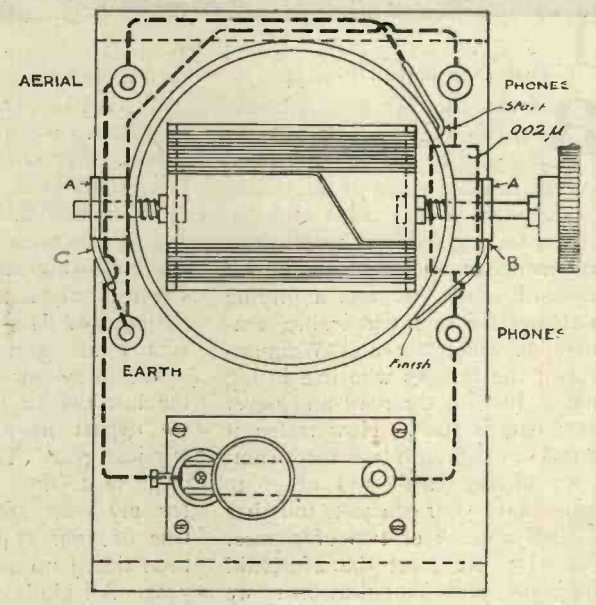
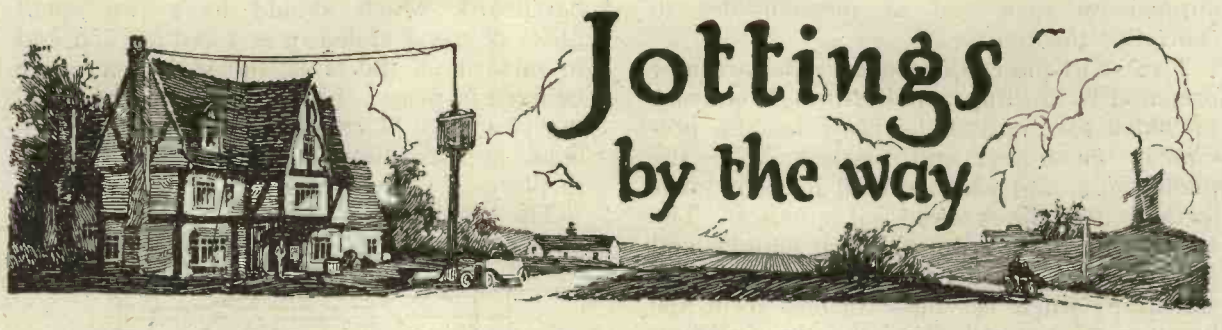


Fig. 1.—Underside of baseboard showing wiring.

The wiring up, which is done on the underside of the baseboard, is a very simple job and will be best explained by Fig. 1. The wire used was ordinary copper bell wire sleeved in systoflex, and wherever possible connections are soldered.

2WQ

THE experimental station 2WQ, Brierley Hill, Staffordshire, will be commencing about August 15th a series of experimental telephony transmissions, on powers ranging from 20 to 50 watts, between 12.30 and 1 p.m., 4.30 p.m. and 5 p.m., and 11 and 11.30 p.m. weekdays, and 11.30 a.m. and 1 p.m. Sundays. Transmissions, which will be on 440 metres, will be of about five minutes' duration. Reports will be gratefully received by C. H. Gardner, Brierley Hill, Staffordshire.



That Overworked Feeling.

BY this time we are all thinking of holidays. Those like you and me who labour hard for eleven months out of the twelve are filled with that noble and uplifting feeling that work well done has earned a rest. Strong in our sense of virtue, we feel a pitying contempt for such despicable creatures as Snaggsby and Wogglesworth, the fellows who live in big houses just up the road and never do a hand's turn. How rotten it must be, say we, to be a mere cumberer of the earth and never to feel that your honest toil has merited a week or two of repose. Yet when we meet the aforesaid Snaggsby and Wogglesworth we find that they have both succeeded in persuading themselves that they are suffering from some obscure form of overwork, and that their need for a complete change is even more urgent than our own.

The truth is that, whether you habitually catch the 8.10, joining during the last hundred yards to the station in a kind of frenzied Marathon and cursing the railway company for its disgusting punctuality, or breakfast in bed at 10 o'clock and later journey in your Rolls-Royce to a palatial office, where you dictate a couple of letters and then go off to lunch feeling that you have had a busy morning, whichever be your lot, you are firmly convinced that you are the hardest-worked man in the world.

Virtue Rewarded.

And so all of us are busy with time-tables and maps whilst our better halves conduct a voluminous correspondence with landladies and hotel-keepers on the subject of rooms. We are determined, of course, that our holiday, at any rate, shall be a complete change. No 'busman's holidays for us. We will do none of the things that we did during the rest of the year. Fresh interests, new surroundings, the outdoor life—that is what *we*, at any rate, are going to have.

We spend our spare time during the last two or three days before we depart in putting away our wireless gear. This in itself is no mean task, since the den (I speak for my own anyhow—is it also true of yours?) has probably not been tidied up since this time last year. All kinds of old and almost forgotten friends are brought to light; I, for example, have just unearthed from beneath a pile of miscellaneous gear a variometer in a vain search for which the whole house was turned upside down a couple of months ago. Things are sorted out and placed neatly upon shelves and in cupboards. The aerial is slackened off or lowered altogether. The accumulators are boarded out with some faithful friend who can be relied upon to look after them and not to let their health suffer.

No more wireless for a month. Really, we admit to ourselves, the thing does become an obsession if you are not careful. There's a lot of truth in what those fellows, who try to be funny in print, say, when they talk about radiomania and condenseritis. We're going to have an entire change, a real rest; we won't talk of wireless or touch a control knob until we come back again. A noble resolve, but——

The Thin End of the Wedge.

At last the great day comes. We are fairly off. When we go to the bookstall to buy *Chortles* and *Leonard Lion's Weekly* for the kids and *The Perfect Lady* for the missis, we determine that our own reading in the train shall confine itself to the pages of the *Daily Megaphone* and perhaps the *Sporting Chimes*. But somehow when the train is started we are aghast to find that a thing with an orange and blue cover has slipped in amongst the rest.

May as well look at it since it's here. Aha! a brand new circuit. Well, now, that's something really novel. I wonder why he's got a condenser across those two leads? Let's try and see what it's there for. Where's my pencil? Don't quite see how he gets the wavelength with that inductance. $C = 1{,}885\sqrt{C.L.}$. Square root of 0.0003 is . . .

"Excuse me," says a voice, "I see you're interested in this new circuit." You look up and find another fellow armed, like yourself, with *Wireless Weekly*. In a moment the ice is broken; you begin to exchange ideas; ere the train has fairly left the town behind, the atmosphere of your compartment is thick with smoke and wireless shop.

Fresh Resolutions.

That, you decide, as the train pulls up at Slopston-almost-on-the-Sea, was a jolly chat, but it was nearly a breach of your excellent resolutions. Nearly, but not quite, for a holiday cannot be said to have begun until one reaches one's destination. No, that was merely

a hang over from the working period. Anyhow, you're not likely to have further opportunities of the kind. The rest of your holiday shall be entirely blameless, and you will fell to earth anyone who so much as mentions an anode in your hearing. You won't look at an aerial or criticise it even mentally. You won't even glance at the broadcasting programmes; if you see a heading in the paper with any reference to wireless your eyes shall hastily pass on to something quite innocuous.

Temptation.

All is well for a day or two. Then as you bask upon your back on the beach your eyes are suddenly arrested by the sight of towering masts with gracefully curving wires suspended between them. "Why, good heavens, that must be GNF (or GLD as the case may be) himself." To think that you have so often listened to him pinging away in your own home, and there he is right in front of you. Never thought of that when you chose Slopston. "Now, by Jove, this really *is* interesting. . . ."

You pull yourself up with a jerk and hastily roll over so that those disgusting masts shall not catch your eye and tempt you to break good resolutions. You see a sailing boat skimming along in the offing and follow her swift progress, turning round so as to keep her in the line of vision. . . . Presently you're gazing at that aerial again and speculating about its height and length. You are vaguely discontented. Something is not quite right about this holiday.

The Lure.

Next day when you fare forth in quest of pipe fuel you discover that the only decent baccy shop is next door to one whose windows are filled with a display of v*lv*s, c*nd*ns*rs, t*l*ph*n*s, rh**st*ts, and other things, whose names must not pass your lips. Averting your eye you pass on, proudly conscious that you have administered a nasty knock to the evil one and put him very properly in his place behind you.

He bobs up again, however, at lunch time, disguised as little Tommy, your eldest young hopeful. "Oh, Dad," he cries, "don't you wish we had the set here? There's such a topping programme on to-night." Hastily you quell the lad's indecent exuberance by suggesting a sail during the afternoon. But the seeds are sown. Deep down in your soul you are conscious of a yearning to twiddle knobs and to feel the clinging caress of the 'phones about your ears. Being the strong man that you are you fight it down.

Gadgets.

Then as you take your evening stroll along the promenade you are suddenly whacked between the shoulder blades. Turning round with a naughty word half uttered, you behold the fellow who travelled down with you. He lives, it appears, at Slopston, and nothing will satisfy him but that you should adjourn to his house for a smoke. Thinking no evil, you go. As the door of his den opens you realise that all is lost, for there before your eyes is the most interesting, the most engaging, the most fascinating mass of wireless gear that you have ever beheld. Gone now are all your noble resolves. To have a proper holiday, you argue hastily, you must do all the things that you want to do, and the thing that you now desire to do above all others is to examine one by one the bits and pieces that are lying about. You get home to your digs at two o'clock in the morning explaining shamefacedly to your spouse that you had to go, in common kindness, to help a man in difficulties with his set. She hears. She sighs. She understands.

Peace at Last.

Next morning you speed after breakfast to the wireless shop, where you buy sufficient parts to rig up a small set. For the rest of your holiday you are thoroughly and blissfully happy, and you kick yourself soundly for having been such an unmitigated ass as to renounce wireless just when you had all the time you could want for trying out a whole heap of things that you had never been able to manage before. You spend half your time in the wireless shop, you are introduced as a temporary member of the local wireless club, and when you return home you take with you a large packing case full of new gadgets bought, begged, or — er — "borrowed." Anyhow you are a new man, for you have had a real holiday for once!

The Limit.

The height of folly was displayed by a few idiots who continued to listen-in to 2LO one evening though a storm was in full swing within a few miles of their aerials. Many of them had their inductances burnt out by the enormous voltages brought in, and one or two received shocks through the 'phones or had their hands burnt. If there are storms about play billiards, bridge, or spillikins; read a book, or retire to the coal cellar if you are of a nervous disposition; but don't try to work your wireless set. That is the one time when the best of all hobbies must be abandoned for a brief season in favour of other pursuits.

WIRELESS WAYFARER.

A TWO-VALVE CABINET RECEIVER

By PERCY W. HARRIS, Staff Editor.

The conclusion of an article dealing with the construction of a tuned anode reaction receiver.

IN last week's *Wireless Weekly* I gave a list of the component parts required to build this receiver, and the initial steps in building the set were outlined. The actual wiring of the instrument—the most difficult part—is best carried out with the aid of the wiring diagram accompanying this article.

Whenever switches are introduced in a wireless set, we must pay the price in greater complication of wiring. In this case there are two anti-capacity switches in circuit and the wiring has some appearance of difficulty. This seeming complication is due to a cross over of several wires from one side of the set to the other in order that there may be a change over from the closed to the open circuit. The general appearance of the wiring can be gathered from the photograph published in the last issue, but this week there is included a large scale drawing of the wiring, which, being taken not only to the panel itself, but also to the sides of the case, needs a special method of illustration. To make everything clear the drawing has been made as if the top and two sides of the cabinet had been opened out. A very clear indication of the actual direction of the winding is obtainable by cutting out this wiring diagram and folding the sides and top to form the shape of cabinet illustrated in the photograph last week.

The method I adopt in wiring up such receivers is perhaps a little extravagant in the use of wire, but is certainly economical in time. It consists of soldering a wire about a foot long on to each screw and terminal which has to be included in the circuit. These wires should be soldered on to all the points on the panel before the latter is screwed in place. Four wires to each of the two two-coil holders can be similarly connected before these are attached to the cabinet. A number of wires will also need to be taken from the valve legs and shanks of the terminals which are placed on the ebonite panel which screws to the top of the cabinet.

The wire used should be about 20 or 22 gauge tinned copper. When all the wires have been connected the front panel, top panel, and two two-coil holders can next be secured in place, the loose wires being pulled out of the back of the cabinet. Before commencing the wiring we should have at hand the soldering iron suitably tinned, a small quantity of soldering flux, and 6 or 8 yards of insulating tubing.

Now with the diagram before us (the full-sized blue print of this diagram is obtainable from the offices of *Wireless Weekly*, price 1s. 6d., post free), we will start first of all with the aerial circuit. It will be seen on inspection of the diagram that there are two or three connections here. The wires from the points to be connected should now be taken in one hand with the remaining wires of the set pushed out of the way. By a few trials the shortest path for these wires will be found, and when this has been ascertained the necessary lengths of insulating tubing should be cut and slipped over the wires. A touch of solder on the point where the wires connect will secure them, and the surplus ends can be clipped off with a pair of wire-cutting pliers.

Now take the earth terminal and connections to it, and similarly wire up after slipping in place the necessary tubing. Stage by stage the instrument can be connected up and as we make progress so the space is cleared and the job becomes easier. It is a good plan to mark off with ink or coloured pencil on the wiring diagram those connections which have already been made. In this way there will be far less confusion and risk of wrong connection. Care should be taken that sufficient lengths of insulating tubing are used in every case to obviate the chance of two wires touching one another. Also, in arranging the wiring, it should be so bent that the various leads are kept well apart.

As soon as the set is wired it can be connected for the preliminary test. First of all connect up the low-tension battery, being careful before the wires are connected to turn the filament resistances to the " off " position. Now try each valve to see that the filament lights properly and is suitably varied in brilliance by the rheostat knob. You will not find that the vernier adjustment makes any apparent difference to the brightness, for a complete revolution of the vernier knob is only the equivalent of a very slight movement of the main knob. If the valves light properly we can now connect the high-tension battery, aerial, earth and telephones.

Looking at the front of the instrument, the switch on the left-hand side when turned to the left will place the aerial-tuning condenser in parallel, and in

series when turned to the right. The right-hand switch connects the first valve to the aerial or the closed circuit. Before attempting to tune with the closed circuit, the switch should be placed on the aerial side and a station picked up in this way.

Coils

Four coils are needed with this set for any particular wavelength range. Firstly, we must have an aerial coil, secondly, a coil in the closed circuit, thirdly, one in the anode circuit, and fourthly, a suitable reaction coil. The coils in secondary and anode circuit should always be of the same value, while the aerial circuit will need to be somewhat smaller than that used in closed and anode circuits. The size of the reaction coil is dependent upon the particular valve used, but usually will be one size larger than that in the anode circuit. For broadcast reception, a good combination is a 25 or 35 in the aerial, one 50 in the closed circuit, another 50 coil in the anode circuit, and a 75 coil in the reaction socket. If Burndept coils are used you will need No. 2 in the aerial, No. 4 in both closed and anode circuits and, say, 75 in the reaction. It is assumed that the condenser is being worked in parallel for this. If the condenser is used in series, then it will be necessary to have, say, a 75 coil in the aerial circuit. Gambrell coils would be A, B, B and C respectively from aerial to anode. It is not possible to indicate to the reader what he will need in aerial adjustments, for this will differ with each aerial used. However, some indication is possible for the secondary and anode circuit, and the table on next page gives the actual settings of the writer's instruments when used to receive all the British broadcasting stations.

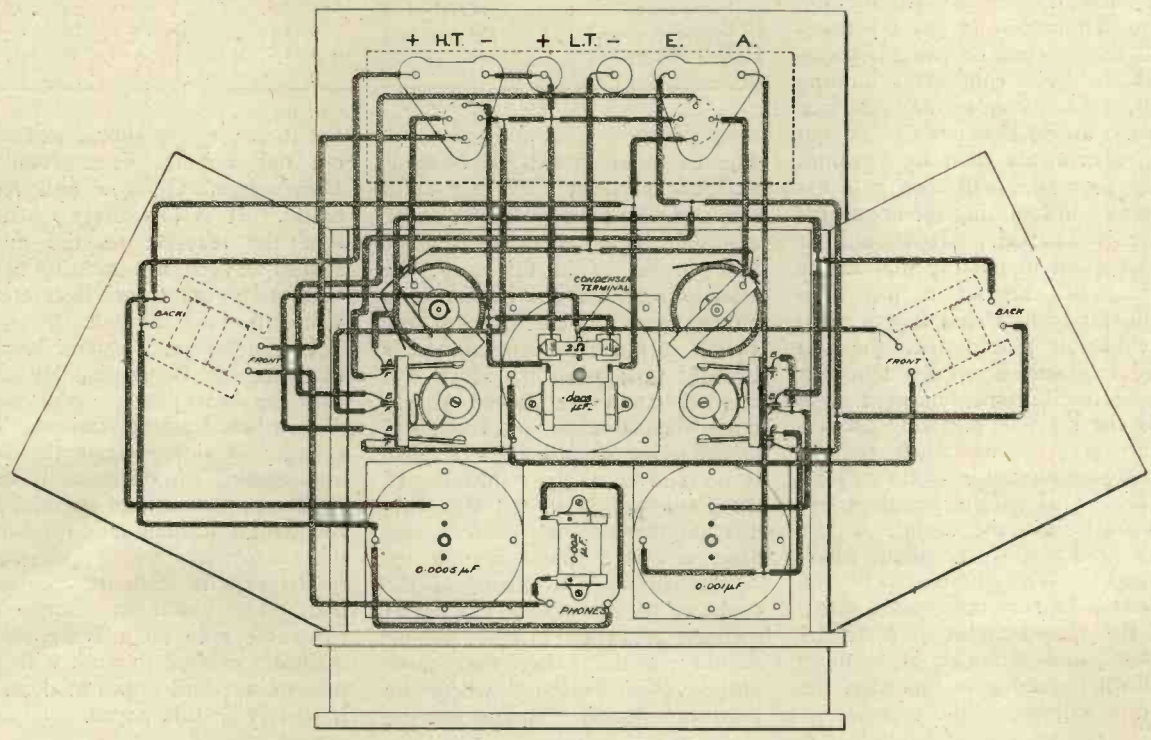
Operating the Set

For longer wavelengths it will be found that the closed and anode circuit coils will need to be of the same value whilst the aerial coil can be one number lower. The reaction coil should generally be one number higher than the anode or the closed-circuit coil. The chart published in the July issue of "Modern Wireless" gives the values of honeycomb coils for various wavelengths, and by reference to this and the notes below the chart, it is quite a simple matter to find a suitable coil to use for any wavelength.

First of all, ignore the closed circuit and work with the switch on the aerial circuit side.

When facility has been gained in handling the circuit in this way, the switch should be placed on the closed circuit side (the right) and experiments should be carried out with loose coupling.

At first, the beginner will find it exceedingly difficult to handle a loose-coupled circuit with tuned anode for the whole set seems to burst into oscillation at the slightest provocation. Actually,



Wiring diagram of the cabinet set For clearness the sides and top of the cabinet have been drawn as if they were opened out. The letters "B" and "F" by the tabs of the anti-capacity switches indicate "back" and "front" respectively. One terminal of the central variable condenser happens to come immediately beneath the gridleak. Where wires join, the tubing is cut away to allow soldering.

however, the oscillation will generally stop when all the circuits are properly in tune, and if the coupling is not too loose. The correct value of the anode tuning condenser can be found when working on the aerial side of the switch, as this tuning does not alter when we change over to the closed circuit side. The aerial position will be approximately the same as that to which it was set on the previous adjustment, and the setting of the closed circuit condenser will not greatly differ from that of the anode condenser. First of all, the coupling should be made fairly tight between the closed and aerial circuit and the three condensers adjusted until the best signals are obtained. Then the coupling should be slightly loosened and the condensers reset. When the coupling is loosened it will be found in nearly every case, that the secondary circuit will burst into oscillation, on *either* side of the correct point, and frequently the aerial and anode circuits will do the same if they are slightly detuned from their proper positions. Far less reaction coupling is necessary on loose coupling. Tuning with a loose coupler and reaction on the anode is better carried out by experiments than by reading, and the reader will soon gain experience in handling the apparatus in this fashion. It should be pointed out in passing that in the wiring of the set it has been deliberately arranged that a positive bias is placed upon the first grid to damp down the tendency to self-oscillation, but even with this the set will slip into oscillation very readily when on the loosely-coupled side of the adjustment. This oscillation does not get back into the aerial, so the user need not worry about interference. The tuning will be found to be very much more sharp on the closed-circuit side of the switch, and although it is more difficult to handle in this way, the results will repay the trouble.

Eliminating Interference by the "Acceptor" Circuit Method

Under the heading of "Random Technicalities," in last week's issue, I described a method I have found of eliminating a great deal of interference received during broadcast reception. This receiver is particularly suitable for experiments of this type, and it will be found quite a simple matter to reduce, if not to eliminate entirely, the jamming from the local broadcasting station, when it is desired to receive a more distant one. The method of carrying out this elimination is as follows:—

First of all, the best possible setting is found on the aerial circuit side of the switch with both aerial tuning condenser, anode tuning condenser, and reaction. The distant signals should be made as loud as possible by very accurate and delicate adjustment of the reaction. Then, when all is set to best advantage in this way, the closed circuit coil (we must remain on the aerial circuit side of the switch during these experiments) is brought up against the aerial coil and its condenser moved slowly until the strength of the local broadcasting or other interference is certainly greatly reduced. If the condenser is turned still further, interference may decrease and after a certain point it will increase again. The setting of the coupling of this coil to the aerial coil and also the condenser setting should now be varied once more until a point is found where the local broadcasting station can be reduced in strength to practically a negligible value without any effective reduction of the strength of the distant broadcasting station. The coupling must not be too loose in this experiment or the absorption of the interfering station will not be sufficient.

On the evening of Saturday, July 28th (to give an actual date when conditions were normal), I listened to every one of the British Broadcasting Company's stations on this set with an outdoor aerial and succeeded by this method in completely eliminating London when receiving the provincial stations—even in the case of Cardiff and Manchester. It took some little time to adjust the set to eliminate London when receiving these latter two stations, but it was a very simple matter to cut out London when receiving Birmingham, Glasgow and Newcastle. It is absolutely essential that the reaction on the anode should be brought almost up to the oscillation point or interference will still come through.

	Aerial Tuning Condenser. (Parallel)	Closed Circuit Tuning Condenser.	Anode Tuning Condenser.
Cardiff	14	12	17
London	17	14	21
Manchester ..	23	19	22
Newcastle	31	22	24
Glasgow.....	32	24	28
Birmingham .	34	25	31

In conclusion, it should be said that this set is particularly suitable for head-phone reception of distant broadcasting stations. The strength of signals from the local broadcasting station is barely sufficient to operate a loud-speaker, but for distant stations it is far better than many sets which give much louder signals from the local station. The writer has designed a two-valve note magnifying set in a similar cabinet to work with the present set, and hopes to describe it shortly in this paper.

NOTES ON THE VALVE

By J. H. T. ROBERTS, D.Sc., F.Inst.P., Staff Editor (Physics).

Some further interesting explanations of the physical and electrical actions taking place in thermionic valves.

Is there a Positive Emission from the Filament?

WHEN a filament is fresh, it may yield a considerable positive emission, at comparatively low temperatures. This is due, as mentioned above, to the presence of traces of impurities in the surface layers, and to the absorbed gas in the wire. After prolonged heating of the filament, however, particularly if during the heating the filament is raised, by means of a battery, to a high positive potential with respect to its surroundings, the positive emission may be reduced to a negligible amount.

If the filament is then made negative with respect to its surroundings, only negative ions can flow from the filament. The negative emission, unlike the positive, persists indefinitely, and after a sufficiently prolonged heating of the filament, the negative emission becomes and remains quite steady. The amount of the negative emission is characteristic of the emitting substance and of the temperature.

How does the Emission depend on the Temperature?

The relation between the temperature of a filament and the total thermionic emission has been the subject of an immense amount of research work, and it has been found that at a certain temperature the emission begins to increase, and thereafter increases with enormous rapidity as the temperature is still further raised. It is assumed here that the heated substance has been brought to the steady state referred to above, when the emission does not vary with time, provided the conditions are kept constant. Thus with sodium it was found that at a temperature of 217 deg. Cent. an emission-current of $1{\cdot}8 \times 10^{-9}$ amperes was obtained, whilst at 427 deg. Cent. the emission-current had increased to $1{\cdot}4 \times 10^{-2}$ amperes. Thus a rise of temperature of about 200 deg. Cent. increased the emission-current by a factor of about 10^7.

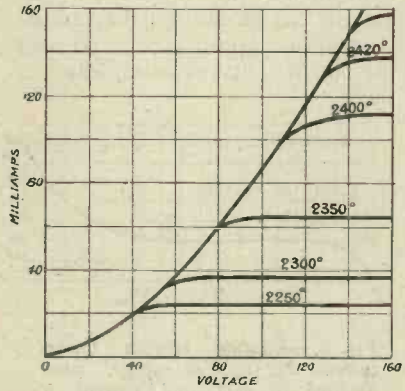


Fig. 1.—Showing maximum emission (saturation current) for various temperatures of filament (Langmuir).

What is meant by the Evaporation of Electrons?

The temperature-variation of the electronic emission from a hot body may usefully be studied from the point of view of thermodynamics. If there is no adjacent electrode into which the emitted electrons may escape, the electrons accumulate in the region of the hot wire and constitute what is known as a "space charge." Since this space charge is negatively electrified, it sets up an opposing electric field, which tends to retard the emission of further supplies of electrons from the filament. If the space charge is allowed to become sufficiently great, the electronic emission from the filament may be entirely inhibited.

This is analogous to the state of affairs above the surface of a liquid which is in equilibrium with its own vapour. Suppose water is evaporating freely, so that the vapour is continuously removed, then the number of molecules which escape through the surface of the water per second depends, amongst other things, upon the temperature of the water. If, however, the space above the water surface is enclosed, the molecules will accumulate in this space and some of them will return to the liquid. Eventually a condition will be reached when the number of molecules returning to the liquid per second is equal to the number escaping from the liquid per second. Under these circumstances the pressure of the vapour is said to be the "saturation pressure" for that particular temperature. If, however, the temperature be raised, the saturation pressure will be correspondingly increased.

The similarity between the escaping vapour from the liquid and the emission of thermions from a hot body has led to the application of thermodynamic principles to the latter phenomenon, and many useful theoretical results have been obtained.

What is Meant by Saturation Current?

If a filament be suitably mounted so that it can be heated by the passage through it of an electric current, and an electrode be arranged in the neighbourhood of the filament, this electrode will in general receive some of the charge thermionically emitted from the filament. The amount of the charge which it receives per second (that is, the *current* which flows into the electrode) will depend, however, upon the intensity of the electric field between the filament and the electrode, which is driving the thermions across to the electrode. It is obvious that, no matter how intense this electric field may be, the maximum charge per second which can be received by the electrode is equal to the charge thermionically emitted per second by the filament. Consequently, if the strength of the electric field between the filament and the electrode be increased, it will be found that, beyond a certain point, increase in the strength of the field causes no further increase in the emission current. This means that all the ions which are being emitted by the filament are reaching the electrode. The emission current which is flowing into the electrode under these circumstances, and which is evidently the maximum emission current which can possibly flow for that particular temperature of the filament, is called the " saturation " current.

When we speak of the emission from a wire at a given temperature we generally mean the *total* emission, that is the emission per second, which would be measured by the saturation current.

As the temperature of the wire is gradually raised from cold no emission is noticed until the wire attains a dull-red heat. At this temperature the emission current begins to be appreciable. As the temperature is still further raised, the current increases rapidly, and in the case of tungsten, which is commonly used for the filaments of wireless valves, the emission may reach a value of about 1½ amperes per square centimetre of surface at a temperature above 2,500 degrees Centigrade. It is not found expedient to run the filament much beyond this temperature in practice; in fact, a safe working temperature is about 2,000 deg. Cent.

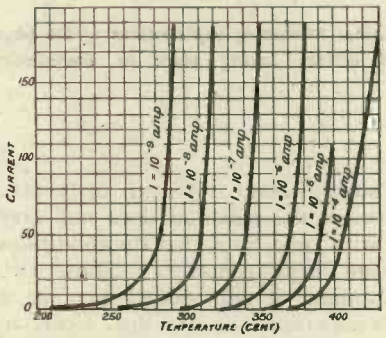


Fig. 2.—Showing the rapid increase in the emission from sodium with rise of temperature (Richardson).

In Fig. 1 is shown the relation between the temperature of the filament and the emission current, and it will be noticed that as the temperature approaches a red heat the emission increases rapidly.

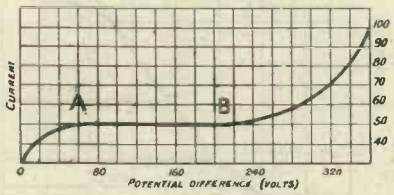


Fig. 3.—Relation between anode-current and applied voltage, when filament is cold and current is carried by ionisation of residual gas only.

Does the Emission Depend upon the Substance?

Generally speaking, metals which are convenient for use in the form of filaments and which are capable of being raised to a high temperature, behave in a manner similar to that described above for tungsten, that is, the emission is comparatively small at a dull-red heat and increases rapidly when the temperature is raised to a white heat.

Metals such as sodium are found to attain the point at which the rapid increase in the emission takes place at a much lower temperature. Fig. 2 shows the relation between the temperature and the emission current from sodium.

What Happens if there is Gas in the Tube?

If we have a simple arrangement of an electrically heated filament and an adjacent electrode enclosed in a glass vessel, the thermionic emission conditions are profoundly affected by the presence or absence of gas in the vessel.

Let us assume, first of all, that the pressure of the gas is not more than about 2 or 3 millimetres of mercury, and that the filament is cold. Then if a potential difference be established between the filament and the electrode it will be found that a minute current will flow, which is practically proportional to the applied potential-difference. As the PD is increased, this current will reach a saturation value as indicated in Fig. 3 OAB, and when the PD is raised to a much higher value, a new phenomenon will set in which will cause the current through the gas to be enormously increased. The first part represented by OA in Fig. 3 is when an increasing number of ions present in the gas are being drawn over by the electric field to the adjacent electrode. The second part AB represents saturation, that is to say, all the available ions in the gas are being utilised in carrying the current. After the point B is passed, the ions acquire such a velocity under the electric field that during their collisions with the molecules of the gas they knock out electrons from the molecules and so cause further supplies of ions; this process is obviously a cumulative one, with the result that the supply of ions increases with great rapidity. The production of ions in this way is known as " ionisation by collision," and when the latter

phenomenon sets in, a " spark " or " discharge " is said to be passing between the electrodes, that is, in the present case, between the filament and the adjacent plate. If the pressure of the air is considerable, say, atmospheric pressure, the electric field necessary to cause ionisation by collision to set in is of the order of 30,000 volts per centimetre, whilst at a pressure of about 1 millimetre of mercury, the electromotive force may be of the order of 30 or 40 volts per centimetre. The discharge which takes place under these circumstances varies in its character according to the pressure of the gas; at atmospheric pressure the discharge will take the form of a spark, whilst at a low pressure it will take the form of a glow discharge.

The above remarks are based on the assumption that the ions which are initially responsible for the transmission of the current are those ions which are normally present in the gas. These are comparatively few, but the number present may be increased by various means known as " ionising agencies." If the gas is exposed to X-rays, or various other kinds of rays, or if it is considerably heated, the number of ions present in it and therefore its conductivity on the part OAB of the curve in Fig. 3 may be considerably increased.

In particular, if the filament be now heated by passing an electric current through it, the gas surrounding the filament is heated and also (if the temperature of the wire be raised sufficiently high) thermions are emitted from the wire. Thus the conditions become much more complicated than those in the case which we have been considering above. The gas provides an extra vehicle, as it were, and consequently the amount of current which can pass from the filament to the plate is increased.

What is a " Soft " Valve?

A wireless valve in which a trace of residual gas is present approximates to the conditions which we have just been discussing. The gas becomes ionised by the heat of the filament and the conduction takes place partly by the negative thermionic emission from the filament and partly by the ionisation in the gas. A valve containing a small amount of residual gas is known as a " soft " valve. Since the gas when ionised provides a supply of both positive and negative ions, a soft valve has not (under some special circumstances) the rectifying power of a " hard " valve, for a certain amount of current will be carried from the filament to the plate even when the filament is positive with respect to the plate.

What is a " Hard " Valve?

If now the evacuation of the valve be carried to the highest possible limit, so that the remaining traces of gas are entirely negligible, practically no collisions take place between the gas molecules and the ions, and consequently we are no longer concerned with ionisation by collision, or " gaseous conduction." A valve of this kind is known as a " hard " valve and has a very definite rectifying property. For if the filament is cold there is no available supply of ions for the carrying of current between the filament and the plate, and consequently no current can be passed through the valve in either direction, no matter how high an electromotive force may be applied.

If the filament be heated to incandescence, however, it emits negative ions or electrons, and if it be made negative with respect to the plate, a current will pass through the valve. If the polarity be reversed, the filament being made positive with respect to the plate, the direction of the electric field between the filament and the plate is such as to prevent the escape of electrons from the filament; as there is no other available supply of carriers for the current, this means that when the filament is positive with respect to the plate (provided the PD is sufficient) no current will flow through the valve.

In practice it is impossible to produce (or maintain) a *perfect* vacuum, and hence no valve is absolutely hard. Consequently no valve can be said to produce absolutely complete rectification of current, but in a good hard valve the " reverse " current (that is the current in the " wrong " direction) can be made exceedingly small in comparison with the thermionic emission current.

For what Purpose are " Hard " and " Soft " Valves Used?

A soft valve is in many cases suitable for use as a rectifier, in spite of the reverse current, which may in some cases be considerable, the rectifying action being more involved. Such a valve may sometimes be used for amplifying purposes, which will be described in more detail later on in these notes.

A hard valve is likewise suitable for rectification, and may also, by proper adjustment of the anode voltage (that is, the applied potential difference between the filament and the plate), be used as an amplifier.

News of the Week

THE Bermondsey Board of Guardians have applied to the Ministry of Health for permission to erect a wireless installation at their Ladywell Institution. Reasonable expenditure on "an object that will add to the comfort and welfare of the inmates" has been sanctioned. It is expected that the wireless set will cost the Guardians about £50.

At Hexham recently, the captain of the British steamship "Mahia," Herbert Charles Elford, was charged with having failed to keep a continuous watch on his ship on a voyage from Liverpool to New Zealand, from New Zealand to South America, and from Las Palmas to the United Kingdom, contrary to the Board of Trade rules. The Board of Trade conducted the prosecution and explained that the complaint against the captain was that when the ship was on the way to Colon, at the east end of the Panama Canal, the wireless watchers were taken from the Marconi room and put on deck duty. In consequence, for about 16 hours a day for three days there was no continuous wireless service on the ship.

The captain, in his defence, said that so long as he was on the trade routes and in call of wireless stations he maintained a continuous watch, and it was only when he got away from the trade routes that he put the wireless watchers on to deck work. He pleaded ignorance of the regulations. The fine and costs amounted to £43.

The Telefunken Co. has recently carried out a series of trial trips from Kiel with the surveying vessel "Panther" using a new radio compass. Little information is available as to the details of the new invention, but it would appear that the trials were extremely successful, and the ship was navigated with considerable accuracy up to distances of about 30 miles even in dense fog.

It is stated that the B.B.C. has agreed to pay royalties to the Performing Rights Society, which represents composers, authors and publishers, for copyright songs and music which are broadcast. Payment will be retrospective and a settlement will place the Broadcasting Company very much in a position of a great theatre, paying the Society an annual sum for all its copyright fees.

At a recent meeting of the Eastern Telegraph Company, Sir John Denison-Pender made some interesting observations in regard to cable companies and their outlook in competition with the wireless systems. He referred to the considerable expenditure upon cables prevalent in Italy, America, Germany and various other countries and expressed his certainty that "the sagacity of America, the commercial instincts of Germany, the national aspirations of Italy, and the prudence of British and Colonial Governments would not allow them to risk respectively the expenditure of vast sums of capital in cable enterprise unless they were confident that cable systems of communication all over the civilised world must continue." It would seem that Sir John Denison-Pender is convinced that in future the two means of communication will go more or less hand in hand.

The uses of wireless underground, which were pointed out in an article in this journal some time ago, seem to be meeting with a considerable amount of recognition. We hear that experiments designed to maintain direct communication with rescue parties in times of emergency are meeting with considerable success in the Ashington Colliery, Northumberland.

The wireless craze was blamed at Whitchurch (Cardiff) Police Court recently when two defendants were charged with stealing a larch tree from a wood belonging to Lord Tredegar. They admitted that they had taken the tree in order to use it as a pole for their wireless aerial, and the solicitor prosecuting stated that a good deal of damage had been done to young trees in the wood by wireless enthusiasts on the look-out for useful timber.

An experimenter of Brynmawr reports that he does not consider that South Wales is by any means such a "blind spot" as recent complaints would make it appear to be. He states that he receives excellent transmissions from Cardiff, 25 miles away, on a home-made crystal set, and that London can generally be tuned in after the Cardiff station closes down. In fact, he claims that he has heard *four* British broadcasting stations with his receiver, and expresses the

opinion that poor crystals and bad workmanship are usually the cause in the case of home-made sets of South Wales being labelled a "blind spot." This experimenter's results would certainly seem to be remarkably good.

A contract has been signed between the Western Union Telegraph Co. and the Italian Submarine Cable Co., under which the latter company undertakes to lay a cable between Rome and the Azores, and the former to lay one between New York and the Azores, where it will be connected with the Italian line.

The Premier of Japan announced recently that the Government has decided to permit private companies to erect and operate under specified conditions international radio stations, and to subsidise them as occasion demands.

It is stated that the construction of the new Warsaw station, which will be one of the most powerful of its kind in Europe, will be completed about August 15th. It is being constructed under the direction of the American Radio Corporation, all the actual work, however, being done by Polish labour. The American engineers were at first doubtful whether the Polish workmen would be able to work on the steel towers at a height of about 400 feet, since they were not used to this kind of work, but the fear proved groundless, and it was found unnecessary to import foreign workmen. The station will work direct with New York and other of the world's high-power stations.

We learn that scholars have installed a wireless receiving equipment at the Cathedral day school, Sheffield.

At Barry Police Court recently a Greek shipmaster was fined £50 and 20 guineas costs for wilful disobedience of Board of Trade regulations regarding wireless apparatus. He was instructed to have his apparatus put right, but he put to sea without complying with the requirements.

A recent portrait of Mr. Ian Oliphant, the Assistant Director of the Manchester Station.

AN ATTACHE CASE ARMSTRONG SUPER-RECEIVER

By A. D. COWPER, M.Sc., Staff Editor.

The following article describes in detail a compact portable Armstrong receiver, the construction of which is within the scope of every experimenter.

WITH the advent of the out-of-doors season, the interest of the radio enthusiast naturally turns from the elaborate permanent set to the possibilities of the ultra-portable receiver, which can be taken anywhere on the holidays, whether on the beach, in the sidecar, or in the canoe. For such purposes the great range and power of the single-valve Armstrong or flivver circuit, in its later stabilised version, offers great attractions: the modest demands on the low-tension supply of the one valve, the excellent results obtainable on a tiny enclosed aerial, and the inherent stability and simplicity of tuning when properly designed and adjusted, all point to the Armstrong as an ideal portable short-wave receiver, and now that the last drawback of the circuit—the continuous whistle of the quenching oscillation—has been removed in an extremely simple manner, there is no reason why hundreds should not avail themselves of the super-regenerative receiver.

The photographs show an example of such a set arranged in an ordinary attaché case, with batteries complete, and with frame aerial in the lid. The apparatus weighs complete about 15 lbs., the heaviest item being the 20 flash-lamp batteries which provide the H.T. Two small ebonite-cased accumulators of about 10 ampere-hour actual capacity provide the L.T.: by the use of a dull-emitter valve the total weight could be much reduced.

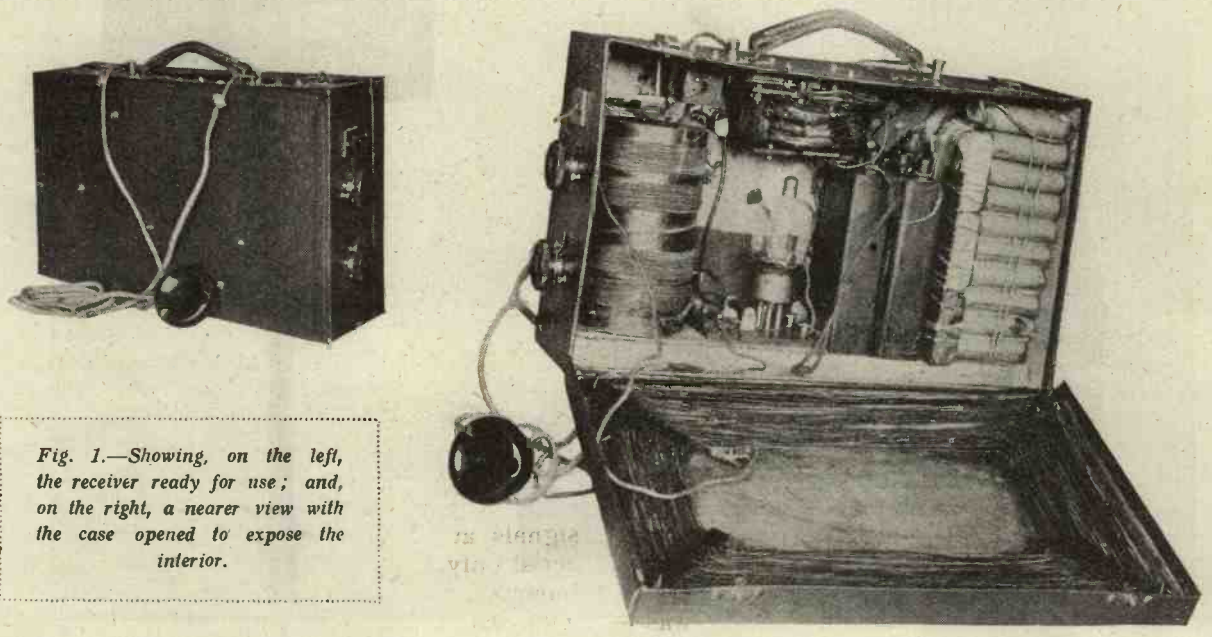


Fig. 1.—Showing, on the left, the receiver ready for use; and, on the right, a nearer view with the case opened to expose the interior.

A Dewar switch on the side of the case switches on the H.T. and L.T. simultaneously without opening the case; with powerful transmissions within its range good signals are easily obtained on rough tuning by simply

turning the reaction knob fairly cautiously. Directional effects are fairly marked on weak signals and at long range; body-capacity effects are practically absent, the tuning knobs being shielded inside by tinfoil grounded to the L.T. positive.

The circuit is practically identical with that of the *Modern Wireless* receiver, except that for compactness a ball-type variometer is used for tuning between the three tapping-points on the aerial (covering from 180 to 390 metres wavelength), and a ball reactance, wound with No. 28 on the ordinary wooden ball rotor, in the same stator-tube, a small sliding mica variable condenser being used across this in the upper ranges. As it was primarily intended for a short-wave receiver, the quenching frequency is set at a higher figure than in the former receiver, only 800 turns being used on the lattice-wound Armstrong inductance. A certain mushiness on loud sibilant sounds in telephony is largely eliminated by adding the high-resistance leak across the transformer choke which is so prominent and successful a feature of the S.T.100 circuit: an anode resistance of a nominal 70,000 ohms being used here. The construction could be very much simplified by re-arranging everything at the back of a panel, instead of having the components distributed casually in odd corners, as happened in the development of this receiver. The materials cost about £3, including valve, 'phone and batteries; and any hard valve may be used, as also may a D.E.R. with a pocket flash-lamp accumulator. On powerful transmissions on the longer waves this set gives loud signals at a dozen miles with "capacity" aerial only, *i.e.*, with the frame aerial out of business, and 'phones-on-the-table strength with two pairs of 'phones using the enclosed aerial and 80 volts H.T. On short waves it really shouts with this H.T.; with only four flash-lamp batteries as high-tension signals are quite readable, and with 40 volts H.T. signals between 200 and 300 metres could be read whilst walking in the open carrying the receiver by the handle with a single 4,000 ohm re-wound ex-Government 'phone in the coat pocket.

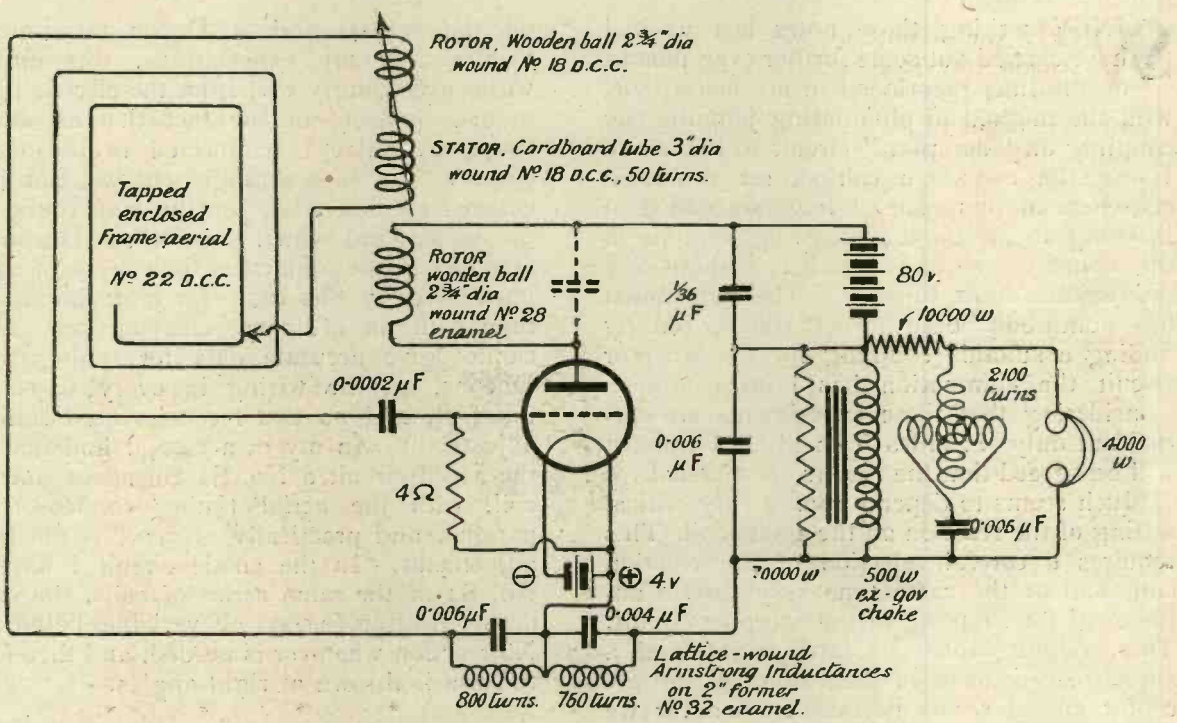


Fig. 2.—Circuit diagram of the portable receiver.

RANDOM TECHNICALITIES

By *PERCY W. HARRIS, Staff Editor.*

More about acceptor circuits—ST100 and the Ducon—Noises on the wires—Troubles with reflex circuits—A novelty in crystals—A solder-saving idea.

SINCE writing these notes last week I have carried out some further experiments, on the lines mentioned in my last article, with the method of eliminating jamming by coupling an "acceptor" circuit to the aerial. Using the two-valve cabinet set described elsewhere in this issue, I have succeeded in listening to all the broadcasting stations in this country, one after another, without any interference from London. The adjustment has admittedly been rather tricky, but by finding a suitable coupling for the acceptor circuit the elimination has been complete. Considering that these experiments are carried out only six miles from 2LO, I think it will be agreed that the results are unusual.

Much seems to depend upon a very critical setting of the reaction on the anode coil. This requires a careful selection of the reaction coil, and at the same time very careful adjustment for coupling of the acceptor circuit. This coupling must be fairly tight, and a slight readjustment of the tuning of the acceptor circuit seems necessary whenever we change from one station to another. I can heartily recommend the method to any experimenters who have either a circuit similar to that described in my article on another page, or a pair of two-coil holders which they can similarly wire up. Readers who succeed in eliminating their jamming by this method are invited to communicate with the writer, care of this magazine.

* * * *

The invasion of my little home by house decorators has necessitated the temporary removal of my receiving apparatus from its usual position, which means, in effect, that I cannot at the moment use my outside aerial. I always keep a Ducon handy for such emergencies, and for the last day or two the broadcasting has been enjoyed by my family on the ST100 and a Ducon attachment. Contrary to my expectations, this circuit works exceedingly well from the electric light mains, in spite of the fact that an audio frequency valve is connected in the aerial circuit. The best arrangement was not discovered on first trial, for the way round in the socket and which side of the Ducon is attached to the apparatus both seem of vital importance in this case—far more important than with an ordinary receiving set. One cannot give accurate data for tuning with Ducons, as the wiring in every house is different, and no two receivers need similar adjustment. In my own case, I find that in the aerial circuit a No. S2 Burndept concert coil, with the aerial tuning condenser in parallel, and practically at zero, is the best adjustment. In the anode circuit I have a No. S4 of the same series of coils, the condenser reading (0.0005 μF variable) being 25. No reaction whatever is needed, and therefore the arm is thrown at right angles.

* * * *

The setting of the crystal detector is perhaps a little more critical than usual, and it is interesting to note that when the cat-whisker is off the crystal nothing whatever can be heard on the set. This is rather contrary to usual practice with the ST100, for usually, on an outside aerial, something, at least, can be heard when the cat-whisker is not in contact. In this case not a sound is audible. When properly adjusted the strength is certainly too great on a loud-speaker for an ordinary room, and it has to be detuned slightly before the sound is comfortable. I have not been able to hear any other stations than London. The audio-frequency howl seems much more difficult to produce than with an outdoor aerial. For the plates I have been using 140 volts in these experi-

ments, with two Cossor valves, the first being one of the red-tipped H.F. variety. The crystal is a picked piece of hertzite with a gold wire cat-whisker. A negative bias on the grid of the second valve is obtained by a 4½-volt flashlight battery.

* * * *

There is only one slight inconvenience with this arrangement. Every time a light is switched on there is a pronounced and annoying click in the loud-speaker. Similarly any other electrical disturbances in the lighting mains make a noise, and at times we hear rather peculiar rumblings, scratchings and grunts. Indeed, on starting my dictaphone in another room for the purpose of compiling this article the noise set up by the slight sparking of the motor was sufficient to create a violent roar in the loud-speaker. As a consequence the preparation of these notes had to be postponed until broadcasting was over!

* * * *

I have recently seen a number of ST100 receivers made up on the lines of my article in *Modern Wireless*. Some of these have worked satisfactorily and others have not. A great deal seems to depend on the kind of transformer used, and the fact that the transformers work well in other circuits is no indication whatever of their suitability in a reflex circuit. In the case of one set which was brought to my house, nothing could be heard but a violent howling. By substituting another make of transformer all went well, and the user was delighted with the results obtained. The kind of crystal used and the delicacy of adjustment of the cat-whisker are also important points, for unless the crystal is well set the results are indifferent.

Another set brought to my notice had been carefully checked as to wiring, and the owner, having tried altering nearly everything, had practically given up hope. I went over the set very carefully and found everything was apparently in order, the component parts used being in practically every case those detailed in my article.

In the end the fault was found to rest with the pins of the valve, which, when opened up by the aid of a pocket-knife so as to make good firm contact with the socket, cured the whole trouble.

* * * *

I see that an American manufacturer is advertising what he calls "reflex" crystals. These are stated to be specially made for use in reflex circuits, as it is claimed that they stand up well to the very high voltages used. I have not seen or tried the crystal, but as far as those used in England are concerned, practically all of the galena variety seem quite good enough. However, those who have the time may care to investigate this aspect of crystal reception to find whether certain crystals work better in reflex circuits. It may be found that crystals seeming relatively insensitive when used in the ordinary way, turn out to be much more satisfactory in circuits of this type.

Another interesting novelty advertised in an American radio magazine is a vario coupler in which the tappings, instead of being brought out to soldering tabs, are each connected to lengths of wire, the wires themselves being fitted with spade terminals. This enables the purchaser to make rapid connection to stud switches without the necessity of soldering—a good idea which might be adopted by British manufacturers who sell tapped inductances. Any arrangement which reduces the amount of soldering needed should find a warm welcome with beginners.

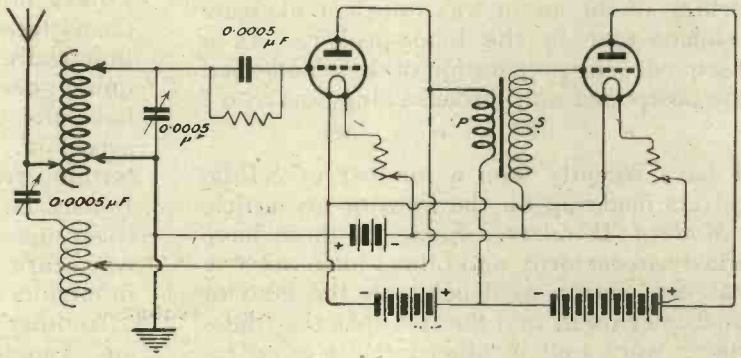
CIRCUITS WORTH TRYING

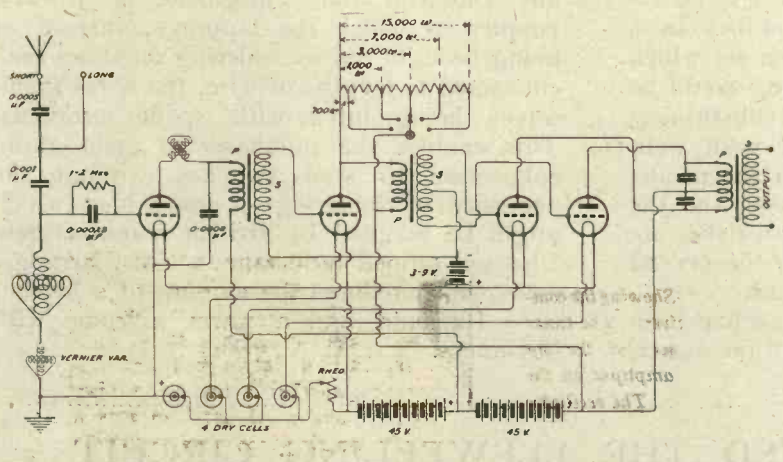
AN excellent circuit for the reception of short-wave telephony and C.W. is the form of Reinartz receiver illustrated below. It consists of the standard Reinartz circuit with a stage of L.F. amplification added for the purpose of compensating for the lack of strength characteristic of the Reinartz when used for telephony.

" vernier " type for fine adjustments, having about five turns on stator and rotor.

This is followed by a stage of L.F. of normal type, and then a stage employing the " pull-push " method of amplification. This consists of two valves in parallel, whose grids are affected by the variations of potential from the ends of the secondary of a trans-

On the right, the Reinartz circuit with a stage of low-frequency amplification added. The additional H.T. battery is desirable, but not essential. If used, it may be of about 36 volts.





On the left, a circuit employing the "pull-push" method of amplification. The filament circuits are arranged for dull-emitter valves. The resistance across the transformer primary is for the purpose of adjusting the output to the desired volume.

Our second circuit is one which has a considerable vogue in the United States for the loud-speaker reception of broadcasting. It consists of a rectifying valve which employs variometer regeneration for the amplification of the signals (note the variometer in the plate circuit), and the aerial circuit is tuned by a main variometer and second former which has a centre tapping. This arrangement produces a differential effect in their anode currents, which pass in opposite directions through the split primary winding of the output transformer. The sum total of the variations consequently appears as output current in the secondary of this transformer.

A COMMERCIAL RECEIVER

This article describes in brief the features of the Marconi "Marine Type" receiver.

THE Marconi standard receiver fitted to large passenger vessels is known as Marine Receiver No. 1, and consists of three essential portions: the "tuner," the "amplifier," and the "local oscillator." These three instruments, taken together, can be adjusted for the reception of signals on any wavelength between 200 and about 25,000 metres.

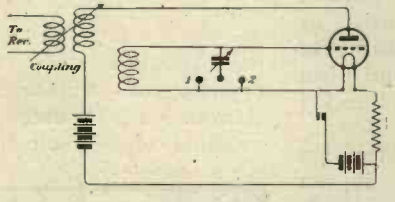


Fig. 1.—Circuit of the local oscillator.

The Tuner

This is of the two circuit type direct coupled. The inductance in each circuit is made up of a number of independent coils, each controlled by a separate key switch. Under normal conditions of working, one coil only is connected in each circuit, and release devices are provided which, when a key is depressed, automatically return all other keys in the circuit to the "off" position, and so disconnect all but the required coil. If necessary, coils may be put in series by the operation of two keys at the same time. A two-way switch enables the aerial tuning condenser to be used in series or parallel. Variable coupling between the two circuits is controlled by a circular switch which taps the requisite number of turns on a special coil. Accidental interaction is provided against by shielding the five elements from each other by copper casing.

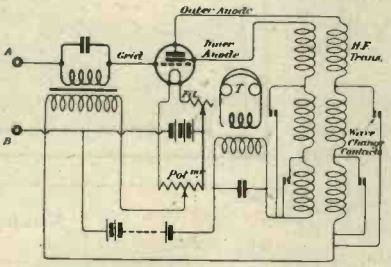


Fig. 2.—Diagram of the circuit arrangements of the amplifier.

The Amplifier

This consists of the Marconi Four-electrode Valve so connected with a series of inter-valve transformers that good high and low frequency can be obtained over the full range of waves carried by the tuner. The "limiting" qualities of the combination are very well marked indeed.

Local Oscillator

This instrument is a generator of high-frequency continuous oscillations for reception by the "beat" method. A large wavelength range has been obtained by the provision of two interchangeable sets of coils coupled with a switch whereby the variable condenser can be connected across the grid coil only or both coils in series. The strength of the local signals can be varied by means of a coupling coil incorporated in the instrument.

This receiver is extensively used in the mercantile marine, and on the large liners where the wireless telegraph services are almost as busy as that of a Transatlantic coast station, this receiver may be seen doing useful work. In such large vessels as the "Majestic," for instance, the receiving side of a wireless service must be particularly efficient, in order that press news and other long-distance services over a variety of wavelengths may be carried out without interruption.

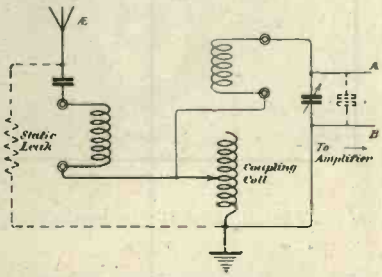


Fig. 3.—Diagram of the tuner showing one of the inductances in each circuit.

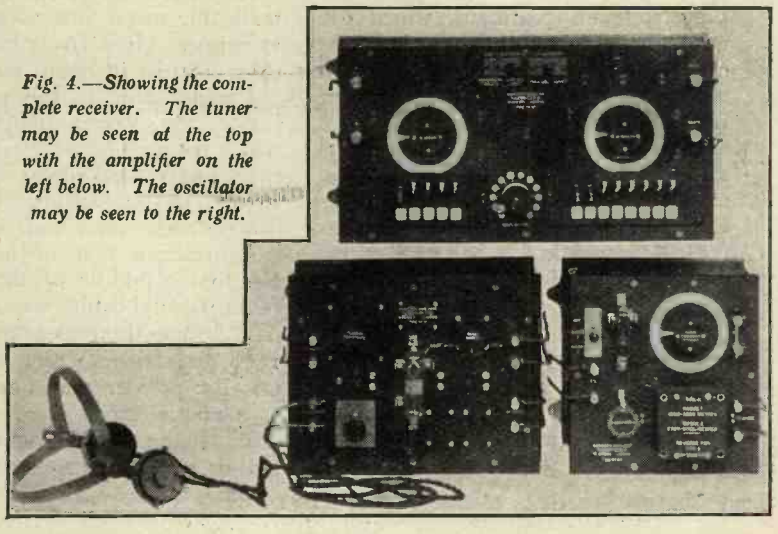
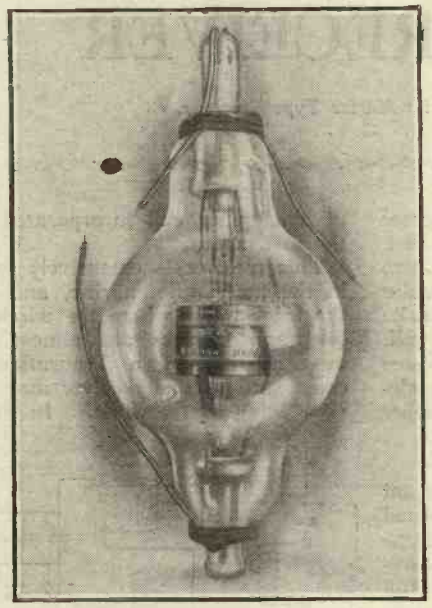


Fig. 4.—Showing the complete receiver. The tuner may be seen at the top with the amplifier on the left below. The oscillator may be seen to the right.



The Mullard O/250 transmitting valve.

THE METALS VA

By E. H. CHAPMAN, M.A., D

An informative article tellin metals which go to the

WERE a scientist with no previous knowledge of the modern wireless valve to be asked to identify the metals inside the bulb of a valve, he would be given an unusual and very interesting piece of chemical analysis to perform. No doubt he would quickly identify the nickel of the anode, but the three rare metals molybdenum, tungsten, and platinum, which are used in the construction of the electrodes and their supports, would call for considerable skill in their identification.

Nickel, the metal of which the anode of a valve is usually made, appears to have been known to the Chinese in very early times. It was not discovered in Europe until 1751, when the metal was obtained from an ore which was called by the German miners *false-copper*, since it possessed the general appearance of a copper ore, yet gave no copper when treated by the process then in use for the extraction of that metal from its mineral ores.

The numerous ores from which nickel is obtained include *niccolite* (the German false-copper), *millerite*, *nickel-glance* and *cobalt speiss*. Of these, *millerite*, a brittle, metallic, brass-yellow ore with streaks of greenish-black, is found in Glamorganshire. The chief source from which nickel is now obtained is the great deposits of nickel ore in Ontario, Canada. The importance of the nickel mining industry of the Sudbury district of Ontario can be judged from the fact that in 1919 Canada exported £2,000,000 worth of nickel. This great demand for nickel was due to the war, and when the war ceased, the world's nickel markets were overstocked. Consequently the yearly output of nickel from the Canadian mines is not likely to exceed the figure of 1919, but there is no doubt that Canada has become of first importance in the production of nickel.

The question may be asked as to what such a large amount of nickel is wanted for. The answer is that nickel is used in several important alloys, for example, German silver and nickel-steel. Then again, some countries, particularly Canada and the United States, have a nickel coinage. In addition, because of its silvery appearance and because it does not easily tarnish in air, nickel is used for "nickel plating" other metals.

Pure nickel is a white, ductile and malleable metal just about as heavy as copper. It is freely magnetic and does not rust in damp air.

Coming now to the rarer metals inside the valve, molybdenum of which the grid is usually made, is an exceedingly hard metal which, when fused, has a silvery-white lustre. *Molybdenite* and *wulfenite* are the two principal ores of molybdenum. Up to the middle of the eighteenth century molybdenite was supposed to be the same thing as graphite, but in 1790 molybdenum was isolated as a metallic powder and was recognised as a new element.

Wulfenite, which contains lead as well as molybdenum, is a red mineral ore streaked with white. The crystals of wulfenite found in Arizona are square plates with bevelled edges, their colour being a brilliant red. Wulfenite found in Austria is of a pale yellow colour.

Showing the derivation of

Molybdenum steel, that is, steel with a small percentage of molybdenum in it, is extremely hard, and is therefore used for making rifle barrels, propeller shafts and high-speed tools. Unlike ordinary "carbon steels," molybdenum steel has the useful property of retaining its

INSIDE THE VE

F.R. Met. Soc. (Staff Editor).

whence come the several manufacture of the valve.

" temper " when heated to a high temperature. It is thus possible to " work " molybdenum steel at a dull red heat without impairing its

the metal parts of a valve.

quality. The hardening effect of molybdenum on steel makes it understandable how lasting is the molybdenum grid of a wireless valve.

Tungsten, of which the filament of a valve is often made, is a rare metal belonging to the same group of metals as molybdenum. The metal tungsten is never found free in nature. Its principal mineral ores are *wolframite*, found in Cornwall and Saxony, and *scheelite* also found in Saxony.

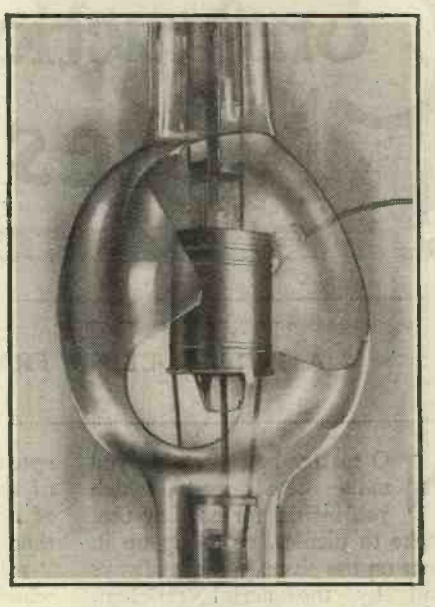
Wolframite, a black mineral ore with streaks of dark reddish-brown, is fairly common in Cornwall. It is of commercial importance as a source of tungsten for use in the manufacture of tungsten steel, which is very similar to molybdenum steel and has the same uses.

Up to the middle of the eighteenth century wolframite and scheelite were supposed to be ores of tin, but in 1783, tungsten was isolated and recognised as a new element just as molybdenum was seven years later.

One of the most interesting uses of tungsten is in the manufacture of non-inflammable articles of clothing. Fabrics which have been soaked in a solution of sodium tungstate, a compound of sodium, tungsten, and oxygen do not burst into flame when fire gets at them, but smoulder away slowly, and are therefore much less dangerous where there is risk of fire.

The use of the metal platinum in a modern wireless valve is an excellent illustration of one of the most valuable properties of that expensive metal. Platinum when heated, expands at almost the same rate as glass. Hence, when it is desired to fasten a piece of wire into a glass tube so that the wire will neither become loose nor crack the glass, platinum wire is the best choice. When heated, copper expands at twice the rate of glass. Putting it another way, copper, when cooling, contracts at twice the rate at which glass contracts. Hence, if a copper wire were fused into the glass stem of a wireless valve, when the glass and the wire had cooled after the fusing, the copper wire would be considerably smaller than the hole in the glass, so something further would have to be done in order to make the glass bulb air-tight.

Platinum, or as its name originally signified, *little silver*, was first brought to Europe in 1735. Unlike the other metals in the bulb of a wireless valve, platinum is found in the metallic state. A hundred years



A broken Marconi transmitting valve, showing the arrangement of the electrodes.

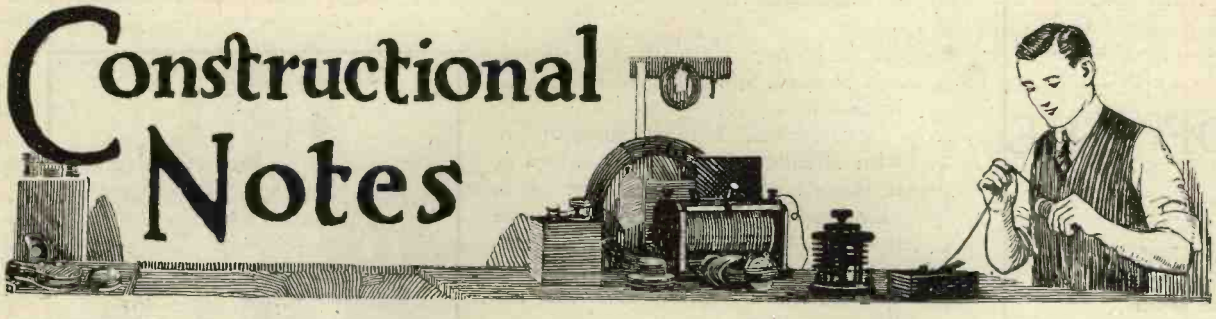
ago, most of the platinum used commercially came from South America, but before the war, Russia held first place in the production and export of this valuable metal, the supplies coming from the Urals.

Platinum is a good conductor of electricity. Apart from its uses in the manufacture of wireless valves, it is used extensively in the making of ordinary electric lamps.

The only mineral ore of platinum is called *sperrylite*. This ore is found in the rich mining area round Sudbury, Ontario.

How young a science wireless is when compared with chemistry may be seen from a comparison of the dates of discovery of the metals inside the valve with the dates which stand out as important in connection with the invention of that valve. Of the valve's metals platinum was discovered in 1735, nickel in 1751, tungsten in 1783, and molybdenum in 1790. The first Fleming valves were made in 1904, and in 1900 de Forest commenced his experiments which led to the invention of the grid.

Constructional Notes



A ROLLER-BLIND FRAME AERIAL

NO matter how portable you make the set itself, which you intend for holiday use, to take to picnics, or to rig up in a boat on the river, you are always faced by the aerial problem. Makeshift aerials contrived by slinging a wire from a branch of a handy tree, may or may not be satisfactory; usually they are not, since one cannot carry about a whole outfit of insulators. There is always the earth problem, too. It is easy enough to solve if one is on the water, but on dry land it presents difficulties, unless an iron spike like the army telephone earth pin is carried.

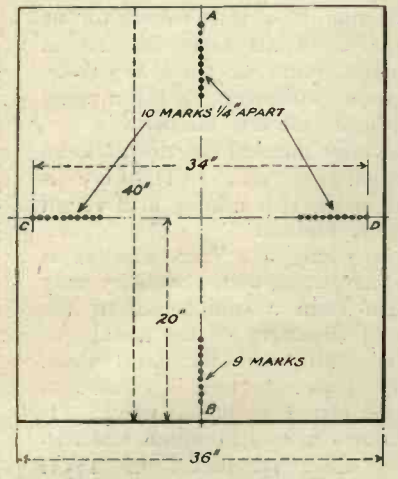


Fig. 1.—Dimensions of the holland foundation.

The ordinary frame aerial does not weigh much, but owing to its spread it is rather a bulky piece of gear to fit in with all the rest of one's paraphernalia. A device that solves all problems is the "roller blind" frame aerial, which when packed up occupies no more space than a sunshade, and requires, of course, neither insulators nor earth.

The materials required are simple, and their cost should not run to more than a few shillings. Here is the list: —

27 yards of single "flex."
1 piece of holland, 36in. by 40in.
1 blind roller, 38in. by 1in. diameter.
1 slat, 38in. by 1in. by ¼in.
2 terminals.
2 ebonite blocks, 1in. by 1in. by ¼in.

The top and bottom edges of the holland should be hemmed. In the measurements given above it has been taken that the others will be selvedge edges; but if they are not, the material must be 2in. wider and hems must be made.

Fix the blind to the table and rule lightly with the pencil the two straight lines AB and CD, each of which is 34in. in length. At the ends A, C, and D make ten pencil marks each ¼in. apart. Make nine similar marks at B. Guide lines for the wires may now be ruled between the marks. The outside mark of D will be joined to the outside mark of C, and so on to B. From B the line runs to the second mark of D, finishing after 9½ turns at the inside mark at C.

The flex is stitched on along these lines, care being taken that the ¼in. spacing is maintained between turns. Wire with an inner sheathing of rubber should be used; the needle and thread can then be passed through the outer silk or cotton covering. An alternative to flex is the paper mounted wire sold by the General Electric Company for use in household bell circuits. It consists of parallel copper wires lying between two paper strips, and can be stitched on to the holland.

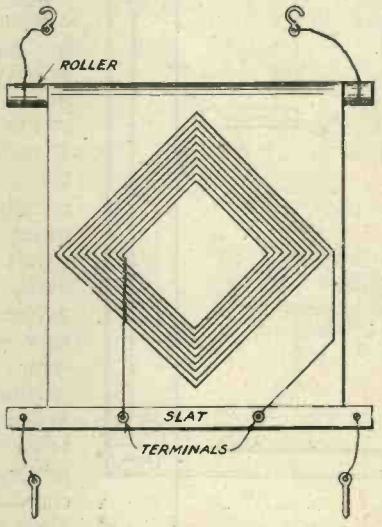


Fig. 2.—The frame ready for use.

The top of the "blind" is tacked to an ordinary roller, obtainable from any hardware shop, 1in. in diameter and 38in. long. To either end of this is fastened a piece of cord provided with a hood. To the lower edge of the holland is tacked a wooden slat,

also 38in. long. To it are attached two lengths of cord, as shown in Fig. 2, each of which is provided with a metal or hard wood pin.

For use out of doors the hooks of the roller can be slipped over a branch which points roughly in the direction of the station whose transmissions it is desired to pick up. The proper alignment is found by turning the frame slowly from side to side when the receiving apparatus has been attached and switched on. When the point at which signals are at their maximum strength is discovered, the blind is fixed by pushing the pins attached to the slat

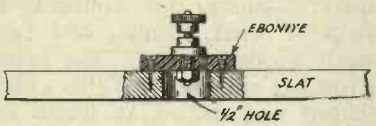


Fig. 3.—Method of mounting the terminals.

into the ground. To enable their cords to be drawn tight cleats like those used on tent ropes may be provided.

When used in the house the frame can be fastened to the top of a room or cupboard door by means of its hooks, and the proper alignment is obtained by swinging the door.

There are two ways of attaching the "blind frame" to the set. One is to bring the two ends of the spiral down to the slat, where they are anchored by means of staples, prevented from cutting the insulation by having little rubber pads inserted between their cross pieces and the wire. About 3ft. of each wire is left below the slat.

The other method which makes a better looking job, is to provide the slat with terminals as seen in Fig. 2. These cannot be mounted directly on to the wood, which would not provide sufficiently good insulation for high-frequency currents. Fig. 3 shows how the desired end can be accomplished.

Two half-inch holes are made in the slat. Over each is, fixed by screws, a block of ¼in. ebonite 1in. square, provided with a 4B.A. terminal. The holes enable the shanks of the terminals and their nuts to clear the wood.

The frame described will tune with a 0.001 μF condenser in parallel from about 350 to 500 metres. It must, however, be remembered that not all variable condensers sold as 0.001 μF really have that maximum capacity or anything like it, whilst in some of them the *minimum* capacity is comparatively high. Hence, with a particular condenser, the upper and lower limits of tuning may differ considerably from those given. The best way is to put on 10½ turns at first, tacking on the last two quite loosely. If one of the longer wave broadcasting stations is found to come in when the condenser is at, say, 15 degrees, you know that you have too much wire. Strip off a little at a time until you get 2LO with the condenser at the 20 degree setting or a little under. The frame will then cover all broadcasting wavelengths comfortably. Should you desire to make a similar frame for receiving greater wavelengths, it is quite easy to do so by reference to recent tables in this Journal.

R. W. H.

STARTING SMALL SCREWS

THERE can be no more exasperating business at times than that of starting a short, fine screw in the hole that has been drilled and tapped for it. It is too short to hold with the fingers; even the finest pliers do not help, and, try as one will, it slips time after time as soon as the screwdriver is turned.

There is a very simple way out of the difficulty. Take a strip of stiff paper about ¼in. wide and 2in. or 3in. long, and push the screw through it quite close to one end. The paper strip is held in the left hand, and with it it is quite easy to place the point of the screw over its hole and hold it there until it has been fairly started in the threads by the screwdriver. Once it has obtained a grip the paper is torn away and the screw is turned home.

Even screws of larger size, such as 6 or 8B.A., are sometimes difficult to start in rather inaccessible positions. There are several little tips that make this an easier task. One is to enlarge the mouth of the hole very slightly by using a drill a size or two larger and giving it two or three turns in the breast drill. Another consists in bevelling off the end of the screw

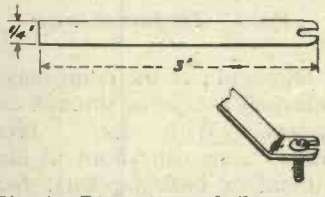


Fig. 4.—Dimensions of the screwholder.

a little with a fine file. Either of these make it much easier to get the screw to remain upright until the screwdriver has made it take the threads.

A still better method is to make a little tool such as that shown in the drawings. It is made of a strip of sheet brass about 3in. long and ¼in. wide. A hole to fit the size of screw for which the device is intended is drilled ¼in. or so from the end, and a slot is then filed from the end into the hole. The slot should be a fairly tight fit round the shank of the screw.

If guides of this type are made for the smaller B.A. sizes and kept in the tap box they will be found to save a good deal of time and to enable one to tackle even the screw that would usually prove most refractory with unruffled temper.

It is sometimes found that when tightened screws are desired to be loosened, they have become stiff and immovable. The best method by which the screw may be made to turn is to give a half twist in a tightening direction before attempting to loosen. R. W. H.

NEW USE FOR GRAMOPHONE NEEDLES

TWO very handy little tools for marking out ebonite or brass can be made up with the aid of gramophone needles. The point of an ordinary scriber becomes blunt after a certain amount of use and the tool must

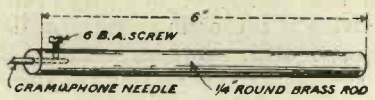


Fig. 5.—The finished scriber.

be reground; or the point may be broken off altogether through carelessness. With the "needle scriber" one can afford to laugh at blunt or broken points, for it is the work of a few moments to insert a new one.

To make the scriber, cut off a 6-inch length of ¼in. round brass rod and trim its ends flat with a file. In the centre of one of them make a punch mark, and drill a hole ⅜in. deep, just large enough to receive the butt end of a gramophone needle. In the side of the rod and $\frac{3}{16}$in. from its end, drill and tap a 6B.A. hole. Insert the needle, fix it in place with a set screw, and the scriber is ready for use. The second tool, shown in Fig. 6, is a beam compass, most useful for marking out large circular holes when they have to be cut out of the panels.

Another 6-in. length of ¼in.

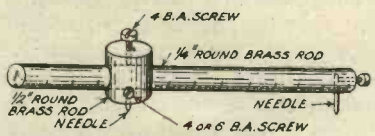


Fig. 6.—Scriber for marking out circles.

round brass rod forms its arm. A needle is fixed to one end as before, but in this case needle and screw change places, the former being secured at right angles to the rod. The slider is made of a 1-inch length of ½in. round rod. A ¼in. hole is drilled right through it so that it will slide on the arm. A needle, which should be cut off short so that the arm will be level, is fixed to its lower end by means of a set screw. In the upper end is a 4B.A. set-screw, which fixes the slider at any point of its travel on the arm.

On the arm are made file cuts at each quarter of an inch. These will serve as guides for rough work, but when the compass is to be used for fine marking the two points are placed on the edge of a rule and the slider is adjusted until the distance between them is exactly right. When using the tool make a punch mark, or, better still, drill a small hole, for the centre point to rest in.

R. W. H.

UNIVERSAL RESISTANCE HOLDER

IT is easy to understand why it is not possible to standardise complete receiving units, but why the bulk of the various components should not be standardised remains a mystery. If, for instance, a standard size of grid-leak or anode resistance was introduced, it would naturally create a demand for a standard holder, and so benefit the manufacturer, as well as making life worth living for the enthusiast. At the present time the length of a resistance varies according to the artistic temperament of the designer. The matter concerning the dimensions of the resistance element is no excuse for this, since a very wide range of values could be conveniently arranged in a casing, say, 2in. long.

However, we are here chiefly concerned with what *is*, having no other choice in the matter but to adapt ourselves (and our holders) to the existing conditions.

The adjustable holder to be described will accommodate most of the commercial grid or anode resistances ranging from 1in. to 3in. in length, and comprises two

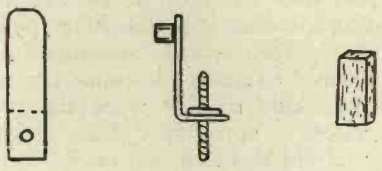


Fig. 7.—Details of the clips.

spring brass strips, two small spacer washers, two terminals, a strip of sheet ebonite, and two small wooden blocks. The brass strips are 1in. long by ⅜in. wide, shaped and drilled as shown in Fig. 7, and bent to right angles at the dotted line. A small spacer washer, as used for assembling variable condensers, is soldered to the top portion of each, in the approximate position shown, and the underside of the terminal collars are soldered over the holes in the lower portion. A strip of ⅛in. sheet ebonite, about 4in. long by ⅝in. wide, is slotted to take one of the terminal shanks, as shown in Fig. 8, and a hole is drilled near the other end and in a direct line with the slot, to accommodate the other terminal shank. Small holes are drilled in each corner for the purpose of attaching the strip to the two wooden supports by means of small screws.

Fig. 10 shows a side view and general arrangement of the as-

Fig. 8.—The base of the resistance holder.

sembled instrument. The spring brass strip on the left is permanently fixed to the ebonite base by means of one of the terminals. The other terminal nut is provided

with two small wings, which may consist of oval pieces of sheet brass carefully soldered one to each side. This permits a quick adjustment when changing over

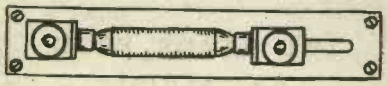


Fig. 9.—Plan of the resistance holder.

from one size of resistance to another.

It will be seen that these adjustments may be made without interfering with the top nut and connecting wires in any way, the terminal collars and shanks being integral with the brass strips.

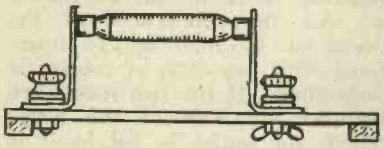


Fig. 10.—The resistance in position.

A top view of the device is also shown in Fig. 9. O. J. R.

A VARIABLE GRIDLEAK.

A VARIABLE gridleak recently made by the writer, consists of a rubber heel-pad and a Meccano part. The pad was screwed on to a piece of ebonite and a brass rod passed centrally through the pad, being held in position by nuts below the ebonite and above the pad. The Meccano part, a flat piece of metal with a cylindrical portion at right angles at one end, was mounted on the rod so that the cylinder rubbed round the rim of the pad.

The high resistance leak was made by putting on the rim of the pad a thin coating of a paste made of powdered graphite and Indian ink. A fixed contact was made at one end of the leak, the other contact being taken off the moving Meccano part.

E. H. C.

VARIABLE CONDENSER CONNECTIONS

THE majority of experimenters have, at some time or other, had need to pause and consider the best method of making connection to the moving vanes of a variable condenser assembled from sets of parts now on the market.

There is a variety of different methods, but none, in the writer's opinion, that can equal the following practical suggestion.

Materials required consist of a strip of copper foil about 4in. or 5in. long by 3-32in. wide, and one valve pin, the latter, preferably one sold for making plug-in H.F. transformers, having a shoulder, nut, and washer.

Reference to Fig. 11 will show that the idea consists of a copper spring, A, securely soldered to the moving spindle B, and, after rotating the condenser knob (from the all out position) one revolution, the other end of the spring is soldered in the slot of the valve pin C, cut to length and fitted in the bottom plate of the condenser at a convenient distance from the spindle.

No further instructions are needed, as Fig. 12 is self-explanatory, but it should be noted that the copper foil should be cut with the grain of the metal running longitudinally along the spring, or else, after being in use for a short time, the foil will break—the experimenter may test this for himself by cutting two strips of foil, one piece being cut at right angles to the other, and then each strip in turn being bent backward and forward between the thumb and finger. The strip cut across the grain will break at the third or fourth bend, whilst the other will stand a fair amount of such treatment.

If the dial pointer moves between a pair of stops all fear of "overwinding" the spring and breaking the connection will be avoided. One further note may be added; a connecting lead can be attached by means of a connecting tag bolted under the valve pin nut, or the wire can be soldered

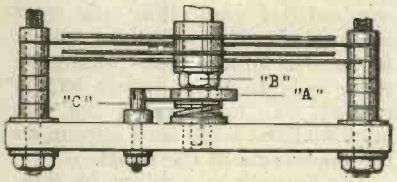


Fig. 11.—Elevation of the connection in position.

direct to the screw tip and taken to one of the condenser terminals, the fixed plate connection being an easy matter by utilising the clamping nuts on one of the support spindles.

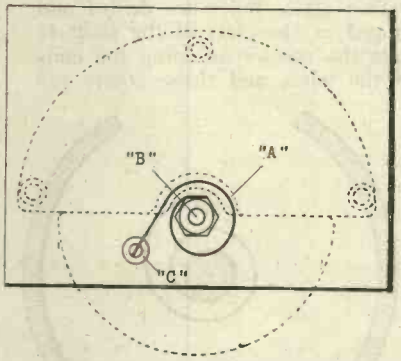


Fig. 12.—Plan of the condenser connections.

This method of making connection to a moving spindle has a great many most useful applications; for example, the average home-made variometer with its rubbing contacts making connection to the rotor is often very unsatisfactory in use, for it gives rise to all sorts of crackling and rustling noises when the knob is turned. The fitting of strip-contacts will cut out all these noises, and will often improve signals.

The advantages of the method are especially noticeable when the receiver is operated in an oscillating condition for the reception of continuous waves. R. B.

A ROTARY POTENTIOMETER

A ROTARY potentiometer is a handy little instrument to use, for it can be provided with a degree scale, which makes it easy to note the exact setting required for controlling the grid potential of any particular valve. It is also much easier than the slider type to adapt neatly to the cabinet set, for nothing but the knob and the scale need appear on the upper side of the panel.

The former is a piece of $\frac{3}{16}$in. fibre 8in. long and $\frac{3}{4}$in. wide. Care must be taken to get its edges perfectly true, otherwise the action of the potentiometer will not be satisfactory, since the arm will make a varying contact as it moves round the strip when it has been bent into a circle.

Two 4B.A. holes are drilled and tapped at the ends of the strip to take the screws retaining the ends of the wire, and three others are

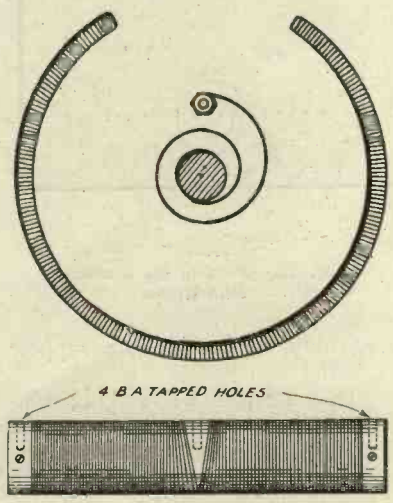


Fig. 13.—Illustrating arrangement of the resistance element.

drilled in the top edges, as shown in Fig. 13.

The windings consist of No. 42 enamelled resistance wire, which must be put on with the turns as close and as tight as possible. At the middle hole in the edge, a gap is left at the top just large enough to allow the screws from the panel to pass into the hole in the former prepared for it; this is done by keeping the windings close together at the top and putting on a few turns at a slight angle. The former will hold 500 turns of wire (there is no need to count them as they are

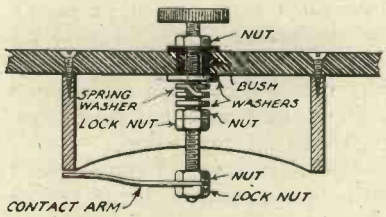


Fig. 14.—Sectional view of potentiometer.

wound), which will give a total resistance of about 300 ohms. Three-quarters of an ounce of wire will just suffice for them.

On the underside of the panel mark a 3in. circle with the scriber and drill 4B.A. clearance holes to correspond with those in the former. Bend the former into a horseshoe shape and fasten it with countersunk screws. At the centre of the circle drill a $\frac{3}{8}$in. hole to take a standard brass bush obtainable from advertisers in this journal.

The spindle is a $2\frac{1}{2}$in. length of 2B.A. screwed rod (or such other size as is a good fit for the bush). It is mounted as shown in the sectional view of the finished instrument in Fig. 14. The arm is a piece of stiffish but springy sheet brass about $\frac{1}{4}$in. wide at the point, and punch-marked from below so that it shall make contact with any one or two turns at a time.

As a brushing contact between spindle and bush would not be found satisfactory, the form shown in Fig. 11 is recommended. This consists of a spiral of thin sheet copper, whose inner end is soldered to the spindle, the outer being similarly attached to a short length of 4B.A. threaded rod screwed into the panel and provided with a pair of nuts, to which a lead may be attached.

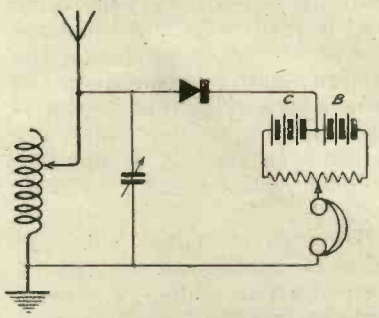
If the potentiometer is mounted on the set itself, connections will be made below the panel. But if it is to be a separate instrument with a small case of its own, connections from either end of the windings, and from the pillars of the copper spiral, should be taken to a trio of terminals mounted on the upper side of the ebonite. R. W. H.

TWO LEADS FROM AN AERIAL.

IT often happens that the experimenter wishes to keep one set solely for broadcast reception and another for experimental work. The latter set is seldom ornamental and has generally to be brought down from a spare room or workshop where it has been put together. Obviously it would be convenient to have a separate aerial in the workroom, so that the connections of the broadcast set need not be interfered with, but this, of course, is impossible. If the two rooms are both on the side of the house where the aerial is led in it is quite practical to take two leads, one to each room, separate earth connections being made to each set. The present writer is using such an arrangement quite successfully, merely disconnecting the set not in use. The strength of signals received upstairs is not so great as on the ground floor, but it is amply sufficient for general test purposes. In this way sets can be tested on the bench as made, with the soldering iron quite handy.

P W. H.

A CORRECTION



It is regretted that last week's diagram illustrating "A Home-made Potentiometer" contained an error, in that the aerial circuit was not tunable. We reproduce a corrected circuit diagram herewith.

A NEW MICROPHONE

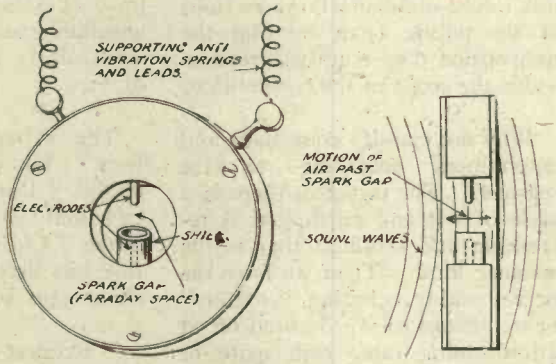
An interesting note upon a very promising new development.

REPORTS have been received of a microphone, based upon an entirely new principle, which has been developed in the Westinghouse Research Laboratory, Pittsburg, by Dr. Phillip Thomas. This microphone depends upon the direct action of the sound-waves in the air upon a minute electric spark.

It is well known that one of the principal objections to the carbon granule microphone and, in fact, to most of the existing forms of microphone, is that they rely upon the vibrations of a diaphragm which is actuated by the sound-waves in the atmosphere. A diaphragm, like any other mechanical vibratory system, has a natural period of vibration; in fact, under the conditions in which a diaphragm is placed in a transmitting microphone, it usually has not one but several natural periods. This means that it selects certain frequencies in the incident sound-waves and responds more vigorously to these frequencies than to others. The net result of this and other defects is that distortion occurs in the resulting reproduced sound.

A very large amount of research work has been devoted to the reduction of this distortion, with some success, but it may be said that no system depending upon the use of a diaphragm can ever be entirely free from selectivity.

The general principle of the new "glow transmitter" is seen from the accompanying illustration. A high-tension discharge takes place between two electrodes arranged opposite to a hole in the centre of a metal sheet. It is well known that in a high-tension discharge there are various light and dark regions, one of the dark portions being known as the "Faraday dark space." This is the part which Dr. Thomas has found to be most sensitive to the passage of sound-waves. Accordingly one of the electrodes is shielded to such an extent as just to expose the Faraday-space to the sound-waves. As the waves cause minute to-and-fro motions of the ionised gas through which the discharge is passing between the electrodes, they have a characteristic influence upon the current in the spark and electrical variations are set up in the spark circuit corresponding to the wave-form of the sound-waves. This new device is said to have no natural period, and to reproduce sounds of frequencies from 50 to 10,000 with perfect faithfulness.

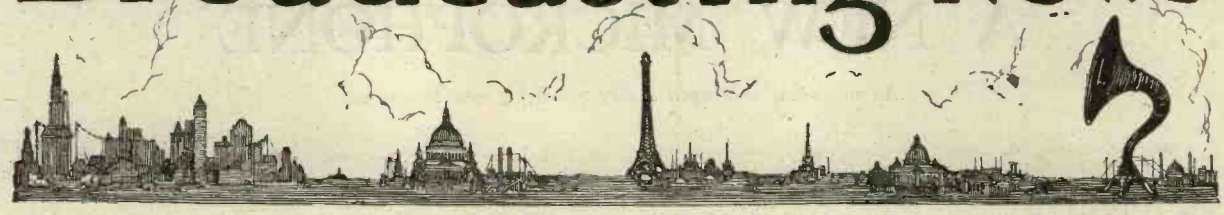


Illustrating the essentials of the new microphone.

Further information as to the practical trials of this instrument are awaited with considerable interest, for there is no doubt that a really aperiodic microphone of sufficient sensitiveness would be a most valuable adjunct to the broadcasting of speech and music. As soon as further information is available, it will be reported in this journal.

J. H. T. R.

Broadcasting News



By OUR SPECIAL CORRESPONDENTS.

LONDON.—The new competition which the B.B.C. announce ought to make a general appeal. There are to be prizes for the most interesting, original and amusing photographs, sketches and/or written descriptions of listening-in experiences. At first the idea was to have only photographs, but when it was pointed out to the B.B.C. officials that this would eliminate large sections of the public from entering the competition they readily agreed to widen the scope of the competition.

◇ ◇ ◇

Why not classify comedians and entertainers according to the seasons? For instance, there is a style of wit and mirth that is refreshing and cooling: that is the summer kind. Then we have the nerve-racking, exciting "patter," being strings of words fired off at an alarming rate, with more or less elocution and diction: that is what one might term "winter pastime," in which, also, one might include the boisterous, laughter-producing sort.

◇ ◇ ◇

With summer here at last, how welcome is the quiet, clean humour at present being broadcast from 2LO by their West Country and North Country entertainers.

◇ ◇ ◇

When, on a hot, sultry night recently, the writer heard, "John Henry calling," he forgot that his head-'phones were unpleasantly warm, and there came to him a vision of a quiet hostelry in Durham, the impression becoming almost realistic when "John Henry" started to tell us about "a bit trouble with his spouse."

Then, too, we have had the delightful description in West Country talk of an oratorio, "orchestéria," etc., etc. Certain it is that this quiet style of entertainment is ideal for the microphone and makes good hearing, and one can only hope that the B.B.C. will maintain the standard of their programmes and sedulously avoid, as hitherto, anything approaching trash or noisy, jerky stuff, totally unsuitable both from a moral and mechanical (broadcasting) point of view.

◇ ◇ ◇

The writer is not a "Pussy-foot"; but would it not be better if the "Uncles" at Savoy Hill eschewed all references to drink in the "Children's Hour"? The tiny tots listening-in will learn all about *that* soon enough.

◇ ◇ ◇

"Request night" was excellent, and we look forward to many more.

◇ ◇ ◇

The only conclusion of the Broadcasting Committee which Mr J. C. W. Reith, the general manager of the B.B.C., has so far divulged is that the term "listener-in" is to be abandoned, and the term "listener" employed instead. Technically speaking, people do not "listen-in." Such an expression is meant to mean the interception of messages between two other parties.

◇ ◇ ◇

The B.B.C. announcements with regard to relay stations have created enormous interest in the localities which might be served by such stations. Some are afraid that if people can listen-in on crystal sets there won't be the same demand for valve sets. Nothing could be further from the mind of the B.B.C. than such a supposition. Their idea is that people who cannot make or purchase valve sets may have the pleasures of broadcasting brought to them by means of crystals.

◇ ◇ ◇

One of the most interesting talks of late from 2LO was that on postal publicity by Mr. G. Woolston. It is to be hoped that the writer of the notorious "Worthy" puffs was listening-in. Then he would have an idea of the legitimate uses of publicity.

◇ ◇ ◇

It is rather interesting that the P.M.G. has established a listening-in set for his own private enjoyment. Perhaps he finds it very soothing after the rather stormy passage he has had of late.

◇ ◇ ◇

Major Harry Barnes, F.S.I., Vice-President of the Royal Institute of British Architects, is broadcasting two more talks from 2LO on Modern London Buildings. On Saturday, 25th August, he will speak on "Bush House and Kingsway," and 17th September on The New Regent Street.

◇ ◇ ◇

Mr. Allen S. Walker had an amusing experience after broadcasting his talk on the Southwark Cathedral. He casually invited any who were interested to meet him at the Cathedral one Monday about 11 a.m. He is accustomed to make invitations of this sort in his ordinary lectures and perhaps half a dozen enthu-

siasts turn up; on this occasion, however, about 600 arrived.

Forthcoming Events

AUGUST.

8th (WED.).—6.45 p.m., "Topical Empire Chat" by Mr. Edward Salmon. 7.15 p.m., Mr. Archibald Haddon on "Dramatic Criticism." 7.45 p.m., Mr. Colin J. Campbell on "August Shooting Stars" (Topical). 9 p.m., Mr. W. S. Crawford on "My Impressions of Business in America."

9th (THURS.).—7.15 p.m., Mr. Percy Scholes on "Musical Criticism." 9 p.m., Mr. Cecil Hallett on "The Egyptian Collections" in the British Museum.

10th (FRI.).—7.15 p.m., Mr. G. A. Atkinson on "Cinema Criticism." 9 p.m., Mr. Mark Allerton on "Serial Stories."

11th (SAT.).—7.15 p.m., open. 9 p.m., Lt.-Col. E. Gold on "Weather Forecasting."

13th (MON.).—7.15 p.m., open. 9 p.m., Mr. B. Rackham on "The Victoria and Albert Museum."

14th (TUES.).—7.15 p.m., Captain Stanley Lawrence on "Reassessment of Property." 9 p.m., Prof. Lefroy on "Insects, and the World's Cloth."

15th (WED.).—7.15 p.m., Mr. Archibald Haddon on "Dramatic Criticism."

◇ ◇ ◇

BELFAST.—From all accounts those boarding-houses in Portrush, the Irish Brighton, which have installed wireless receiving sets are earning the preference in patronage. However, the general complaint is that the duration of each dance item is altogether too brief. In fact, it is just when the swing of the dance is reached that disappointment comes in the voice of the announcer declaiming the next item.

◇ ◇ ◇

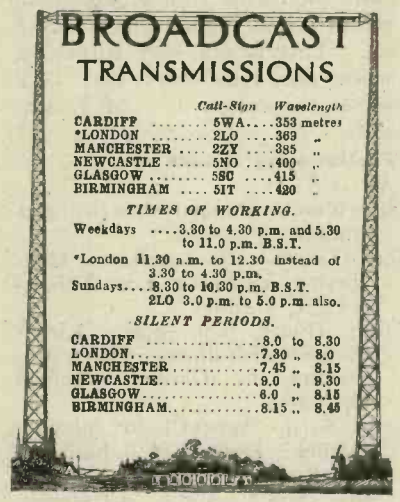
As regards wireless concerts, Mr. W. J. Gilmore, the Belfast representative for the Marconi Company, finds the demand for the services of the Marconi two-valve set with a two-valve amplifier and Amplion loud-speaker much more than he can meet. This week, at the Ulster ex-Service Men's Festival at Bellevue the Marconi receptions drew bumper audiences.

◇ ◇ ◇

BIRMINGHAM.—August 11th will mark the beginning of a new chapter in 5IT's history, for on that day the new studio will be opened.

◇ ◇ ◇

The proposal to form a station choir and repertoire company is being developed, and an appeal to musical aspirants has brought a very gratifying response. The task of selecting artistes with the likeliest "wireless" voices will occupy the attention of Mr. Lewis for some little time to come. After that the necessary rehears-



ing will be tackled, and by the arrival of autumn 5IT may well be proud of its choir, and qualified to make something like a stir in the broadcasting world.

◇ ◇ ◇

The furnishing of the new premises in New Street is being done as quickly as possible, and no pains are being spared to secure the desirable acoustic effects in the artistes' studio.

◇ ◇ ◇

Birmingham is fortunate in having in its midst men whose authority on matters both scientific and artistic has earned them national repute, and the number of letters received by the station director is eloquent of the success of their contributions to this section of broadcasting.

Forthcoming Events

AUGUST.

11th.—Opening of new Studio. Band of the Royal Air Force.

◇ ◇ ◇

BOURNEMOUTH. — The Bournemouth station will be opened about the middle of September. A site has been secured near the North Cemetery for the transmitting station; and the studio will be in Holdenhurst Road.

◇ ◇ ◇

The transmitting station will be erected in an open space, whilst the studio will be the largest of any of the provincial stations.

◇ ◇ ◇

CARDIFF.—A happy ending has been reached to an incident which robbed the "Comradios" of the Cardiff station for a time of the popular chats given by "Mr. Everyman," who, it is an open secret, is the station director, Major A. Corbett Smith.

◇ ◇ ◇

It appears that a chance remark—which was in fact a quotation from an essay—made by "Mr. Everyman" during a recent chat upon Henley Regatta and the spirit of carnival in this country as compared with the Continent, gave offence to the susceptibilities of one listener-in to such an extent that he addressed a strongly worded letter of complaint to the general manager of the British Broadcasting Company.

◇ ◇ ◇

"Mr. Everyman" caused a formal apology to be broadcast, and it was intimated that as his position at the station had been seriously jeopardised by the incident and that there was no guarantee that another innocent remark might not lead to similar trouble, it had been decided to discontinue the chats.

◇ ◇ ◇

This announcement led to quite a storm of protest from "Comradios" who had found the feature

a very interesting one, and the gagging of "Mr. Everyman" was the subject of an amusing cartoon in the leading Welsh daily newspaper. The upshot of the affair is that the majority of opinion has won the day, and "Mr. Everyman's" looks at the world have been restored to the programme of the Cardiff station.

◇ ◇ ◇

GLASGOW.—The question of holding a wireless exhibition in Glasgow this year was dealt with at a conference in the city between Mr. E. G. Dunn of the Radio General Publicity Co., Manchester, and members of the Glasgow wireless trade. The project was fully discussed, and it was eventually agreed to hold a meeting to further the scheme.

◇ ◇ ◇

Mr. Carruthers, the popular station director, has just received a letter from a little girl of 12 living in the far-away Isle of Iona on the West Coast, mentioning that her father has made for her the first wireless installation on the island. The most wonderful thing she heard come over the seas, she adds, was the resounding battle-cry in the stirring clan song, "M'Gregor's Gathering."

◇ ◇ ◇

We hear on every hand very great appreciation of the operatic nights, and respectfully suggest that more of this class of music would be welcomed. We also hear constant enquiries as to whether any preparation is being made for broadcasting the performances of the operas during the visit of the British National Opera Company.

◇ ◇ ◇

The Clyde turbine steamer *Queen Alexandra* has now been equipped for the season with a first-class receiving set which will operate about half a dozen loud-speakers in the saloon and on deck. Several tests have already been made, and these proved so successful that broadcasting from 5SC has been decided upon as a regular feature of the cruises.

MANCHESTER.—The news that Mr. Wright is shortly to resign the directorship of the Manchester station has come as a great blow, especially to those who have known the station ever since the now familiar "2ZY calling" was first heard.

◇ ◇ ◇

Why does the B.B.C. keep on supplying us with "millibars" in the weather forecasts? We find the barometer readings in inches more than enough. It isn't as if they were of use to the average man: this is where they differ from the "cotton futures," which are of great value to business men; in fact, we have it on very good authority that in a good many cases the cotton futures have been the principal inducement to buy a set. This is not very surprising when one remembers that 2ZY serves the cotton area of Lancashire.

Forthcoming Events

AUGUST.

8th (WED.).—Popular orchestral programme.

9th (THURS.).—Jo Lamb, the Manchester violinist; Lee Thistlethwaite, vocalist

10th (FRI.).—6.30 p.m., King's Own Scottish Pipers. Dance programme by Garner Schofield Orchestra.

11th (SAT.).—Agnes Clarke, soprano. Harold Derbyshire, baritone. The Radio Orchestra.

12th (SUN.).—Annie Chadwick, soprano. Further arrangements not yet announced.

13th (MON.).—Popular programme. Winifred Fisher, soprano; Lyell Johnson, baritone; L. T. Whipp, Lancashire dialect reciter.

14th (TUES.).—Beatrice Mirenda and Mr. W. Anderson will give extracts from "Faust," "Lohengrin," etc.

15th (WED.).—Orchestra.

◇ ◇ ◇

NEWCASTLE-ON-TYNE.—The educational possibilities of broadcasting have received official recognition from the Newcastle Education Committee. Local teachers are to be invited to give lectures of educational value. These are to be broadcast on five evenings weekly. Those children who, through poverty or for other reasons, have no facilities for listening-in, may do so at the schools after the beginning of September on two evenings weekly.

◇ ◇ ◇

Mr. Herman Darewski, the well-known composer, provided an extra turn in the 5NO programme on July 25th. He gave an entertaining account of his early experiences in the musical world, together with hints on the writing of lyrics, illustrating on the piano phrases that have popularised songs.

◇ ◇ ◇

Mr. W. A. Crosse, conductor of the Newcastle Wireless Orchestra, had the honour of being complimented by H.R.H. the Prince of Wales on the music provided by his orchestra at the civic banquet on the occasion of the Prince's recent visit to the city.

◇ ◇ ◇

SHEFFIELD.—The temporary broadcasting station at the home of Mr. F. Lloyd, in Ventnor Place, Sharrow, is already giving considerable satisfaction to many hundreds of new listeners-in.

◇ ◇ ◇

One lesson emerging from this first effort to broadcast in Sheffield is a matter of comment among amateurs. Why go to the trouble, it is asked, of providing the relay station when it has been proved that we can broadcast direct without great trouble? Sheffield lacks nothing in the matter of musical, elocutionary and dramatic art, and progress so far has shown that there are a good number of volunteers to face the microphone. That is a state of affairs which might not last, of course, but the extra expense of a local broadcasting station over that of a relay station when installed, should compensate for the lack of quality that might ensue from relay until perfection is reached. Up to now it has been shown that the main power at present used, 100 watts, is sufficient to transmit with quality over a wide radius to sets of modest range. The arrangements for the station are progressing, and negotiations are in progress for a permanent site.

AERIAL RIGGING AND MAST BUILDING

By F. H. PHILPOTT.

A further article dealing with mast erection of special interest to those readers who are not familiar with this class of work.

(Continued from Vol. 1, No. 13, page 753.)

WHERE there is a convenient building and permission can be obtained, the writer advocates attaching a pole to a chimney as being perhaps rather simpler and cheaper than erecting a mast.

The writer adopts the following method, and provided the erector

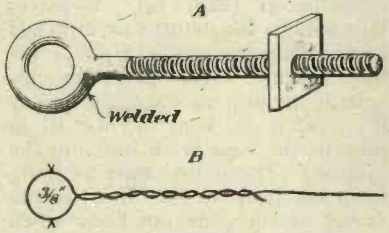


Fig. 15.—The eye-bolt and a wire loop.

has a friend who has a tolerably good head for heights, it is not necessary to call in a skilled man.

In addition to the pole (say 16ft.), pulley, etc., the materials required for one chimney are :—

A sufficient length of, say, 12 gauge galvanised wire to go round your chimney six times, with about 12ft. to spare.

Two galvanised eye-bolts (Fig. 15A) ⅜in. × 6in. or 8in. long, threaded "all the way." (These should be obtainable for 6d. each at any ironmongers.)

Two iron washers about ¾in. to 1in. diam., with a ⅜in. "clearance" hole for the eye-bolt.

Temporarily required :—

Hammer, pliers or chisel. Ladder to enable you to get on the roof. Builder's "crawl-board" or "cat-ladder."

To ascertain the length of wire required, which of course varies with the width of the chimney, it is not necessary to climb on the roof to measure it. Count the number of bricks in the width of the walls of your chimney, and get the measurement by multiplication. An average brick measures approximately 9in. × 4½in. × 3in., but they vary, and rather than rely upon these dimensions you can do better by actually measuring the proper number of bricks on the ground floor, including the courses of the mortar, which are usually ½in.

A house is generally built with the same size of brick throughout, so that those in the chimney will be the same size as those on the ground floor.

Measure off the required length of wire, allowing the 12ft. spare.

It is required to make the wire up into a three-strand cable, so lay the wire out on the ground in three equal lengths.

The cable can be best made with the aid of a hand-drill, or an ordinary carpenter's brace. Secure the ends of the three wires (it is not necessary to cut them) to some fixed object, such as the spike of an iron fence, but first make a loop at each end just large enough to slip

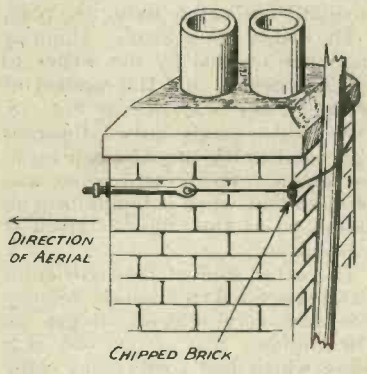


Fig. 16.—Method of fixing pole.

easily over the thread of the eye-bolt (Fig. 15A).

Now fix the other end of your wires to the brace, either by actually gripping them in the chuck, or, better, by attaching them to a wire hook which would be held more securely by the chuck. Now, keeping as heavy a strain as possible on the wire, you can wind an excellent cable with a good "spliced" eye at each end by simply turning the brace. When winding the cable, care should be taken to avoid accidentally releasing the handle of the

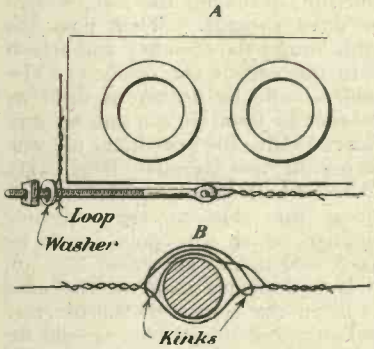


Fig. 17.—Showing arrangement of cable.

brace, as the cable will spring and unwind itself for a few turns, and the handle of the brace will fly round. This will, of course, happen when you release it after having wound the cable sufficiently, and you must be prepared for it.

To make the two belts required for the chimney, the cable must be cut in the middle, one strand at a time. If your pliers are poor and you have no chisel, the cable may be laid over a corner of an iron fence and struck a few blows with a hammer. It can then be easily broken by bending it backwards and forwards.

You are now ready for the roof. A crawl-board usually consists of an ordinary plank with slats nailed across, and a block of wood at the upper end for hooking over the ridge of the roof, and it is used to enable one to walk safely up the sloping roof. When placing the

crawl-board it should be "wriggled" up the roof (working from the ladder, of course), and special care must be taken not to dislodge the ridge tiles, which are easily knocked off. The crawl-board should be placed as close to the chimney as possible, and at the side on which you propose to put your pole.

Most chimneys have some sort of coping round the top, as in Fig. 16, so that when the pole is fixed it will have a slight slope.

The pole should be placed on the side of the chimney farthest away from the direction of the aerial, when the slight slope will not be detrimental to the appearance.

To fix the pole, first fit the top belt to the chimney as follows: Thread the eye-bolt through the loop of the belt, and replace washer and nut, screwing the nut on two or three threads. Then pass the cable round the chimney and attach it to the *eye* of the eye-bolt. The cable should be drawn as tight as possible by hand (it will still be very loose) with the eye-bolt at one corner of the chimney (Fig. 17A). The eye-bolt should preferably be along the side of the chimney against which the pole is to be fixed, and not as shown in Fig. 16. It is undesirable to allow the wire to lie in the course of the mortar, and to avoid this a chip should be knocked out of each corner brick

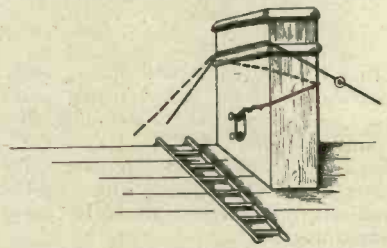


Fig. 18.—Using chimney ledge as anchorage for aerial.

with the hammer, so that when the cable is in position it is impossible for it to slip.

Having got the cable into position, it should be hammered at each corner to make it lie close to the brickwork. Then slide the pole between the cable and the chimney, and place it in position. Hammer the cable on each side of the pole so that it forms kinks as close to the pole as possible (Fig. 17B). These kinks should be as pronounced as possible, as they must prevent the pole from slipping sideways after tightening up.

Now pass a binding wire (preferably something thinner than your 12 gauge) three times behind the pole as shown in Fig. 17B, and get them just as tight as you can. Now by screwing up the nut on the eye-bolt the wire will be strained tight, and as it will to some extent straighten out the kinks it will tighten up your binding at the same time.

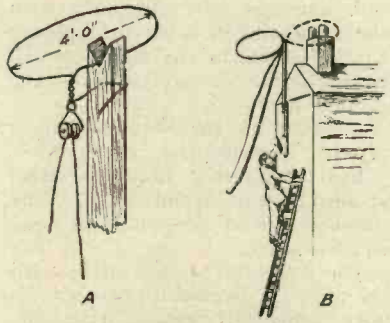


Fig. 19.—Method of lifting loop over chimney.

The same operation is performed with the lower belt, and it will be found a perfectly satisfactory way of rigidly and safely fixing the pole.

The ledge on a factory chimney was once utilised by the writer to hold the aerial, and the method of getting it up is shown in Fig. 18. Two clothes-props lashed together were used to lift the wire belt on to the ledge. Fairly stiff wire was used, so that when it finally bent to the shape of the chimney stack it "stayed put."

The other end of this particular aerial was fixed to a house chimney that was very difficult to get at. The chimney was at one end of a house which had some fancy ridge tiles, making it impossible to hook the crawl-board over the ridge. The ladder was reared against the end wall of the house, but, being some 12ft. or so short, the method adopted was as follows:—

A hoop of stiff wire (about 8 gauge) was made, about 4ft. in

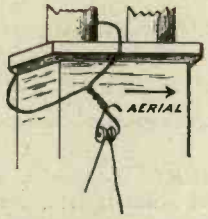


Fig. 20.—Showing the loop in position.

diameter and with a "tail" bent in such a way that the hoop could be held horizontally in the fork of a clothes-prop (Fig. 19). A porcelain bobbin insulator was attached to the hoop for use as a pulley for the halyard. (A porcelain insulator makes an excellent pulley if a wire is bent across it to prevent the rope from jumping the groove.) The pulley must be hung from the hoop so that it is free to swing or turn, as the hoop when up may take some position that was not expected, and if the pulley is rigidly fixed it may be found to be at such an angle that the halyard will not run through it. The writer has made this mistake.

Two clothes-props tied together gave the necessary height.

By mounting the ladder and crooking one knee through and round a rung, both hands were left free. The hoop with halyard attached was hoisted to just above the chimney-pot, then twisted round (shown dotted, Fig. 19B) and lowered over the pot, and the corner of the chimney-stack (Fig. 20). The props were then lowered, and used to poke and prod the hoop and pulley into position. It may be mentioned that it was found very much easier to put the hoop over the chimney than it was to get it down again to readjust the pulley.

SPEAKING FROM 2LO

A wireless amateur's impressions on broadcasting from the London station.

I SUPPOSE amongst the numerous readers of *Wireless Weekly* there are many who have taken part in the programmes sent out by the British Broadcasting Company from the London station, and, on the other hand, there are many more who have not. As, until the other night, I was numbered amongst the latter, perhaps a few impressions of my *début* as a broadcaster may be of some interest to fellow-broadcatchers. (I wonder who coined the horrible expression!)

Before you can achieve the distinction of being accepted as a performer by the Director of Programmes you must have something either to say, sing, or symphonise; that has a very important influence upon your being accepted, whilst it is obviously an advantage to have a voice unless you can supply the deficiency with a musical instrument.

My own effort consisted of a spoken contribution to the "Men's Hour"; and, between ourselves, I felt just a wee bit nervy about addressing the "invisible audience," as listeners-in are described by the average broadcaster. When my "dope" had been written out—although, of course, I tried to disguise it, when speaking, as an extemporaneous effort—my words were addressed to a milk-jug disguised as a microphone in order to familiarise myself to the sound of my own voice, because I don't happen to be a bookmaker by profession. Here, as I found later, I went wrong; the milk-jug should have been substituted by a meat-safe mounted on a pedestal, which bears a closer resemblance to the actual microphone cabinet.

Arriving at Savoy Hill on the momentous evening, I entered the lift and said "Studio" to the hoister in as brazen a manner as my highly strung nerves would permit, and was ushered to the threshold of the torture chamber, where my feelings underwent a complete change.

First of all, the member of the Veterans' Corps who ushered me in wore the Mons ribbon, which made me feel I had found a friend, and the tastefully decorated lobby where I awaited my turn almost charmed away all symptoms of the anxiety which had held me for days. There was a comfortable settee, and the cool breeze from the river wafted the scent from a vase of flowers in my direction; and what with that and the muffled strains of a singer's voice proceeding from the closed door beyond, I really began to feel quite comfortable.

As far as I could gather, the Director of Programmes and the *chef d'orchestre* were very important persons, but the boss of the show seemed to be an Irishman—for repeated references were made to Mike Rofone—of whom everybody stood in awe. Here again, however, I was wrong, for the whispered respects were meant for that wonderful instrument so soon to be faced, which, though not actually the boss at 2LO, yet holds a high position in the organisation. The new microphone is so sensitive that one has to be very careful not to *think* too loudly when standing near it, or else all one's innermost sentiments will become public property.

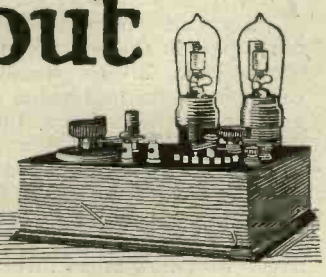
The Director of Programmes received me into the actual studio, where he and the other Uncles have so much fun over the Children's Hour, and I came into the presence of the microphone. Mere artists are not told what the cabinet contains, which makes some of the more imaginative feel they are before some potent pantheistic personality; but before being announced I was allowed a preliminary canter by addressing it privately. A few remarks from my cicerone made me quite at ease, when, to everyone's horror, it was found the switch was on, so that listeners-in had all the benefit of the parade to the starting-post. Once given a start by the kindness of all the B.B.C. folk I had met, things went off without further incident, and I must say the "invisible audience" behaved quite well—at least, they gave no indication of disapproval; and as my *fiancée* was good enough to say afterwards, "Oh! it wasn't so bad for you," I imagine the actual speech must at least have been tolerable. As far as one can see, the B.B.C. will have no difficulty whatever in attracting all the talent they require to amuse and instruct the wireless public when their arrangements are so thoughtfully and efficiently prepared for those who participate in the broadcasting entertainments.

R. T.

THE MULLARD "LOW FILAMENT" VALVES.

We are informed that the price of the Mullard low-temperature valves is being reduced. These valves are known as the L.F. Ora B and L.F. Ora C, and their new price is 27s. 6d.

Mainly about Valves



Our weekly causerie written by the Editor.

Varying the Grid Potential

THERE are many cases where a varying grid potential is desired, whether this potential is positive or negative. A particular case which I call to mind is that where the grid of a valve has to be given a varying negative potential which enables the valve to act as a low-frequency amplifier with a minimum of distortion.

Grid currents are, of course, the great bugbear of low-frequency amplification, and therefore should be eliminated by applying a negative potential to the grid of the amplifying valve, this negative potential being at least equal to the maximum amplitude of the low-frequency E.M.F.'s applied to the grid. An increase of anode voltage usually accompanies this application of a negative potential.

The use of potentiometers is objectionable because they cause the grid battery to run down. To avoid this, a variable grid battery may be used, and this may be tapped in sections. Such a battery will last almost indefinitely, as no current is taken from it. A careful adjustment, however, is not possible, and therefore I usually prefer, myself, to use the arrangement shown in Fig. 1, which is not often used by the experimenter.

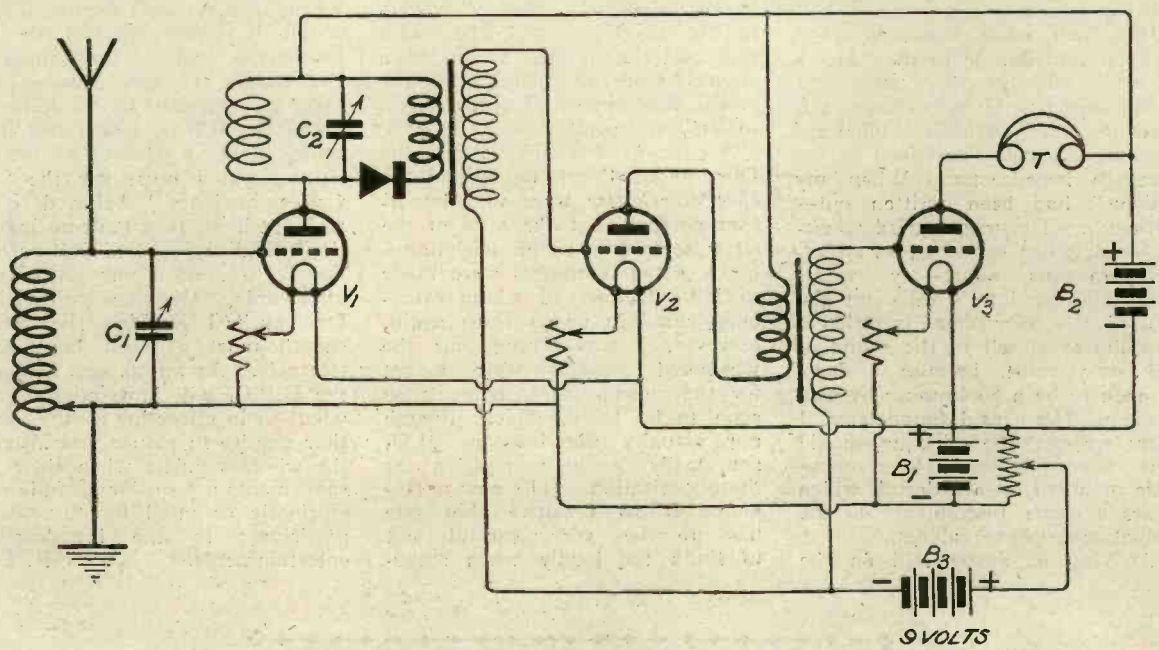


Fig. 1.—A method of obtaining exact adjustment of grid potential.

In Fig. 1 a three-valve circuit is shown, the first valve acting as a high-frequency amplifier, followed by a crystal detector and two note magnifiers. To obtain the full degree of amplification and to avoid distor-

tion, a variable negative potential is applied to the grids of the two valves V_2 and V_3. A grid battery, B_3, is employed, but instead of connecting the positive terminal of this battery to the negative terminal of the filament accumulator B_1, it is connected to the slider on a resistance connected across B_1. This resistance and slider constitute a potentiometer, the resistance being of any convenient value. A value of anything above 50 ohms will do perfectly well. In any case, the current taken by this potentiometer will be negligible compared with the current taken from the accumulator by the valve filaments.

Let us suppose that the battery B_3 has an E.M.F. of 9 volts. When the slider is at the bottom end of the resistance—that is, at the negative terminal of the filament accumulator—the potential on the grids of the two valves is −9 volts. If, however, we move the slider to the top, we add another 6 volts positive to the grid potentials. These potentials will, therefore, be −9 volts+6 volts, which equals −3 volts. By moving the slider to different points along the resistance, it is possible to obtain any grid potential between −9 volts and − 3 volts.

If the battery B_3 had an E.M.F. of 6 volts, the grid potentials could be varied between −6 volts and −6 volts + 6 volts, which equals zero volts. It would, therefore, be possible to give the grid a potential of anything from zero to −6 volts.

By using this method, it is always possible to vary by 6 volts any battery included in the grid circuit, whether this battery is connected in such a direction as to make the grid positive or negative.

The position of the filament rheostat will modify the normal grid potential, and this must be allowed for.

WIRELESS FOR THE BLIND

The monotony of hospital life at the Royal London Ophthalmic Hospital will in future be relieved to some extent by the introduction of wireless into its wards. Our photograph shows patients and nurses listening-in with apparatus presented by the Marconi's Wireless Telegraph Co. Ltd.

THE PALLOPHOTOPHONE

To the Editor, *Wireless Weekly*.

Sir,—The description of the Pallophotophone in *Wireless Weekly* for June 6th and 13th, 1923, and the article by Mr. C. F. Elwell, "Wireless and the Film" in *Wireless Weekly*, July 4th, 1923, fulfil in almost every detail the prediction I made at the conclusion of a lecture delivered by me to the Wireless Society of London at the Royal Society of Arts on June 29th, 1920. The following is a précis of what I then said. (See the Proceedings of the Wireless Society of London for that date.)

May we not confidently look forward in the near future to a much wider use of wireless telephony? I see no reason why photographic records could not be taken of public speeches, important lectures, etc., by making use of a Ruhmer Photographophone, invented in 1900. In this connection I should not omit to mention Dr. Rankine, who has been, and I believe still is, carrying out similar experiments in this country.

All public platforms could be fitted with a number of microphones, much as they now are for the electrophones. These microphones would be used to control a speaking arc or manometric flame, the light from which is focussed upon a moving strip of photographic film. When developed this film would be of uneven density, corresponding accurately to the variations in the intensity of the light from the arc as controlled by the voice. The film could then be sent to the wireless transmitting stations, where it would be passed in front of a steady source of light, and the variations of light intensity produced by it would be focussed upon a selenium cell. The corresponding current variations passing through this cell could then be amplified from the aerial of a transmitting station. So that not only would people hear the news, but they would hear the actual speeches delivered word for word in the voices of the original speakers.

I foresee a time when a room is set apart where photographonic records of important lectures which have been delivered during the week in all parts of the world, are re-delivered, either by wireless from transmitting stations, or by reproduction directly from the film by using a selenium cell, amplifier, and loud-speaking telephone, etc., in the lecture room. This, together with a cinematographic reproduction of experiments given at the lecture, synchronised with the speech film, should give a most life-like representation.

The synchronisation of the photographonic film with the cinematographic films opens up great possibilities to film producers.

I am, etc.,

G. G. Blake, M.I.E.E.

Richmond, Surrey.

TRADE MARKS

To the Editor, *Wireless Weekly*.

Sir,—In view of the fact that many owners of Trade Marks for sound-reproducing instruments are now dealing in wireless apparatus, it may be useful to learn that further application for registration in respect of wireless apparatus is necessary if protection is wanted.

It may, however, be stated that official objection is taken to an application for the registration of a Trade Mark for wireless apparatus if a similar Mark is already on the official records for sound-reproducing instruments.

Yours faithfully,

H. T. P. Gee.

51-52, Chancery Lane, W.C.2.

THE NEW LANGUAGE

To the Editor, *Wireless Weekly*.

Sir,—A few weeks ago you published a letter from a correspondent complaining of the looseness with which the word "Vernier" is used. There appears to be a growing tendency in the realms of wireless towards the use of bizarre words, even to the extent of coining absurdities.

In the issue of *Wireless Weekly* for 11th ult., one advertiser states that if a certain loud-speaker is used "rendition of speech and music will be found so true and distortless . . ." Now, I will agree that the English language holds the word "rendition," but it is almost obsolete, and its meaning is "surrender of a place or person"; "rendition" in the sense of "rendering" is an Americanism for which there is no need, but what on earth does "distortless" mean?

I always read the advertisements in *Wireless Weekly* before I go on to the letterpress, and was much relieved to find the "distortless" was omitted from the firm's advertisement in the issue of 18th ult. I have, however, not yet recovered from the shock of reading another advertisement in that issue, in which it is claimed that a certain other loud-speaker

is free from distortation. I dread opening *Wireless Weekly* of August 8th in case I should read that " the X loud-speaker is free from resonation."

I am, etc.,
H. W. FULLER.
Westminster Bridge, S.E.1.

SYMBOLS

TO THE EDITOR, *Wireless Weekly*.

SIR,—*Re* your note at the end of W. E. Bennett's letter on " Valve Combinations " in No. 12.

You ask for suggestions for distinguishing a valve used in a dual capacity when using Mr. Bennett's notation for classifying valve combinations.

Might I suggest that an index be added to the figure which would represent the valve under ordinary circumstances, and that the index be a letter denoting the second function of the valve.

For instance, ST100 would be :—

I^1—C—I

the index " 1 " denoting L.F. amplification.

Whether a set employed reaction or not would, I am afraid, need to be stated separately, as complications would arise in denoting (by symbols) between which of the circuits reaction was employed.

Wishing your very excellent papers every success.

I am, etc.,
C. HUME-HENDERSON.
Perthshire, N.B.

A GROUSE

TO THE EDITOR, *Wireless Weekly*.

SIR,—I read your paper every week, also all the others. I like yours the best, but I want you to have a little more consideration for unfortunate experimenters like myself. My trouble is this.

When I started wireless I was happy with one valve. This soon increased, contentment at the same time varying inversely as the square of the number of valves in use.

Of course, as a reader of American radio papers I became convinced that the Armstrong Super was the only circuit worth hooking up. This, when my auditory apparatus was convalescent, was followed by the Flewelling—then a friend (?) told me of the " one and only " circuit.

At this stage it was still possible to look on the bright side of things and some mental stability remained, though naturally my bank balance had long become a negative quantity. Then, Sir, in an evil moment you published the ST100—an excellent circuit had I never heard of it, and now you announce " An Improved Flewelling Circuit " ! It is more than human brain can stand.

Please give us more theory. This is quite harmless. I regard the B.B.C. as my only benefactor. I used to have the worry of a transmitter. Thank goodness amateur transmitting is washed out.

I am, etc.,
C. H. S.
Wolverhampton.

[What do our readers think? Why not adopt my constant recommendation to use separate components which may be wired up to any circuit you like in ten minutes?—ED.]

THE NEW FLEWELLING CIRCUIT

TO THE EDITOR, *Wireless Weekly*.

SIR,—I was most interested in the new Flewelling super circuit described in No. 2 issue of *Wireless Weekly*, and have pleasure in being able to report that excellent results were obtained by one of our most prominent experimenters, Mr. Bateman, of Cadnam, Hants, at a meeting of our Society held on June 12th, where he described and demonstrated the circuit now published, the only difference being that the variable gridleak was connected between the grid and the positive end of the filament. At the meeting, Cardiff was received on an 18in. frame aerial. The variable gridleak used was a home-made affair consisting of a test tube full of alcohol, a copper wire being immersed at different depths giving the variations required, and the one used was continuously variable between 0 and 18 megohms.

The use of the circuit as a super, and as an ordinary regenerative circuit, was described by Mr. Bateman, who stated that as a super it should most certainly not be used on an ordinary aerial (as previous accounts said it could be) owing to the annoyance that it would undoubtedly cause to others.

The object of this letter is to testify to the efficiency of the new circuit and to call attention to the fact of its being not quite so new to our Society as it will be to some, thanks to the efforts of Mr. Bateman.

I am, etc.,
PERCIVAL SAWYER.
Southampton and District Radio Society, Southampton.

CATALOGUES RECEIVED

G.W.I., Ltd. — Experimenters will be pleased to note that this firm undertakes the repair of broken valves, new filaments being fitted, after which the bulbs are re-exhausted. The price for renewals is 7s. 6d., with an extra charge of 1s. for glass replacements where necessary. A fair time is required for this process, but it is claimed that in many cases renewed valves are better than the originals.

Radio Equipment Co., Ltd.— We have received from this Company an illustrated catalogue of complete sets and components at very reasonable prices. The two-valve set is complete in itself with the exception of the accumulator, provision being made for the H.T. battery.

Apparatus we have tested

A B.B.C. Crystal Set

MESSRS. C. F. Elwell, Ltd., have submitted for test a broadcast crystal receiver outfit. The instrument tested tuned from 355 to 900 metres on a twin aerial of approximately P.M.G. standard dimensions, and was provided with terminals for loading coils to reach the higher wavelengths. It is a handsome little set, of the panel-topped box type, very finely finished, and of irreproachable workmanship.

The tuning device is of the most efficient type—low-resistance variometer of reasonably thick and well-spaced wire—with moulded ebonite rotor and loading coil tapped at three points to cover a large range of wavelengths and to cope with various types of aerials. The only criticism we can suggest is that for listeners situated in the Cardiff area the minimum inductance is a little high if a large double aerial be used, or a long, poorly isolated lead-in, so that a series condenser would have to be interposed. A thoughtful addition on the selector-switch is a " safe " off position, which earths the aerial when the set is not in use. Both telephone jack and terminals are provided. The crystal is apparently a tellurium-zincite combination, " Talite," which, in the experience of the writer, is an exceedingly sensitive and at the same time enduring combination. The detector at first appears to be somewhat clumsy to set, but on test it was found admirably suited to this particular combination of crystals and held a sensitive setting for a whole evening's transmission. A very good point, which other makers might well copy, is the provision of a rapid and easy means of replacing the crystal ; not content with this, Messrs. Elwell, Ltd., actually provide a spare zincite crystal ready mounted ! It is this idea of " service," of maintaining their products in efficient operation long after the first sale is effected, which will go a long way towards establishing a permanent interest in radio and a lasting market for the manufactures.

The Elwell crystal set.

As might be expected from the design, the signal strength on practical trial (on a good suburban aerial some thirteen miles from 2I.O) was very good indeed—as good, in fact, as on any B.B.C. set that has come to our notice. It can be gauged from the fact that the seven o'clock transmission was plainly audible across a small room (not particularly isolated nor quiet) on an efficient loud-speaker, every word being readable at a distance of several feet. The tuning was sharp, and the crystal setting found immediately.

A New Crystal

Messrs. Harrington Bros., Ltd., have submitted for tests a sample of a new crystal, of the synthetic galena type : " Granulite." The crystal specimens have a dull exterior, but an interior of brilliant crystalline appearance familiar with galenas ; in those submitted we could not substantiate the claims of the makers that the dull exterior gave good rectifying points, as these were few and far between (in fact, at fractures in the surface only) ; but, on breaking open the specimens, the bright crystalline faces showed most excellent rectifying properties practically over the whole surface. Accordingly the ordinary cat's-whisker could be laid aside, as the makers suggest, and the side of a No. 22 gauge copper wire bent into a moderately springy loop substituted for the more customary fine point, greatly simplifying the setting of the crystal.

In extended practical tests in actual reception, the signal strength compared very favourably under identical conditions—fair aerial and low-resistance tuner —both with a very reliable perikon standard, and with other synthetic galenas, on local broadcasting and ship stations. In the ST100 circuit, extremely noisy loud-speaking was obtained at 12 miles from 2LO ; with a double two-stage simultaneous circuit, giving two stages H.F. amplification before the crystal—an extremely severe test of stability of a crystal—it stood up well to 2LO's fierce carrier wave.

Information Department

Conducted by J. H. T. ROBERTS, D.Sc., F.Inst.P., assisted by A. L. M. DOUGLAS.

In this section will appear only selected replies to queries of general interest or arising from articles in "Wireless Weekly," "Modern Wireless" or from any Radio Press Handbook.

All queries will be replied to by post, as promptly as possible, providing the following conditions are complied with.

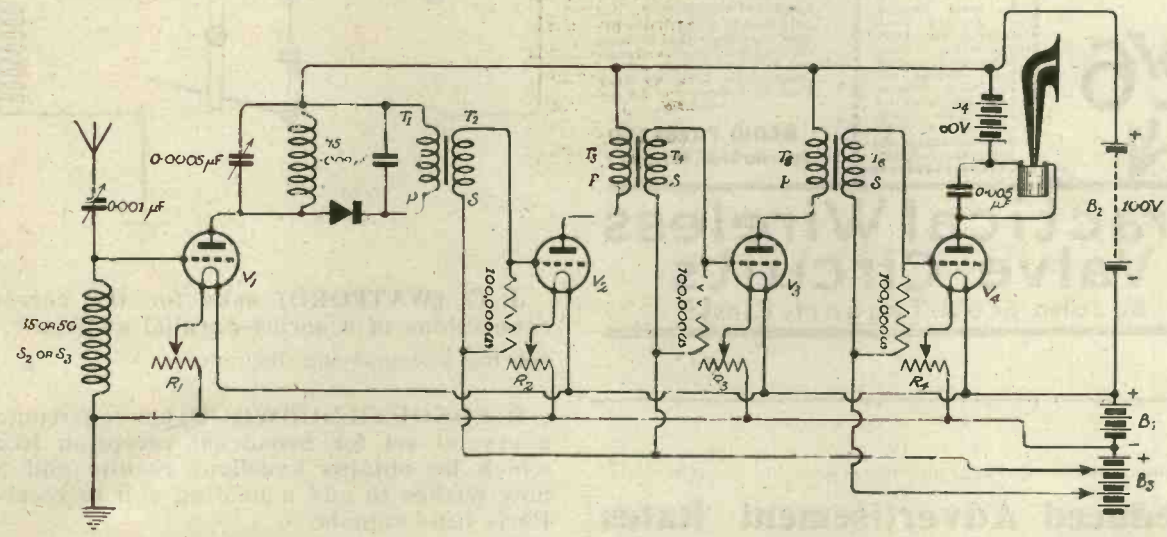
1. A Postal Order to the value of 1s. for each question must be enclosed, together with the Coupon from the current issue, and a stamped addressed envelope.

2. Not more than three questions will be answered at once.

3. Queries should be forwarded in an envelope marked "Query" in the top left-hand corner and addressed to Information Dept., Radio Press, Limited, Devereux Court, Strand, London, W.C.2.

L. N. (LEWISHAM) asks for a suitable circuit for working a large loud-speaker in his garden situated 10 miles from London.

We reproduce herewith a circuit which will give the desired results with minimum distortion. The sizes



for Igranic and Burndept coils are shown in the figure, together with condenser, battery, and resistance values. The battery B_3 may be variable up to 9 volts.

E. H. F.L. (ABINGDON) refers to the article on multi-layer coils, "MODERN WIRELESS," No. 4, and asks whether the zigzag spacing layer is counted in the number of turns in the case of lattice coils.

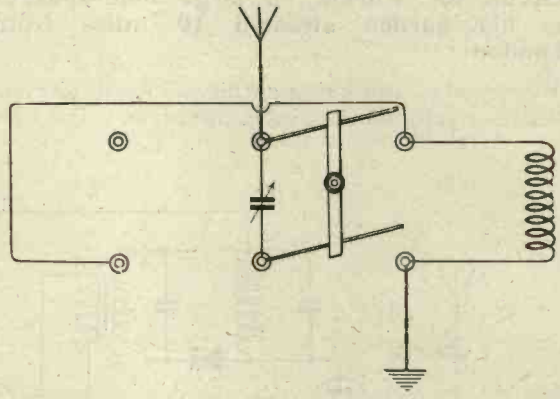
The number of zigzag turns is usually so small compared with the total number of turns in the coil that it is safe to neglect it. For greater accuracy, however, it would be as well to make some allowance for these turns.

C. E. C. (PUTNEY) submits a circuit diagram of his receiver, from which he does not obtain good results. He asks if we can help him.

We find that your circuit diagram contains an error which fully explains the poor results which you have obtained. The error lies in the connection of the end of the secondary winding of the low-frequency transformer to the low-tension positive, instead of the low-tension negative.

W. G. L. (DULWICH) refers to the loose coupled crystal receiver described in "MODERN WIRELESS," No. 3, and asks (1) What happens to the ends of the windings of the primary and secondary coils. (2) How many turns of wire are there between each of the tappings of the secondary tube. (3) What kind of wire should be used for connecting the component parts of this receiver.

(1) One end of each winding is free in both primary and secondary coils, the connections being made to the other end and the moving contact. (2) There are approximately 22 turns of wire between each tapping on the secondary winding. (3) Insulated flexible wire, such as electric light cable, might be used for connecting the various components of this set together.



J. G. (WATFORD) asks for the correct connections of a series-parallel switch.

See the accompanying diagram.

R. F. (SOUTH NORWOOD) has constructed a crystal set for broadcast reception from which he obtains excellent results and he now wishes to add a loading coil to receive Paris time signals.

We should advise you to construct a large sliding inductance for this purpose, since you will find such an instrument very useful for general experimental work. It may be 12in. long by 4in. in diameter wound with No. 24 enamelled wire.

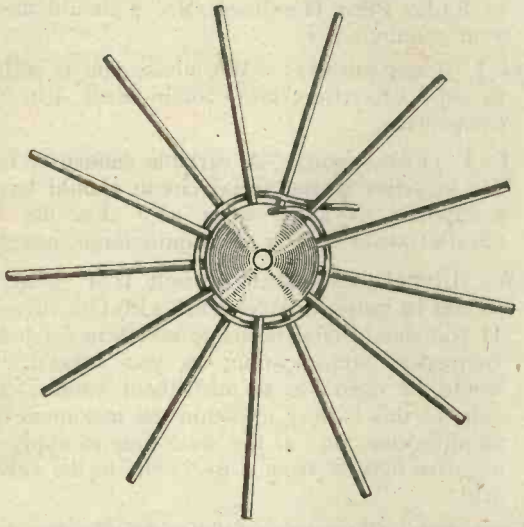
C. B. (FORT HOUSE) asks (1) Whether a certain gauge of wire, of which he submits a specimen, is suitable for winding an inductively coupled tuner for a crystal set. (2) Whether a cylindrical former may be used

in place of a rotor to produce reaction effects. (3) Whether there is any detector which is more efficient than a crystal.

(1) The wire submitted is No. 36 standard wire gauge double cotton covered, and is decidedly too fine for winding the inductance suggested. Nothing finer than No. 28 should be used for this purpose. (2) A cylindrical former is quite satisfactory, if arranged to slide along the axis of the coil into which reaction is desired. (3) There is little to choose in sensitiveness between a good crystal and a three-electrode valve so long as reaction is not introduced in the circuit of the latter.

J. H. O. (KILMACANNOGUE) asks for a diagram showing how to wind basket coils on a metal spider.

We reproduce herewith the desired diagram. Note that the spider must have an odd number of pins.



J. H. (SUNDERLAND) proposes to wind a set of 6 basket coils on cardboard formers having an internal diameter of 1in. with No. 28 standard wire gauge double cotton covered wire. He asks how many turns will be necessary on the various coils to produce a set to cover a range of from 100 to 1,500 metres.

A suitable set of coils will be as follows :—

No. 1	...	30 turns.
No. 2	...	50 ,,
No. 3	...	75 ,,
No. 4	...	100 ,,
No. 5	...	150 ,,
No. 6	...	200 ,,

F. W. F. (CATFORD) wishes to construct a tubular inductance covering a wavelength range of 300 to 2,600 metres and asks for dimensions.

A cardboard tube 4in. in diameter and 12in. long should be wound full of No. 26 standard wire gauge double cotton covered wire, and tappings should be taken at about every ¾in. along the coil. This coil, in conjunction with a variable condenser of 0·001 μF, together with a series-parallel switch, will cover the wavelength range easily.

BRIEF REPLIES

T. F. D. (DURHAM).—We advise you to pay particular attention to your aerial system, keeping in mind the following essentials :—(1) Height, (2) length, (3) insulation, (4) isolation—*i.e.*, absence of screening—and, lastly, make sure that you have a good low resistance earth connection.

R. W. J. (SHEFFIELD).—You are not legally entitled to erect an aerial until permission to conduct experiments is actually given in writing.

W. H. T. (WHITBY).—Leeds is amongst the towns which are mentioned as possible relay stations.

T. T. (MANCHESTER).—We think you will find the blue print diagram, obtainable from this office, price 1s. 6d., of considerable assistance.

W. F. O. (TOTTENHAM).—The apparatus described in Radio Press Handbook No. 7 should meet your requirements.

V. G. J. (CHISLEHURST).—We advise you to write to our advertisers and obtain their list of components.

D. T. J. (EDINBURGH).—A variable condenser for use in series in the aerial circuit should have a capacity of about 0·001 μF. For use in parallel one of 0.0005 μF is quite large enough.

S. W. (LIVERPOOL).—Your 60 volt H.T. battery should be quite suitable to use with Ora valves. If you should later desire to use them for low-frequency amplification, as you suggest, it would be desirable to add about another 30 volts to this battery to obtain the maximum of amplification, and at the same time to apply a negative bias of from 2 to 6 volts to the valve grid.

"ENQUIRER" (BARROW).—Of two aerials of equal length, the higher one will usually pick up slightly stronger signals, but much increased interference from atmospherics and undesired signals. So long, therefore, as an aerial is reasonably clear of screening it is not a very great advantage for it to be of great height for receiving purposes.

J. H. T. (CARNARVON).—We should strongly advise you not to attempt to use more than two high-frequency valves, especially as you are comparatively inexperienced. To use more than this number, especially in amateur constructed apparatus, makes it necessary to use some damping device, such as a potentiometer, by means of which deliberate losses are introduced to prevent self-oscillation. The efficiency lost in this matter is often so great that it would be just as well to reduce the number of high-frequency valves, and work them more efficiently.

B. F. C. (SOUTHAMPTON).—The plate pin of a valve is the one which stands out at a distance from the others. The opposite pin is the grid, and the other two are, of course, the filament pins.

An Experimenter's Licence is well worth having.

This is what the P.M.G. said

"In order to ascertain my position I felt it my duty to place the whole facts before the Law Officers of the Crown, and I have just received the opinions of the Attorney-General and the Solicitor-General.
These are that I am not only entitled, but compelled by law to issue an Experimenter's Licence to those applicants in regard to whom I am honestly satisfied that they are genuine experimenters.
This being so, while it would be wrong to issue an Experimenter's Licence to the man who is obviously merely a broadcast listener-in, it would be equally wrong to decline to issue such licences on a wholesale scale."

To a Representative of the Press.

UNDOUBTEDLY a very large number of wireless enthusiasts are contravening the present regulations regarding licences. Some through ignorance, others wilfully because their applications for Experimental Licences have been turned down.

If you are a genuine Experimenter, prepared to take up Wireless as a serious hobby and not merely as a means of passing a pleasant hour in listening to broadcast Concerts, then you are **entitled** to an Experimenter's Licence.

Many applications for Licences have been turned down by the authorities because the applicants were not fully aware of the necessary requirements which had to be fulfilled.

This little book by E. Redpath (assistant Editor of Wireless Weekly) has been written to explain exactly what an Experimenter should know and how he should set about obtaining his Licence.

Remember this important point—even if a Constructor's Licence is issued, it is practically certain to contain special restrictions regarding the use of Receiving Sets and Circuits. With an Experimenter's Licence your work is practically unhampered. Why not get a copy of this book to-day and legalise your position at once and for always?

Gilbert Ad.

RADIO PRESS Series No. 11.

Radio Press, Ltd
PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
DEVEREUX COURT, STRAND, W.C.2.

1/-

From all Booksellers & Newsagents, or 1/1½ post free direct.

Printed for the Proprietors. RADIO PRESS, LTD., Devereux Court, Strand, W.C.2, by THE CORNWALL PRESS, LTD., Paris Garden, Stamford Street, London, S.E.1. Published on Wednesday of each week at 3, Bolt Court, Fleet Street, London, E.C.4. Address for Subscriptions and Editorial communications:—Devereux Court, Strand, London, W.C.2. Advertisement Managers:—THE SCHEFF PUBLICITY ORGANISATION, LTD., 125, Pall Mall, London, S.W.1. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates:—32/6 per annum, 16/3 for six months, post free. Sole Agents for Australasia:—GORDON & GOTCH (Australasia), LTD. For Canada:—IMPERIAL NEWS LTD. For South Africa:—CENTRAL NEWS AGENCY, LTD.

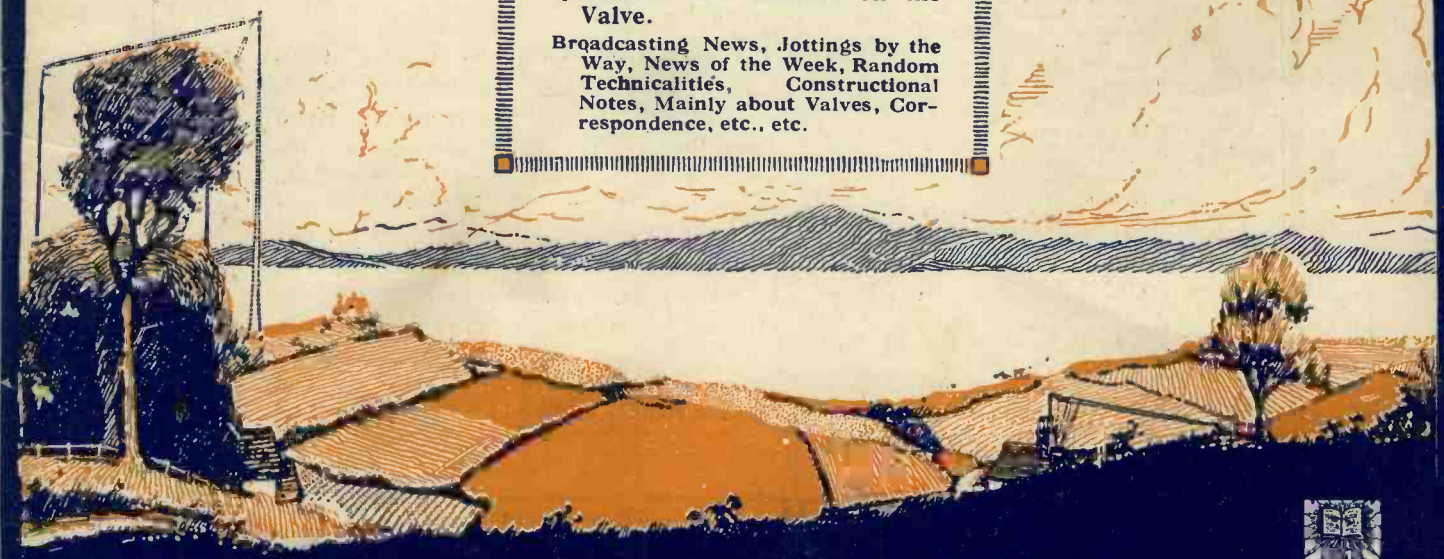
Wednesday, 6d. Net. Vol. 2. No. 5. August 15th, 1923.

Wireless Weekly

and The Wireless Constructor

Vol. 2. No. 5.

CONTENTS



How I Invented the Flewelling Circuit—By E. T. Flewelling

Radio Press Books give him all the information he needs

Complete List

	Price.	Post Free
1. Wireless for All .... John Scott-Taggart, F.Inst.P.	-/6	-/7½
2. Simplified Wireless.. John Scott-Taggart, F.Inst.P.	1/-	1/1½
3. How to Make Your Broadcast Receiver . John Scott-Taggart, F.Inst.P.	1/6	1/7½
4. How to Erect Your Wireless Aerial .... B. Mittell, A.M.I.E.E.	1/	1/1½
5. The Construction of Wireless Receiving Apparatus ..... P. D. Tyers.	1/6	1/7½
7. How to Make a "Unit" Wireless Receiver ..... E. Redpath.	2/6	2/8
9. Wireless Valves Simply Explained .. John Scott-Taggart. F.Inst.P.	2/6	2/8
10. Practical Wireless Valve Circuits..... John Scott-Taggart, F.Inst.P.	2/6	2/8
11. Wireless Licences and How to Obtain Them ..... E. Redpath.	1/-	1/1½
Elementary Text-book on Wireless Vacuum Tubes ..... John Scott-Taggart, F.Inst.P.		10/- (Post free)

¶ Those printed in heavy type have been published recently.

HOW many turns for a Coil to reach the Paris Wavelength—the type of circuit to operate a Loud Speaker using only an indoor Aerial—Crystal or Valve rectification in a multi-valve Set? These are a few of the questions which confront the amateur constructor.

Some will find out the correct answers by expensive experiment—others, more wisely, will benefit by the experience of those who have trodden the thorny paths of Radio before them.

The concentrated experience of some of the best known Wireless engineers and experimenters is available for all readers of Radio Press Books. You cannot do better than purchase the complete Library—one Book at a time. Each Book covers a different phase of Wireless and none overlap. Get one or two to-day and keep them by you for ready reference—they are sure to save their cost many times over. From all Booksellers.

RADIO PRESS LTD.,
Devereux Court, STRAND, W.C.2.

Radio Press Books
— a complete Wireless Library

Gilbert Ad.

Wireless Weekly

Vol. 2, No. 5
Aug. 15, 1923

CONTENTS

Editor: JOHN SCOTT-TAGGART, F.Inst.P.
Assistant Editor: E. REDPATH.

Radio Press, Ltd.
Publishers of Authoritative Wireless Literature
DEVEREUX COURT, STRAND, W.C.2
Tel.—Central 3763.

Advertisement Managers: SCHEFF PUBLICITY ORGANIZATION, LTD., 125, Pall Mall, London, S.W.1. *Tel.—Regent* 2140.

All correspondence relating to contributions is to be addressed to the Editor of "Wireless Weekly."

Nothing contained herein is to be regarded as permission or encouragement to infringe any patent rights.

Editorial

The New Amateur Organisation

WE hasten to congratulate the Radio Society of Great Britain, the parent society of all British wireless experimenters, upon the action which it has taken with a view to securing closer co-operation between the various amateur associations.

Elsewhere in this issue will be found full particulars of the new scheme which should certainly afford the provincial societies, who previously have no doubt felt somewhat neglected, an opportunity of taking a more active part in the direction and control of amateur activities.

We feel sure that the move is a good one, and look for some original suggestions with regard to co-operative experiments. It is high time that such interesting events as transatlantic tests were originated and organised on this side, and we hope that in the coming autumn and winter season some interesting and instructive experimental work will be arranged for.

The Report

The latest news to hand as we go to press is that, owing to certain financial questions, the completion of the long-awaited report of the Broadcasting Committee will be delayed another two or three weeks. This is very disheartening, especially as we had been assured that the report was practically completed and would be issued almost immediately.

It appears to be the same old story—whether in naval affairs, the development of efficient aircraft, the Imperial wireless communications or the proper development of broadcasting; whilst other nations forge ahead and make splendid progress, we are kept in a state of enforced idleness whilst a committee carefully sift the last page of evidence and see that all the i's are dotted and the t's crossed.

Despite everything, however, there is every indication that the "critical point in the curve" is passed and that a substantial trade revival is approaching. Such signs and portents as are perceptible show that public confidence in the successful continuance of broadcasting and active interest in it are slowly returning to normal. This, in the present summer weather, augurs well.

The Power of the Press

In our Editorial of May 9th last we alluded to the disastrous effect upon the wireless industry which resulted from the general indecision regarding the future progress of broadcasting, and particularly from the attack of the daily Press.

It is not suggested for a moment that the Press could foresee the unfortunate state of affairs that would result, but this is certainly a splendid opportunity for them to lend their valuable support in this extremely urgent matter of obtaining an official pronouncement upon the broadcasting position, particularly as it affects the issue of licences, at the earliest possible moment.

Wireless Demonstrations

One of our correspondents, whose letter appears an another page, calls attention to the very bad opinion of broadcasting created in the mind of the public by inferior open-air demonstrations of wireless telephony. It behoves everyone who has anything to do with this class of demonstration to use every care in order to produce really satisfactory results, and any firm who entrusts this type of publicity to representatives who have not proper technical knowledge are making a mistake which injures not only themselves, but broadcasting generally.

HOW I INVENTED THE FLEWELLING CIRCUIT

By E. T. FLEWELLING.

This particularly interesting article has been specially written for "Wireless Weekly" by the inventor.

WHILE a very great amount of interest has been shown in the Flewelling circuit and its action, it has not exceeded that of the writer in watching the use and popularity of the circuit spread all over the world. The writer's personal mail, as a result of queries about the circuit, at last reached such volume that it became a physical impossibility to answer each of the very kind letters that I received. Magazines and newspapers throughout the U.S. besieged me for information and articles on the subject until over 25,000 words have been written covering the construction and operation of the receiver. Interest seemed to centre upon how the circuit was invented, as to what action took place in the circuit, and how the best results are to be obtained. It is the purpose of this article to outline briefly the answers to these questions.

Mr E T. Flewelling, the inventor.

Because the theory of so-called super-regeneration is so complicated, and would not come within the scope of this article, I will endeavour to limit the discussion of the theory of this circuit to a general outline of its internal action.

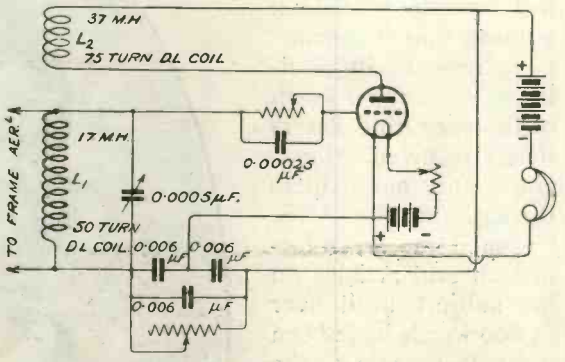
The Flewelling circuit is a true super-regenerator, depending for its action upon the net resistances of a violently regenerative receiver, but exercises this control by means of condenser discharge ripples acting upon the grid of the valve. We are all familiar with the rapid increase in audibility of the incoming signal as regeneration, or retro-action, is increased. We are also familiar with the limiting point at which the receiver spills over or goes into oscillation. No doubt thousands of folks have wished, as the writer did, for some means of going beyond the spill-over point, so as to secure further advantage from the rapid increase of signal strength. The writer was familiar with the negative resistance control ideas of Turner and Bolitho, with the buzzing C.W. wavemeter of Armstrong and Hazeltine, and the methods of securing super-regeneration of Logwood and Armstrong. Taken as a whole, these ideas really constitute working a separately tuned oscillating circuit in some way or manner, with the regenerator in use. To the writer's mind this constituted a very undesirable additional complication to a

receiver, due to the additional large inductances, wiring, etc., called for.

In attacking the problem it was thought that some method might be used whereby the windings of the 'phones might be employed in connection with suitably large condensers, and it was at first thought that the solution of the case was arrived at in this manner. Study of the circuit, however, disclosed the fact that an entirely different action was going on.

For those who may wish to study the fundamental idea of the Flewelling circuit, I can do no better than to call to their minds the action of a condenser periodically charged and discharged, remind them of the resulting ripple, and suggest that such ripple be applied to the grid of a regenerative or retroactive circuit at the proper time, and go further by referring them to page 346 of Scott-Taggart's "Thermionic Tubes," where, under the heading of "A Buzzing C.W. Wavemeter," Mr. Scott-Taggart describes one of the fundamentals of the Flewelling circuit. To quote from the reference: "When a valve possessing a leaky grid condenser commences to oscillate, a negative charge is built up on the grid by the usual valve action. The grid potential will gradually decrease until the operating point approaches the lower bend of the anode current characteristic curve. Under these conditions the valve ceases to oscillate. The negative charge now gradually leaks off the grid and the operating point on the anode curve rises until it reaches a position where self-oscillation recommences. The grid potential now drops again and the process is repeated." This action taken with the large value condenser in the filament lead, for instance, of the tuning inductance, will result in condenser ripples acting upon the grid of the valve and varying in speed from one per second, or less, up to probably 10,000 or 15,000 times per second. What really happens in the circuit is that regeneration is advanced to the point of "spill over," and as the action goes beyond this point the tube is blocked, started again, the condensers charge and discharge, and the resulting condenser ripple is used to control the receiver at a point of maximum regeneration. This point is considerably beyond that obtained in a plain regenerator, due to the fact that we now have a positive control over the positive or negative resistance condition of the circuit.

We have, then, an entirely new and different method of securing super-regeneration, in that we do not depend upon the maintenance of a separate tuned oscillating circuit. The circuit may be used with any type of energy collector, such as an open or closed antenna, on the ground, without any other collector, frame antennæ or large conducting bodies (such, for instance, as automobile frames, stoves, or even the human body), and has given surprising results when using no other energy collector than the wiring of the set itself. By this last method, in exceptional cases, distances up to 1,000 miles have been covered. Reception is, of course, dependent upon receiving conditions to an extent, but it is of much greater volume, and can be relied upon for greater distances than is usual with a one-valve circuit. No tests have been possible, due to lack of time, etc., as to radiation, but if the extent of this were such as to make use of the circuit inadvisable, it is suggested that high-frequency amplification would be the cure.



The circuit referred to by Mr. Flewelling.

In putting the circuit into operation there are several points that should be considered if one is to secure proper results. As usual, one must have a suitable tuning arrangement which would be represented by the coil L_1, the 0.0005 μF condenser in the diagram, and a feed back from the anode circuit which may be in the form of the tickler, or be through the elements of the tube in conjunction with the usual tuned anode circuit. The various constants for the usual arrangements of the circuit are shown with the diagram. As a rule the anode coil will have approximately 25 per cent. more inductance than that ordinarily used in a plain regenerator.

One must have a hard valve and such variable gridleaks or high resistances as will enable one to secure proper control of the grid of the valve and thus properly time the blocking action. It will be found that this action is audible in the 'phones, and results in the shrill, high-pitched whistle that is characteristic of the super-regenerative receiver. The adjustment of the receiver should be such that, as the incoming signal is tuned in, the pitch of the whistle rises until, at the point of maximum signal strength, the pitch is so high as to be almost inaudible.

Care should be taken that none but the better types of apparatus is used. The 0.006 μF condensers are not critical in value, and may run from 0.005 μF to 0.01 μF with no serious effects. Any type of hard tube may be used, and the anode voltage will be in accordance with the tube used, generally being between 45 and 100 volts. Filament control is not critical beyond the fact that the tube, generally speaking, gives its maximum results at maximum filament. It will be found that the lower variable resistance may be set at the most convenient point, and all further adjustments made with the grid-leak, there being no fine balancing point, provided that the value of the former is such that the blocking action may take place.

The circuit calls for no more than the usual care, and, judging from reports received, constitutes a very successful form of super-sensitive receiver, especially adapted for long-distance reception on short wavelengths. Amplification is obtained even greater than theory gives, which is to the effect that amplification increases inversely as the square of the incoming wavelength, and the writer is watchfully awaiting reports of the action of the receiver in the range of 10 to 25 metres.

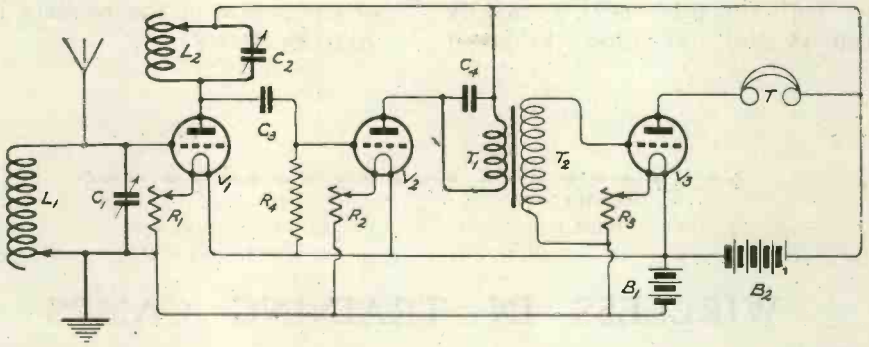
WIRELESS IN TRAINING CAMPS

Nearly 40,000 public school boys have this summer been spending their holidays in camp near Aldershot. Our photograph shows troops out on a route march, passing Marlborough College cadets at wireless practice.

Wireless Weekly Circuits

No. 18.

A Three-valve Tuned-anode Receiver



COMPONENTS REQUIRED.

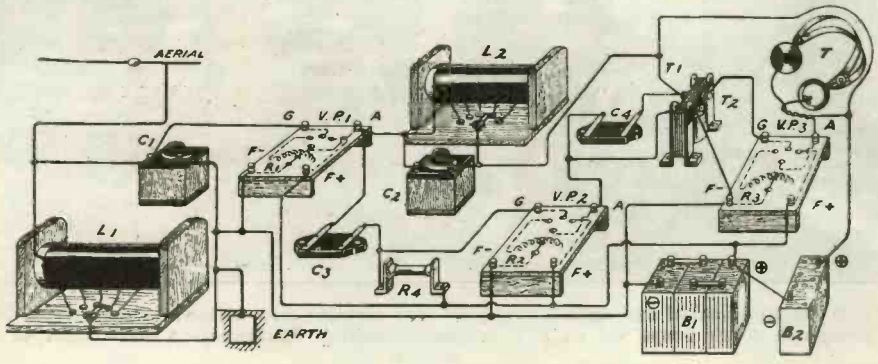
L_1 : A variable inductance.
L_2 : A variable inductance.
C_1, C_2 : Variable condensers of 0.0005 or 0.001 μF capacity.
C_3 : A fixed condenser of 0.0003 μF.
R_4 : A gridleak of 2 megohms resistance.
C_4 : Fixed condenser of 0.002 μF.
T_1, T_2 : Step-up intervalve transformer.
T : High-resistance telephone receivers.
B_2 : High-tension battery of about 60 volts.
B_1 : Six-volt accumulator.

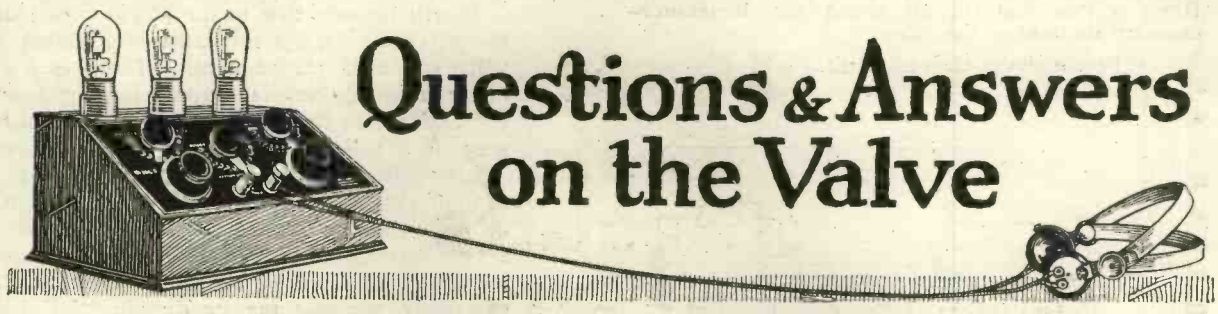
GENERAL NOTES.

In this circuit the first valve acts as a high-frequency amplifier, the second as a detector and the third as a low-frequency amplifier.

VALUES OF COMPONENTS.

The inductance L_1 may be a cardboard tube 3 in. diameter wound with No. 26 double cotton-covered wire, tappings being taken at the 10th, 15th, 20th, 30th and 40th turns. The inductance L_2 may be a coil wound on a 3in. tube. Fifty turns are provided, tappings being taken at 20th, 25th, 30th, 35th, 40th, 45th and 50th turns.





Questions & Answers on the Valve

A COMPLETE COURSE ON THERMIONIC VALVES

By JOHN SCOTT-TAGGART, F.Inst.P., Member I.R.E., Author of "Thermionic Tubes in Radio Telegraphy and Telephony," "Elementary Text-book on Wireless Vacuum Tubes," "Wireless Valves Simply Explained," "Practical Wireless Valve Circuits," etc., etc.

PART XVI

(Continued from Vol. 2, No. 4, page 151.)

What is meant by "Reactance-capacity Coupling"?

Reactance-capacity coupling is the name usually given to the method of coupling the anode circuit of a high-frequency amplifying valve to the grid circuit of the next valve by means of an inductance. The inductance acts as the reactance, while the grid condenser is the capacity which helps to effect the coupling.

Fig. 1 shows a theoretical circuit which will help to explain reactance-capacity coupling. In this figure it will be seen that an inductance L_3

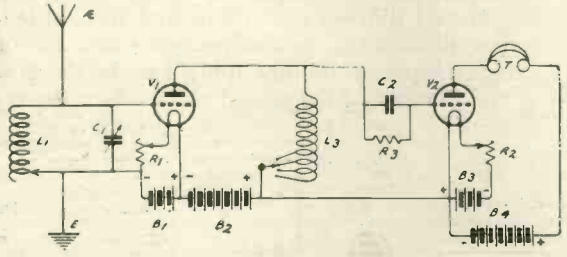


Fig. 1.—Theoretical circuit illustrating reactance-capacity coupling.

is included in the anode circuit of the valve. The inductance L_3 is also included in the grid circuit of the second valve which acts as a detector. To understand the action of the inductance L_3, we can compare the effects of a direct current flowing through a resistance. When a direct current is flowing through a resistance, E.M.F.s are set up across that resistance. In other words, the voltage across the resistance will depend upon the current flowing through it; the larger the current, the greater will be the voltage across the resistance. If an oscillating current is passed through a resistance, oscillating potentials will be established across it, and, as will be seen later, a high resistance may be used for coupling two valves together.

When dealing with high-frequency currents we can obtain a very similar effect by using an inductance coil, instead of a resistance; this inductance may have a very low resistance, yet possess a very high reactance. If a direct current is flowing through an inductance coil of low resistance, there will be, to all intents and purposes, no voltage produced across the coil. If, however, we pass a varying, or alternating, current through the inductance, we will obtain potential differences across the coil. The greater the frequency of the alternating currents, the greater will be the electromotive forces produced across the coil.

When dealing with wireless frequencies, therefore, an inductance coil included in the anode circuit of one valve will serve as a coupling, because when the anode currents are flowing through it, potential differences will be set up across the coil, and these are communicated to the grid circuit of the second valve.

Why is the Reactance Coil often made Variable in Steps?

The reactance coil is usually tapped in order that it will work most effectively on the wavelength to be received. The greater the wavelength the more turns of inductance are required. It will be found that for signals of any particular wavelength there is a certain amount of inductance necessary to couple effectively the two valves. If the inductance is increased above this value, the signal strength will usually fall off, but only slowly. The tuning of a reactance is usually not at all critical, although it may be found that louder signals are obtained with a definite amount of inductance in the anode circuit of the first valve.

Draw a Practical Circuit using the Reactance-capacity method of Coupling.

Fig. 2 shows such a circuit.

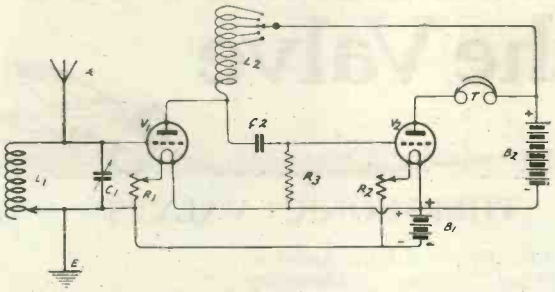


Fig. 2.—A practical application of reactance-capacity coupling.

What is the Difference between Tuned Anode and Reactance-capacity Coupling.

In the case of the tuned anode circuit, accurate tuning is essential, whereas in the reactance-capacity method rough tuning will usually suffice. Greater interference is experienced with the reactance-capacity method.

Reactance-capacity coupling, when the inductance is adjusted to a value which gives the loudest signals, really becomes a form of tuned anode coupling, the inductance being tuned by its own self-capacity and by the capacity of the electrodes of the valve.

How do "Tuned Anode" and "Reactance-capacity" Methods compare with Regard to Selectivity?

The tuned anode method of coupling is very much more selective than the reactance-capacity method. Moreover, the former method lends itself to the use of a phenomenon called "reaction" which is explained later. The reactance-capacity method of coupling does not lend itself equally well to the use of reaction. The best results are always obtained when the inductance is tuned, either by separate variable condensers, or in some other way, to the incoming wavelength.

What is Resistance Coupling, and how does it Work?

Resistance coupling is not unlike reactance-capacity coupling. Instead of the inductance, however, we have a high resistance, usually non-inductive: that is to say, the resistance has no inductance and takes, say, the form of a piece of blotting-paper soaked in indian ink, a piece of carbonised cotton, or something of the sort. The value of the resistance is usually about 50,000 to 70,000 ohms, and this resistance is included in the anode circuit of the first valve. Fig. 3 shows the theoretical circuit.

It will be seen that in the anode circuit of the valve we have a resistance R_1, having a value of, say, 70,000 ohms. There is normally a steady anode current flowing from the filament to the anode, through the resistance R_1, and to the high-tension battery. There will, therefore, be normally a large drop of potential across the resistance R_1, but, owing to the fact that the gridleak R_2 of about 2 megohms value, is connected directly across the grid and filament, the grid condenser C_2 effectively prevents the steady potential difference across R_1 being communicated to the grid of the second valve. When, however,

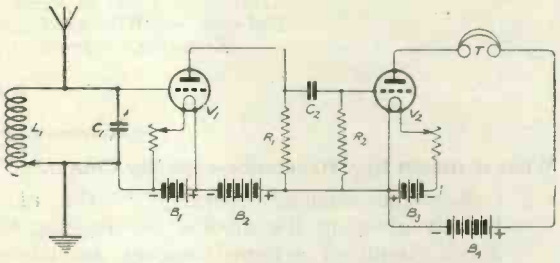


Fig. 3.—A theoretical circuit explaining resistance capacity coupling.

high-frequency oscillations are applied to the grid circuit of the first valve, the current flowing through the resistance R_1 will vary, and, as has been previously explained, if a varying current passes through a resistance, it sets up potential difference across it, and these potential differences, in the present case, are of high frequency and are applied across the grid and filament of the second valve, which detects them.

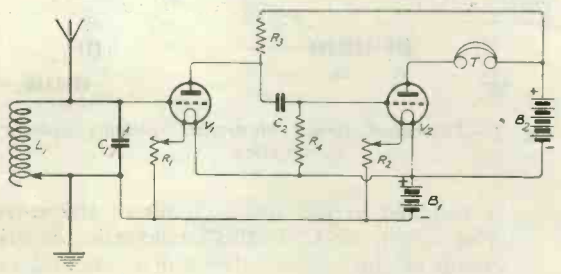


Fig. 4.—A practical circuit illustrating resistance capacity coupling.

Draw a Practical Two-valve Resistance-coupled Receiving Circuit?

Fig. 4 shows a practical form of resistance-coupled receiver. The high-frequency potentials set up across the resistance R_3 are communicated to the grid of the second valve, which acts as a detector, the telephones being included in the anode circuit of this valve.

DESIGNING SIMPLE CRYSTAL RECEIVERS

By E. REDPATH, Assistant Editor.

The following article will appeal particularly to those readers who are contemplating the construction of their first receiving set.

NO doubt many beginners experience some difficulty in deciding what form their first receiving set shall take. The excellent supply of wireless literature now available, whilst invaluable to experimenters who have some little knowledge and experience, often has the defect of confusing a beginner, who, attracted by the general appearance of some set, together with the claims made as to its performance, is tempted to embark upon the construction of a two- or even a three-valve receiving set.

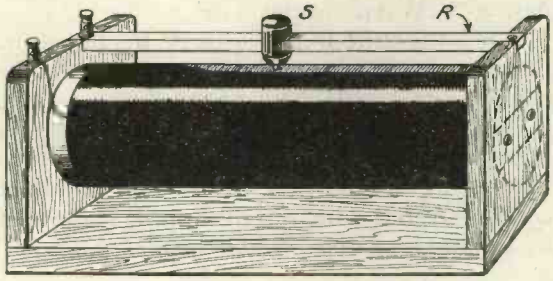


Fig. 1.—A "single slide" tuning inductance.

For a beginner to do this is really only inviting trouble, and, although the constructional details may be given in a perfectly clear manner and all reasonable care be taken to illustrate the various points, I know only too well from past experience that, although many sets are completed and give excellent results almost immediately, quite a number of constructors have an anxious time before the set finally gives satisfaction, due in most cases to lack of knowledge of principles and of the necessary manipulative skill.

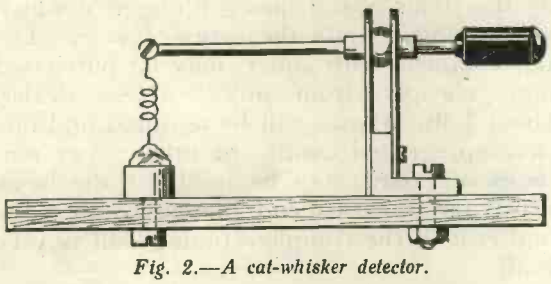


Fig. 2.—A cat-whisker detector.

Even with a comparatively straightforward hobby such as fretwork it is admittedly necessary to spoil a few pieces of wood and break a few saw-blades before even a moderate proficiency is obtained. I would strongly advise anyone taking up wireless telegraphy as a hobby to commence by constructing and experimenting with a simple crystal receiving set which, in view of the establishment of additional broadcasting and "relay" stations, may have quite a useful practical value quite apart from the instructive and experimental side of the question.

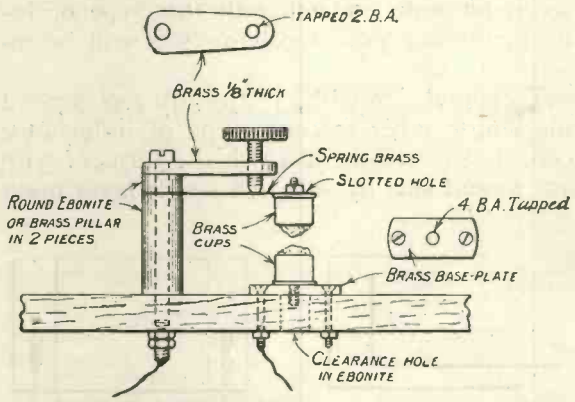


Fig. 3.—A "combination" detector employing two crystals; sometimes called a "perikon" detector.

General Questions Affecting Design

Having decided to construct a receiving set employing a crystal detector, the most important point to consider is the wavelength range over which it is desired to receive signals. If reception over the broadcast band of wavelengths is desired, the tuning induct-

ance, whatever type it may be, should be capable of adjustment between about 300 and about 500 metres *when connected to the aerial* which, for the purpose of this article, we will consider as standard according to the regulations of the Post Office.

If it is desired to receive signals from coast stations and shipping, or from a near-by air-station, the inductance must be large enough to tune the aerial to 600 and 900 metres respectively, whilst, if reception of the Paris time signals is intended, an inductance large enough to tune to 2,600 metres must be employed.

It should be noted that, as the dimensions of the inductance or tuning coil and the number of turns upon it are increased, the efficiency upon the shorter range of wavelengths falls off considerably, owing to the absorbing effects of the unused turns of wire which, in the case of a coil capable of tuning to 2,600 metres but actually adjusted to tune in 2LO on 369 metres (for instance), would comprise about seven-eighths of the coil.

It was this consideration, of course, which led to the introduction of the original ".plug-in" coils now so extensively used in valve receiving sets. The use of this type of inductance in crystal receiving sets will be referred to later.

To commence with, I strongly recommend the single layer solenoid type of inductance coil, that is, a coil in which the turns of wire are wound side by side in a single layer upon

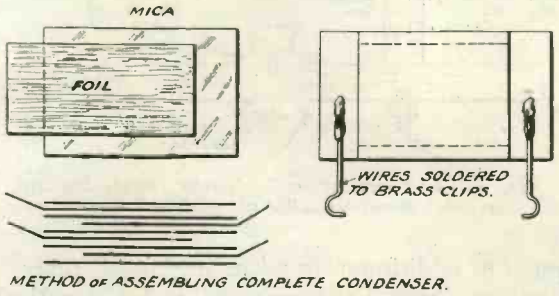


Fig. 4.—The arrangement of parts for making a telephone condenser.

a cylindrical former consisting of an ebonite or wax-impregnated cardboard tube.

Quite apart from the actual method of tuning employed, the dimensions of the coil are determined by the wavelength range. For a range of 250 to 600 metres, a tube 2½in. in diameter by 6in. long should be closely wound for about 5in. of its length (approximately 120 to 130 turns) with No. 22 S.W.G. copper wire.

For an effective range of about 600 to 2,600 metres, a tube 4in. in diameter by 10in. long should be closely wound for 9in. of its

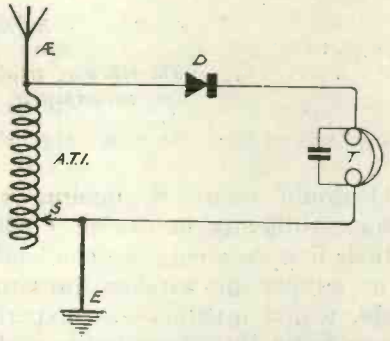


Fig. 5.—A simple crystal receiver circuit.

length (approximately 350 to 400 turns) with No. 26 S.W.G. copper wire.

The wire must in all cases be insulated, but the nature of the insulation (*i.e.*, whether enamel or double cotton covering) depends upon the method employed for varying the number of turns in circuit, enamel-covered wire being used where a slider is fitted and cotton-covered wire where tappings are taken to a tuning switch or switches.

Single-Slide Inductances

Fig. 1 shows a simple single-slide tuner consisting of the inductance coil complete upon its former, rigidly fixed between two wooden end supports attached to a wooden baseboard, which, if desired, may be made wide enough to carry the crystal detector, telephone terminals and telephone condenser. R is a brass rod ($\frac{3}{16}$in. or $\frac{1}{4}$in. square) carrying the slider S, the spring plunger of which makes contact upon the turns of wire. The rod, complete with slider, may be purchased quite cheaply from any wireless dealer. About $\frac{1}{4}$ lb. of wire will be required and one wax-impregnated cardboard tube. Any odd pieces of board may be used for the baseboard and the two end pieces, so that the total cost of the complete tuning coil is very small.

Winding the Inductance

The smaller inductance may readily be wound by merely rotating the cardboard tube in the hand and feeding the wire into place,

taking care to keep an even tension throughout, otherwise the turns will become displaced. Half an inch from each end of the coil make two small holes with a drill or a large darning needle. Secure the commencing end of the winding by threading the wire into one hole and out of the other, leaving several inches of wire projecting for subsequent connection to the aerial terminal and to one side of the crystal detector, as illustrated in the circuit diagram Fig. 5. The finishing end of the coil is to be similarly secured, but in this case no projecting end of wire is necessary. As soon as the winding is completed, apply two good coats of shellac varnish, allowing time for the first to set thoroughly before applying the second one. Into each end of the cardboard tube a wooden cross-piece is fitted and is secured by means of small brass screws passing through the cardboard. The coil is then secured in place by means of brass screws passing through the end pieces, as shown in Fig. 1.

For larger inductances it will be found a great advantage if the tube can be rotated in a lathe or in some simple device to facilitate the winding operation.

Next fit the brass rod and slider into place, cutting small recesses in the top of the end pieces as shown, or merely screwing the rod on to the upper edge. Slip a piece of fine emery cloth beneath the plunger and move the latter (together with the emery) up and down the rod, so as to remove the insulating enamel sufficiently to enable the brass plunger of the slider to make reliable contact upon the turns of wire. Avoid removing insulation unnecessarily or adjacent turns of wire may possibly make contact.

The Detector and Telephone Condenser

Figs. 2 and 3 show the constructional details of a crystal detector suitable for use with any kind of tuner. If preferred a detector may be purchased complete or built up from the sets of parts now obtainable from wireless dealers. Almost any of the specially prepared crystals and "cat-whiskers" advertised will give excellent results if properly fitted and adjusted. In this connection I much prefer to have the "whisker" attached to the upper arm of a detector of the type shown in Fig. 3, the regular movement and fine adjustment thus obtainable proving very advantageous.

For a two-crystal combination suitable for use with the detector shown in Fig. 3, I have never yet found anything to beat really good specimens of zincite (in the upper cup) and bornite. This combination has the additional advantage that it works quite well without any applied potential.

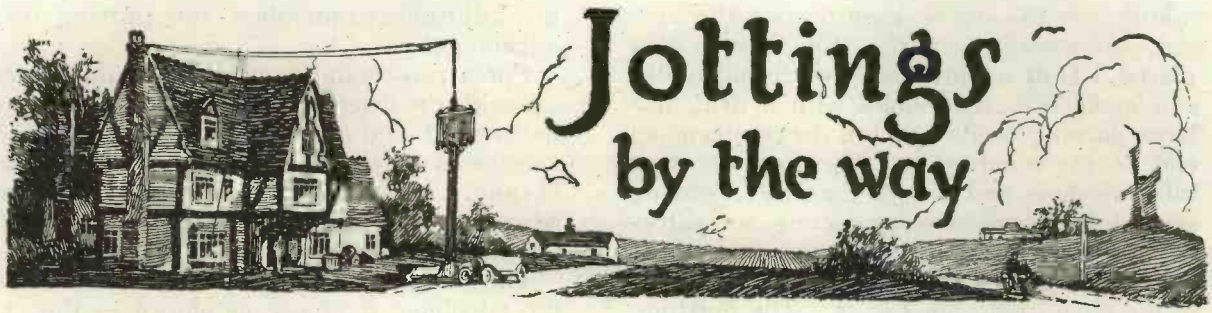
The small fixed condenser connected across the telephone receivers, as shown in Fig. 5, is not strictly necessary, but, as considerable improvement is sometimes effected by its use, one should be made up consisting of four pieces of tinfoil or copper foil, each $1\frac{1}{4}$in. by $\frac{3}{4}$in., separated by pieces of mica approximately 1-500th of an inch thick, two pieces of foil projecting at one end and two at the other, the actual area of the overlap being $\frac{3}{4}$in. approximately. Two additional pieces of mica are placed above and below the assembled foils, and the projecting ends are bent over and secured in place by means of two brass strips bent to form clips, to which connecting wires are to be soldered as shown in Fig. 4.

The Complete Set

The complete circuit arrangement of the simple receiver employing a single-slide tuning inductance is shown in Fig. 5, in which Æ represents the aerial, A.T.I. the tuning coil with slider S, E the earth connection, D the crystal detector, and T the telephone receivers with small fixed condenser shunted across them.

The advantage of the single-slide inductance is that there is only one tuning adjustment, and, as the slider is slowly moved from one end of the coil to the other, the complete range of wavelength is covered, and any transmission within receiving distance taking place upon a suitable wavelength should most certainly be received. The main disadvantage is that the tuning is not sufficiently selective. This, although a distinct advantage when searching for signals, means that if two stations are transmitting on slightly different wavelengths, one station may interfere considerably with the other.

Other types of crystal receivers, comprising "tapped" inductance coils, variometers and plug-in coils, will be dealt with in subsequent issues of this journal.—ED.



We Fine Fellows

DO you not think that we of the sterner sex are very wonderful beings indeed? To us alone is given the great gift of attaining the familiarity that breeds almost contempt with all that is mechanical and electrical. Woman is not mechanical; she says so herself and she ought to know, though if you as her lord and master have ever tackled the sewing machine, whose complicated innards are as an open book to her, you may feel inclined to wonder whether in making this statement she is not exercising her age-old prerogative of saying one thing and meaning another.

Personally I rather fancy that she lets us believe that we have the monopoly of mechanical knowledge simply because it suits her book to do so. If she let on, for example, that she knew just as much about the workings of a car as we do, or think we do, then beauty with a choked carburetter jet would not be beauty in distress, and she might have to do the job of unchoking it herself. As it is she sits pathetically beside her stricken car until some male passes by. He stops and goes to the rescue. She knows that he will love to do it, for though he may make his hands dirty and cause his best trousers to bag at the knees in the process, he will feel that he is doing a noble deed and showing her what a splendidly capable fellow he is.

Making it Plain

It is much the same with wireless. The average woman does not in the least want to know how the thing functions yet she will invariably ask the male to tell her. She does so, I firmly believe, for two reasons: (a) so as to give him the opportunity of feeling a fine fellow, a superior being, and (b) so that she may laugh inwardly at the knots into which he ties himself as he flounders with er's and hum's and d'you see's. "George, dear," she says cooingly, "this wireless is *so* interesting. Please tell me all about it; you always make things so clear." "Well, er," replies George, trying hard to assume an easy air, "er, you see it's like this. This is the loud-speaker, which is, er, attached to the receiving set. At the other end there's a thing just like it only exactly the opposite, if you see what I mean. The fellow there sings into it and his voice goes into a dynamo which shoots it up a wire to the aerial. Then it goes flying about until it hits my aerial. It trickles down that wire there into the set, and so, d'you see, it comes out of the trumpet." "Oh, how wonderful," cries the lady. "I've never been able really to understand it before. How splendid it must be to be able to explain things to people like that." George beams and tries quite unsuccessfully to look modest. He does not realise that he is now the hot iron upon the anvil, and that next moment she will strike. Therefore he has no defence ready when she suggests a new hat or a little dinner followed by a play. In his exalted mood he agrees heartily almost before he knows what is happening. Woman may not be mechanical, but she is a born tactician.

The Threat of Television

Do you view with equanimity the possibility that television, to use the horrible name, a hybrid of two dead tongues, that has been given to the process of seeing by wireless, may become an established fact before you are much thinner on the top, or ere your manly chest has had time to carry much further the downward glide that marks the passage of years? Do you? Frankly, I do not. To me music is one thing; those that make it, especially if they are of the male variety, quite another. Bobbed hair may be an adornment to the gentler and more ornamental sex, but the sight of flowing locks about a man's head rouses in my otherwise peaceful bosom a wild desire to kick the wearer heartily. One half of my alleged soul, fed by the ear, enjoys the sounds that are coming from the piano; the other, aided by the eye, is filled with hatred, loathing, and all manner of savage passions.

Now with wireless as it is music is all charm, but if television is to disturb the peace of our homes by throwing on to a screen before our eyes the workings of the flautist's india-rubber upper lip and the soprano's painful struggles to get her top note, then I for one will have none of it. Musicians in general should be heard and not seen.

Unmasked

There are other terrible possibilities, too. When Reginald Strongithbrawn, author of a score of tales of high adventure reads us a thrilling chapter from his latest book, we picture him standing six burly feet, we seem to see the

working of his great muscles beneath a silken skin. The clear cut features, the wide-set, purposeful blue eyes, the jaw that can close like a rat trap, when Reginald squares his chin to meet an emergency, yes, we picture all of these, and we feel that he is a Man.

What will happen when television shows us the bald head, the spectacled weak eyes, the receding chin, the sloping shoulders, the skinny wrists of the real Reginald as he stands before the microphone with bony knees beating against one another in abject terror? Shall we ever sail the Southern Seas again in his company or thrill when he leads us to the pirates' lair? I think not. We shall think of those knees and smile sadly, for television will have called Reginald's bluff

The Sad Truth

The sad fact is that Great Men in the flesh are too often utterly different from what they ought to be. The man, whose rollicking humour makes you laugh until you ache as you read his pages, may look like an out-of-work undertaker, whilst the writer of slashing articles against the decadence of the age may have the outward appearance of the most dissolute of rakes. Your eminent divine may have a face that would have made his fortune upon the music-hall stage, whilst the protagonists of socialism might pass easily as company promoters. Let us live in our present paradise, even though it be that of fools. Television, I fear, can bring only disillusionment.

Wireless Comes into its Own

Any pastime to be really fashionable must have a malady all of its own. Thus we have already tennis elbow, rider's sprain, halfpenny shover's palm, motorist's face, marbler's knee, and fox-trotter's toe. Even bridge has its own disease in dealer's thumb. So far wireless has been rather left out in the cold. It is true that it has been held responsible for a general feeling of malaise by those who claim that they are all shaken up by these new waves, but the cause of this condition has been traced by Profesor Blinkowl to the subtle influence of evil spirits (40 u.p.). We therefore cannot claim it as a genuine radio malady. Things were, in fact, beginning to look rather black, for though radiomania is, of course, well known, there seemed to be no minor and distinctive disorder that wireless could claim exclusively as its own.

But we wireless men can now hold up our heads again, thanks to labours of Doctors Spoophem and Blisterham, the eminent Harley Street specialists, who have been successful after long and painstaking research in establishing Oscillator's Twitch (dactylitis oscillatorum) upon the list of the little ills to which humanity is heir.

Symptoms and Treatment

The victim of this disease is unable to keep his right hand still. He appears to be grasping something between the finger and the thumb, whilst the wrist makes continual jerky movements of a rotatory nature. In many cases the left hand may also be affected in a rather curious way; the forefinger is moistened from time to time on the tongue and then brought down as though to touch something on the same level as the fingers of the other hand, but some inches away.

No treatment could at first be found to alleviate the disorder. Thanks, however, to the unremitting labours of these leading lights of the medical profession a complete cure can now be obtained in less than six months. In the early stages of the disease the patient is allowed to assume the position that he desires. This invariably takes the form of kneeling on his bed with his face to the rail at the foot. He twiddles one knob incessantly and taps the other.

Over the bed is hung a cage containing a screech owl. When his paroxysms become fewer and less violent one of the knobs is removed. Later a canary is substituted for the screech owl, and eventually the second knob is abstracted.

The last stage of the treatment consists of placing him in a straight jacket and strapping a pair of 'phones over his ears. These are connected to a set tuned to a broadcasting station. During transmitting hours a second receiving set situated in the vicinity is made to howl, moan, and chirp almost without intermission. After a few weeks of this treatment the patient is entirely cured, and after signing a simple pledge he is allowed to depart.

WIRELESS WAYFARER.

THE PHYSICS OF THE VALVE

By J. H. T. ROBERTS, D.Sc., F.Inst.P., Staff Editor (Physics).

An interesting explanation of the physical action of the valve.

FOR the moment we are considering a two-electrode valve, that is, a valve containing only a filament and anode. If an electromotive force be applied between the filament and the anode, the latter being made positive, a current will flow, the maximum value of which depends upon the temperature of the filament, as previously mentioned. Suppose now we keep the filament at a definite

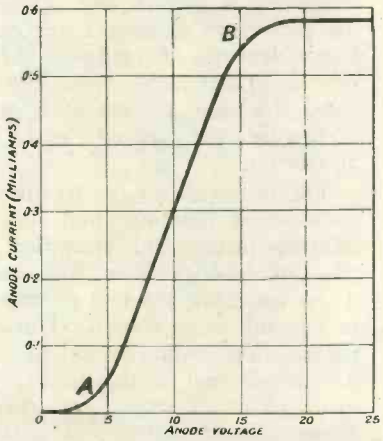


Fig. 1.—Characteristic curve of 2-electrode valve (or triode with grid and anode connected together).

temperature and gradually increase the potential difference between the filament and the anode, starting from zero value. It will be found that the current which flows in the anode circuit will increase with the increasing potential difference, until finally it attains a maximum or saturation value, beyond which no further increase takes place.

But the current between the filament and the anode does not increase uniformly as the potential difference is increased. In fact, if we plot on a graph the various values given to the potential difference and the corresponding values obtained for the current, we shall find that the curve showing the relation between these two quantities has the form indicated in Fig. 1. On this curve it will be observed that the current at first increases extremely slowly with the applied potential difference, then begins to increase more rapidly, and finally increases less rapidly as the current approaches the saturation value.

The curve shown in Fig. 1 is called a "characteristic curve" of the valve, and from it a great deal of information is obtained as to how the valve will behave under any particular circumstances.

It might at first be thought that up to the point where saturation begins the shape of the characteristic curve should be a straight line, that is, the current in the anode circuit should be proportional to the applied potential-difference. This is not so, for several reasons. For one thing, the presence of the cloud of electrons in the vicinity of the filament, known as the "space charge," acts as an impediment to the escape of the electrons from the filament to the anode. After any of the emitted electrons have managed to get through the space charge, however, they then have the advantage that the space charge is behind them and so helps them on. The result is that as the potential difference is gradually increased, more and more of the electrons begin to get through the space charge. The electrons which are emitted from the filament do not all start with the same velocity, and consequently some are able to get through the space charge without requiring so much assistance from the applied field as others. When the saturation point is reached the space charge is not stationary but is entirely drifting towards the anode, and although it still has a reducing effect upon the velocity of the emitted electrons, this effect is not sufficient to prevent any of the emitted electrons from reaching the anode.

Valve at its Saturation Point

Under ordinary circumstances a valve is used in such a way that the current in the anode circuit lies on the part of the characteristic curve between the points A B in Fig. 1. If the applied potential

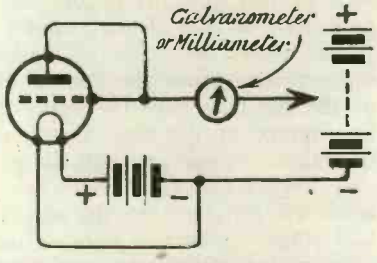


Fig. 2.—Simple method of determining characteristic curve of valve

difference is so great that the saturation current is reached, it is obvious that the valve cannot respond to any further increase in the applied P D. For this reason a valve would not be used for the purpose of amplification or modulation in such a way that the saturation current was reached. As a matter of fact, the "overloading" of a valve (for example, the last low-frequency power amplifying valve of a wireless receiving set employing a loud-speaker) sometimes occurs by accident, but results in the distortion of the reproduced waves.

Since current can pass through the anode circuit when the filament is negative with respect to the anode and not when the polarity is reversed, the valve has a very definite rectifying action.

A point which, however, frequently causes difficulty with amateurs and on which many questions are asked, is as to the reason for employing the valve in the condition represented by the point A in Fig. 1. The reason is connected with the amplitude of the potential variations which can be applied to the valve; if this amplitude is large, the valve may be used in the condition represented by the origin O, but if the potential variations are extremely small, as in the case of wireless reception, it is necessary to employ the valve in a condition more appropriate to this particular purpose, such as that represented by point A. This important point, however, which is frequently misunderstood, will be discussed more fully later on.

Why a Valve Sometimes Becomes "Soft"

If after use it is found that a valve becomes soft, this means that a certain amount of gas has entered the interior of the vessel. Gas may find its way into the valve by leakage through the walls at the points where the leading-in wires are sealed through the glass, but this is not likely to be the cause in most cases, for if there were any leakage the valve would soon become so soft as to be useless.

The most usual cause of the softening of the valve is the evolution of absorbed gas from the metal of the filament, the grid, and the anode.

All metals have the property of absorbing gas, the amount of such absorbed gas depending upon the nature, condition, area, and so on of the metal, and also upon the nature of the gas. Platinum, for example, has the property of "occlusion," as it is called, to a very pronounced degree, and of all the gases, hydrogen is the one which, generally speaking, is most readily occluded or absorbed. Consequently, when the valve is in operation, absorbed gases are gradually evolved from the metal parts.

When a valve is in process of manufacture, and whilst the glass container is still connected to the vacuum pumps, it is usual to maintain the filament, for a certain time, at a white heat, as this has the effect of driving out most of the occluded gas. At the same time a strong electric field is maintained between the filament and the anode and grid, so as to drive the electrons from the filament against the grid and anode with a high velocity. The impact of the electrons against the grid

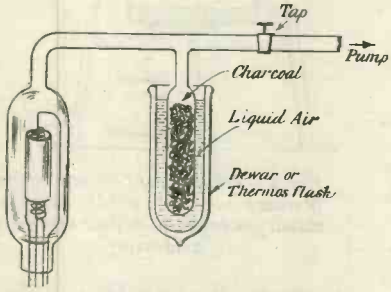


Fig. 3.—Illustrating the method of employing charcoal cooled by liquid air, for absorbing the residual gas which cannot be removed by pump.

and anode has the effect of knocking out the molecules of occluded gas, and of raising the temperature of the grid and anode, which also facilitates the removal of the absorbed gas. This latter process is called the "bombardment" of the valve, since the grid and anode are bombarded with electronic projectiles. If a valve has been thoroughly bombarded before being sealed off from the vacuum pumps, there should be very little further evolution of gas when in use.

In the case of high-power transmitting valves, this anode bombardment may be a very lengthy and laborious operation, as will be understood when it is considered that an anode with an area of perhaps several square feet has to be raised, by means of the electronic bombardment, to a red heat and maintained so for several hours.

The success of the valve is entirely dependent upon the production of the necessary vacuum, and it may be said that but for the great improvements which have been made in recent years in vacuum-producing apparatus and methods, the valve could never have been a practical proposition. It has already been mentioned that in a hard valve the current consists almost entirely of the electron stream emitted from the filament. This condition, which considerably simplifies the action of the valve, depends entirely upon the attainment of a high degree of evacuation.

Up to perhaps ten or fifteen years ago, the readiest means of obtaining high vacuum was by means of mercury pumps, of which the "Gaede" was the most convenient and most generally used.

During the past few years, however, a large section of the research work which has been carried out by physicists has necessitated more and more the employment of the very high vacua, and consequently attention has been largely concentrated on the improvement of pumps and the introduction of new appliances and methods for this purpose. The next advance, after the "Gaede" rotary mercury pump, was the "Gaede" molecular pump. This was a bold step in practical design, in that it consisted essentially of a drum rotating at such a high speed that gas molecules coming into contact with its periphery were literally "kicked out." A good number of these pumps are still in use, but they have been largely superseded by others, and by chemical methods of exhaustion.

A disadvantage of the rotary mercury pump, or in fact of any pump which depends upon the compression of the extracted gas, is that it is not adapted to deal with traces of residual vapour, such as water-vapour, owing to the fact that such vapour by continually condensing and re-evaporating is able to evade the action of the pump. The rotary molecular pump, however, has the

advantage that it clears out any drifting molecules indiscriminately.

Amongst what may be called chemical methods of exhaustion is the use of phosphorus, which, as has already been mentioned, forms a coating on the glass wall of the valve and cleans up residual gas. Another method which comes under this heading is the use of liquid air and charcoal. Various porous substances, of which charcoal is a good example, have the property of absorbing large quantities of gas, particularly if the substance is reduced to a very low temperature. The employment of charcoal in this way is illustrated in Fig. 3. The charcoal is broken up into small pieces, and is contained in a glass tube which is connected to the apparatus to be exhausted. When the pumps have produced as high vacuum as they are able, a tap shuts off the pumps from the apparatus, and a vessel of liquid air is raised, so that the charcoal tube is immersed in the liquid air; this reduces the charcoal to a temperature of about 180 Centigrade degrees below zero, and at this temperature the charcoal absorbs a large percentage of the residual gas.

Recently, however, a great improvement has been effected in the production of high vacua by the invention of the "diffusion" pump or "mercury-vapour" pump, as it is called, by Dr. Langmuir, of the General Electric Company of America. This pump is extremely simple in design; the principle of its construction is indicated in Fig. 4. The pump is connected to a subsidiary pump, which may be an oil pump or a rotary "Gaede" or other suitable pump, which produces a vacuum of perhaps 0.1 millimetre of mercury or less on the side of the Langmuir pump remote from the apparatus which is to be exhausted. Thus the Langmuir pump has only to draw residual gas from the apparatus and to deliver it against a pressure of less than 0.1 millimetre of mercury. Mercury is boiled by means of the Bunsen burner, and the vapour

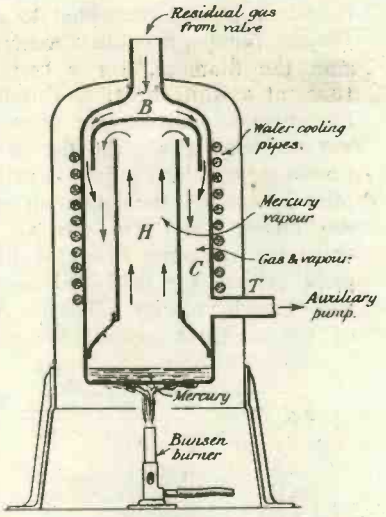


Fig. 4.—Principle of Langmuir pump. Mercury vapour "wind" blows residual gas before it, vapour afterwards condensing.

passes up the tube H, is deflected downwards by a baffle plate B, and, in flowing down the outer space C, it acts as a *wind*, and blows the residual gas from the apparatus before it. This gas

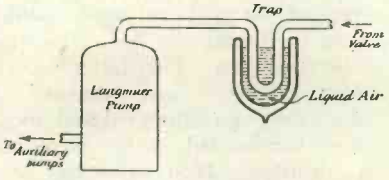


Fig. 5.—Mercury trap to prevent mercury vapour from reaching the exhausted vessel: used for production of very high vacua.

then escapes through the side tube T to the auxiliary pump, whilst the mercury vapour condenses and runs back to join the pool of mercury at the bottom of the pump. It is essential, for the production of the highest possible vacuum, to prevent the mercury vapour from reaching the vessel which is being exhausted. This is done by introducing a "trap" between the Langmuir pump and the vessel, as shown in Fig. 5, the trap being cooled by means of liquid air or solid carbon dioxide; the mercury vapour which reaches the trap is condensed and cannot pass into the vessel. These Langmuir pumps are now finding increasing employment in industrial manufacture of electric lamps and wireless valves.

Whilst the pumping is taking place, the valves are heated in a suitable oven, so as to drive out as much as possible of the gas which is occluded on the glass walls.

By means such as the above, it is now possible to produce a vacuum in which the pressure of the residual gas is as low as 0.0000001 millimetre of mercury (10^{-7} mm.), that is, about one ten-thousand-millionth (1/10,000,000,000) of atmospheric pressure. At this pressure there are still about 3,000,000,000 molecules of gas per cubic centimetre in the valve; although this seems a very large number, it is extremely small compared to the number of gas molecules per cubic centimetre at atmospheric pressure, which is about 3×10^{19}. The "mean free path" of a molecule is the average distance which it travels between successive collisions with other molecules; at the pressure in question (10^{-7} millimetre of mercury), the mean free path will be about 1,000 metres, so that the chances of a molecule colliding with another molecule within the small space of the valve are exceedingly slight. Electrons emitted from the filament will thus travel across to the anode with very few collisions with the gas molecules, and hence gaseous ionisation can be ignored.

News of the Week

WE understand from the *Cape Times* that the City Council is considering a scheme of municipal wireless broadcasting, and that in this connection Sir David Graaff has offered to erect at his own expense a complete 6 kilowatt Marconi broadcasting station, which he is willing to present to the City on certain conditions, not yet published.

At the motor car and cycle speed trials which were held at Eastbourne recently, an interesting feature was the use of a Sterling loud-speaker to announce the results. This added greatly to the interest of the large number of visitors. The apparatus was fitted by Messrs. Caffyns, Ltd., of Eastbourne, and was operated in conjunction with a Sterling 4-button hand microphone.

The useful range was about 300 yards with two stages of amplification (one R valve and one LS3 valve with 120 volts on the plates). The results were considered excellent, and it is proposed to use the same loud-speaker for future trials.

We learn that Burndept wireless manufactures will be a prominent feature in the exhibits of British products in charge of the British Trade Commissioner, Mr. N. W. Field, Toronto, at the Canadian National Exhibition, August 25th to September, 1923. The Trade Commissioner is making a great deal of this display of British products, and Burndept apparatus will have a prominent position. We take this opportunity of reminding our readers that the address of Burndept of Canada is 152, King Street West, Toronto. We also learn from Burndept's that the administrative and executive departments, comprising advertising and sales, have removed to Aldine House, 13, Bedford Street, Strand, W.C.2, to which address all correspondence should be sent.

We have recently received from the Wireless Development Syndicate, Ltd., a prospectus relative to the issue of 20,000 preference shares of 5s. each, carrying a preferential dividend of 100 per cent. We are advised by this Syndicate that "the wireless industry is the biggest money-making proposition of recent years, and is to-day only in its infancy, so there is still an opportunity of participating in the gigantic profits to be made by becoming interested." This sounds pretty good, but we did not know that fortunes were so easily made.

The linking up of the French Colonies by wireless, which was decided upon in 1917, has not been forgotten, although as the result of the war only the station at Saigon has been completed. It is hoped, however, that the other stations which were included in the 1917 programme at Bamako, Brazzaville, Saida, and Antananarivo, will be finished next year.

A Bill has been tabled proposing that power stations equal to the foregoing should be established at Noumea, Papeete, Djibouti, and Martinique. It is pointed out that nations are rapidly increasing the number of wireless stations in the Pacific, Germany being very active in the Dutch Colony, and that when in 1926 the Agreement between the French States and the French Cable Company lapses French Colonies will only be linked with the home country by foreign lines. While the establishment of a French Colonial wireless system is considered to be necessary from the point of view of prestige, it is also regarded as a commercial proposition, wireless now being in a position to take the place of cables.

We learn from the *Westminster Gazette* that the Wandsworth Borough Council gave notice to quit to all tenants of their houses who have installed listening-in apparatus. Some at first refused to remove the aerials, but as they were unable to find alternative accommodation they took them down and made good the damage. The notices were then withdrawn.

It is usually characteristic of human nature that while criticism is always outspoken, due appreciation is too often silent. So on all sides it is pleasant to record that Belfast listeners are very grateful to Glasgow and Newcastle for the many bright and varied programmes broadcast from these cities. The cheery "just one minute" of the genial Glasgow Director is always more pleasing than the approach of the customary nightly curfew hour, and in particular one must signal out for praise his very distinct enunciation in the final news budget each night.

Several conferences have been held between the Irish Free State

Postmaster-General and the Irish firms interested in broadcasting with a view to arranging an exhibition of wireless apparatus. However, no definite results have been reached so far, since the firms are not in unanimity regarding the scheme outlined. It is stated that some of these wish more preferential treatment to be given to purely Irish concerns. In the meantime, genuine manufacturing firms, who have not yet made application for incorporation, should do so immediately.

It had been anticipated that the Broadcasting Committee would be in a position to present its Report to the Postmaster-General early in August, but it has been found necessary to make further inquiries into certain financial questions affecting the broadcasting problem, and the Committee will in consequence be unable to make its Report as early as had been expected.

Listeners-in may rest assured that the time signals sent out from the British Broadcasting Company's new stations will be of the most accurate nature. For some time past the Birmingham Station has been equipped with a system of "Pulsynotic" Electric Impulse Clocks made and supplied by Messrs. Gent and Co., Ltd., Faraday Works, Leicester. Now owing to the unqualified success of this system it has been decided that the new stations at Aberdeen, Bournemouth, and Manchester shall be fitted with similar clocks for time signal announcements. Each installation will have a master clock, from which the time signal is given, and from the beat of whose pendulum the announcer counts the seconds. In addition, three secondary dials, driven by the master clock, indicate accurate and uniform time in other rooms in the station.

The director of the Cardiff broadcasting station has received a letter from a "Comradio" living at Zurich, Switzerland, stating that he is a regular listener-in to Cardiff, and that he is able to get the concerts quite distinctly on a loud-speaker.

Field lectures have been substituted for those indoors during the summer months by the Cardiff and South Wales Wireless Society, and have proved a popular innovation. The last field day took place high up on the Garth Mountain, where tests were made on the society's standard set and members' private sets with many strange aerials.

Arrangements have been made for holding a Scottish National Radio Exhibition in Glasgow next month. The show, which will take place under the auspices of the wireless trade in Glasgow, will be held in St. Andrew's Hall, and will be open from September 3rd to 8th inclusive. The organisation of the exhibition is in the hands of the Radio and General Publicity Company, Glasgow and Manchester.

A wireless aerial was struck by lightning during a thunderstorm at Perth. An old ash tree on the South Inch had been utilised by a public entertainer to support an aerial which conducted the transmission to a loud-speaker instrument he had placed on a specially erected platform. At the height of the storm a flash of lightning swept along the wire and down to earth, in its passage cutting a wedge-shaped piece right out of the side of the tree. Fortunately, no one was in the neighbourhood of the tree at the time; consequently no one was hurt.

The British Broadcasting Company sent out a message from 2LO, their London station, recently, with the object of getting into touch with a relative of Miss Florence Stanford, who was then lying seriously ill in Paddington Infirmary. The announcement, made twice during the evening, stated that the young lady had been staying at a boarding-house in the West End, and that the keeper of the boarding-house had sought the assistance of the company. Nothing definite was known as to the whereabouts of relatives of the girl, but it was thought that a brother might be in Brighton, and the company asked that, should he receive the message, he would get into touch with them either by telephone or by telegraphing. The only person of that name who could be found in Brighton was promptly communicated with by the representative of a Press agency, but he knew nothing of Miss Stanford. No relative had been traced when the young woman died some few days after the message was broadcast.

We learn from the *Westminster Gazette* that we shall soon have the novelty of chess matches by wireless. One of the most popular all the year round features of chess club activities are the matches played through the post. When the new use of wireless takes place these encounters between distant players will have a new thrill for chess enthusiasts.

Manchester will broadcast its moves and Hastings champions will wireless their responses. It will also extend the interest in play, for at present, of course, only those in receipt of the post-card or letter moves, and their immediate friends can follow particularly fascinating games.

It may interest our readers to learn that chess matches played by wireless have been carried out innumerable times, even in the very early days of wireless, especially between persons aboard two ships at sea. Arrangements are made by the operators, the moves transmitted in code, the rate of charge being so much per move.

A wireless receiving set has been installed in the private room of Sir Laming Worthington-Evans, at the House of Commons.

"Laugh and the world laughs with you" was well illustrated by the B.B.C. last Thursday after 11 p.m., when 2LO started the ball rolling.

RANDOM TECHNICALITIES

By PERCY W. HARRIS (Staff Editor).

A few notes relative to experiments and apparatus of general interest to readers.

ONE evening recently I tried my ST100 receiver on an aerial some five miles from London where excellent facilities existed not only for making a great noise without disturbing a roadful of residents, but also for testing different kinds of valves, loud-speakers, and plate voltages. The audience (quite the correct word in view of the volume of sound) included several people well known in wireless circles who had not previously heard this receiver in operation at full strength. All were astounded, and the volume of sound could only be equalled by a well-known make of two-valve receiver to which had been added an equally well-known make of power amplifier using two stages of amplification with high plate voltages and power valves. The voltage used on my own set was 104 on the plates with $4\frac{1}{2}$ volts negative on the grid of the second valve.

This voltage was subsequently increased up to 300 with very little improvement in strength, and the substitution of power valves, although giving a little greater clarity at full volume, did not greatly augment the volume. Birmingham could be heard in the intervals when 2LO was not working, but when this latter station was under way it was impossible to distinguish anything from the Midland city. On my own aerial, which is only one mile farther out, the strength from the London station is not quite so great, but Birmingham is more than twice as loud, and with careful adjustment of the condensers it is possible to understand every word spoken by the Birmingham announcer whilst 2LO is working.

* * * *

In several amateur sets I have examined lately, it has been quite evident that the builder has not realised the importance of good, sound electrical connections throughout the receiver. I frequently find that wire connections are most carefully soldered to give perfect conductivity, whilst such equally important points as the rubbing contacts of switches are entirely overlooked. Many filament resistances now on the market have very unsatisfactory moving contacts, and several would be improved by the soldering of a flexible lead to the moving arm to replace the contact (often far to light) of a rather soft spring washer which is supposed to provide the path for the current.

* * * *

I recently purchased at different shops six or eight ebonite valve sockets of a very well-known make. Each has been slightly different, and in no case has it been possible to insert the valve pins without more pressure than one cares to use with a good valve. In other sockets I have found the holes to be much too large, and in one ST100 set which was brought to my notice as not working, the trouble turned out to be nothing but this looseness of the valve pins in their sockets. The defect was remedied by opening out the pins of the valves with the aid of a pocket knife, but of course this was really adding a second wrong to make a right, for the socket should be so designed as to make a good contact with any properly spaced valve pins without the necessity of opening these latter to a greater extent than the normal.

* * * *

It is a pity that there are so few really satisfactory moving coils stands on the market. The extenson handles so generally fitted are often made very unsatisfactorily from the mechanical point of view, and, what is really worse, the extension rod is generally brought out so that the hand must come almost in contact with the coil itself in order to move it. Then, again, some of the extension handles (called by some "anti-capacity handles") are made of brass rod, with a thin ebonite sheath at the end. Such a handle,

when securely grasped, will often give even more hand capacity effect than would be obtained without it. Practically all of the extension handles are secured to round spindles by means of small grub-screws. These rapidly work loose, and the handle slides round the spindle without moving it. It would be far more satisfactory if these spindles were made with square ends to prevent this slipping, and a more substantial screw would usually prove advantageous. Manufacturers should take advantage of the present rather quiet time for preparing really sound accessories for the coming autumn and winter boom. If they do not turn their attention to design now, they may not have the opportunity later on when big business is being done.

* * * *

Have you ever noticed mysterious and persistent noises in your telephones—noises which cannot be put down to atmospherics? The growing popularity of electrical equipment in the house is partly responsible for some of these strange sounds. Electric fans are a prolific source of noise, and having recently installed one I find that it is essential to shut it off when I am receiving wireless signals in any part of the house. I have two separate leads-in for my aerial—one to the dining room for the main set and another to my work room where I test various sets as they are evolved on a special test table. When the fan is running in the dining room it is impossible to receive distant wireless signals in the study upstairs, so that it is quite probable that if an electric fan is working in the house next door it may affect your reception.

* * * *

I am surprised to find that more use is not made by the wireless experimenter of electric lighting flex. In both the double and the single form it has many uses, as well as electrical advantages not generally realised. In its double form it will serve for high- and low-tension leads, there being no need to untwist it. What capacity exists between the two wires of the twisted flex adds to the value of the shunting condenser across them, and as such a condenser is always an advantage across the high-tension terminals no detrimental effect is found. So far as the low-tension leads are concerned, whilst a condenser across them is not necessary, its presence does no harm.

* * * *

It is well to make a practice of knotting the wire which is to be the positive lead. The best procedure is to open out the wires of the twisted flex and tie a knot in one of them. Then, with a galvanometer or any other instrument which will give an indication of electrical continuity, find which of the opposite ends corresponds with the knotted wire and knot it also. It is useful to keep several such pairs of leads in the work room where they can be used at a moment's notice for joining up high-tension or low-tension batteries. The perfect flexibility of the wires and the fact that the insulation is always thoroughly good makes the wires very convenient and safe to use.

* * * *

For the connections between the aerial lead-in and the set and between the set and my earth connection I use double flex with the two ends joined together, the wires thus being in parallel. At each end I solder a spade terminal, which makes for greater facility when changing from one set of apparatus to another.

* * * *

Spade terminals stamped out of brass are now obtainable at every wireless dealer's for a very small sum. I recently purchased a few dozen off the stalls in Farringdon Road for the princely price of 6d. per dozen. Whenever I have a few spare moments (not often) I heat up the soldering iron and solder a few of these tags to odd lengths of flexible wire. Then, whenever I am trying a new circuit or arrangement I am able to connect up the set much more rapidly than usual without the risk of one wire shorting another. The tags are particularly useful when several wires have to be joined to one terminal, usually an abominable business when two or three bare wires have to be so joined up.

* * * *

It is an easy matter to untwist a yard or so of the twisted flex for the purpose of making single leads, but when a dozen yards or more have to be undone the job is not so simple as it looks. Single flex can be purchased at some shops, and if there were any general demand for it I am sure wireless dealers would stock it.

THE AMATEUR ORGANISATION

A Scheme for Closer Co-operation.

FOR the purpose of ensuring fuller representation of the affiliated societies on the Committee of the Radio Society of Great Britain, a scheme has been prepared whereby the country shall be divided into four groups :—(1) Scotland, (2) Wales and the West, (3) East, (4) South. Each group will provide, by election, a representative, who shall be a member of the Committee of the Radio Society of Great Britain, this Committee being increased from eight to twelve in order to accommodate these additional representatives.

As it was anticipated that the election of representatives might take some little while, the Committee of the Radio Society have temporarily appointed representatives, but definite election will take place at the Annual Conference to be held next January.

The necessity for introducing some such scheme as this has been realised by the Committee of the Radio Society ever since the last Annual Conference, when proposals were made with regard to fuller representation of the affiliated Societies, but no definite scheme was adopted.

In order to ensure that a representative of each group shall attend Committee meetings regularly, it is suggested that an alternative representative, resident in the Metropolitan area of each group, should also be appointed.

Below is published the text of a letter which has been forwarded to the Secretaries of all affiliated Societies, and a list of districts where affiliated Societies are located, indicating exactly to which group each belongs.

DEAR SIR,—You and your Committee will be aware that the Radio Society of Great Britain has always desired closer co-operation with its affiliated Societies, and has raised the question at each annual conference in the hope of finding some means of giving the provincial and suburban societies more effective representation in all questions affecting the general body of amateurs. As no solution of the problem was reached at the last conference, the Committee of the Radio Society of Great Britain have themselves formulated a proposal which I shall be glad if you will place before your colleagues.

It is proposed to increase the number of the Committee of the Radio Society of Great Britain from eight to twelve by the addition of four members to represent the affiliated societies, these members to be elected annually at the conference customarily held in January.

It is suggested that for the purpose of the election the affiliated societies be divided into four groups, thus :—(1) Scotland, (2) Wales and the West, (3) East, and (4) South. A list of the societies in each group is enclosed, from which it will be seen that the dividing lines are drawn approximately from London to Bristol and from Kingsway to the Pennine Range. Each group will elect its own representative, who must be a member of the Radio Society of Great Britain either individually or by virtue of the office he holds in an affiliated society. Each group will form its own organisation for the purpose of election, but until such an organisation is formed, and in order that the scheme may be started without loss of time—so that some working experience of it may be had before the next January conference—we propose to make a temporary appointment of a representative of your group to act until you elect one of your own choice at the January conference. A portion of the Metropolis is included in each of the groups (2), (3), and (4).

The Committee are anxious that the affiliated societies should always be well represented on our Committee. They suggest appointing an *alternative* representative from the Metropolitan area of *each* group. In the event of both the provincial and Metropolitan representatives being able to attend the committee meetings, both would be welcome, but only one would vote.

To give immediate effect to this proposal, the Committee are inviting the following gentlemen to represent the provincial affiliated societies by attending their meetings in London during the first half of the forthcoming session—*i.e.*, until January conference :—

(West) Mr. Y. P. Evans—Manchester Radio Society. (East) Mr. F. Lloyd—Sheffield Radio Society. (South) Mr. T. Hesketh—Folkestone Radio Society. (Scotland) Not yet arranged.

Although these gentlemen have definitely undertaken to attend our Committee meetings, we nevertheless propose to invite the alternative representatives from the Metropolitan societies of each group, and a further communication to the Metropolitan affiliated societies will shortly be sent out.

The publication of the P.M.G.'s Committee's report and the probability of new legislation within the next month or two may demand strong action by the general body of amateur experimenters. The Committee of the Radio Society of Great Britain, in submitting this scheme, believe that by having representatives of the affiliated societies directly in touch with them, they will more readily obtain the unanimous opinion of those they represent.—Yours faithfully,

L. MCMICHAEL
(*Hon. Secretary*).

WESTERN GROUP

Berkhamsted, Birkenhead, Birmingham, Blackburn, Blackpool, Bolton, Burton-on-Trent, Cardiff, Cheltenham, Cirencester, Coventry, Coventry (Humber), Darwen, Denton (near Stockport), Eccles, Evesham, Finchley, Glevum (Gloucester), Gloucester, Hall Green, Hendon, Hereford, High Wycombe, Hinckley, Liverpool, Malvern, Manchester (Wireless Soc.), Manchester (Radio Soc.), Merthyr Tydvil, Morecambe, Newport (Mon.), North Middlesex, Oxford, Preston, Preston (Dick, Kerr), Powisland, Redditch, Shrewsbury, Smethwick, Southport, Stockport, Stoke-on-Trent, Stoke-on-Trent (North Staffs. Rly.), Stratford-on-Avon, Swansea, Wallasey, Wembley, West London, Willesden, Wolverhampton.

(*Continued on page* 226.)

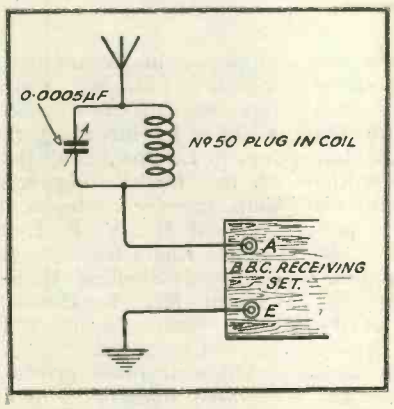


Fig. 1.—Type A wave-filter—a simple oscillatory circuit connected in series with the aerial lead. When this circuit is tuned to the interfering wave, it will act as a trap for this wave and will very largely reduce the jamming.

WAVE-TRAPS AND F

By *PERCY W. HA*

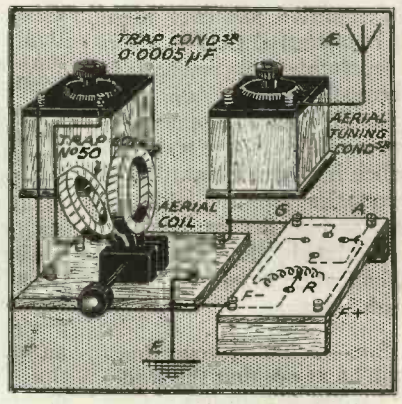
In this article Mr. Harris describes and illustrates several station can be considerably reduced, and even cut out, wh The methods described are applicable to both

BROADCASTING has now been running for nearly a year, and most listeners-in seem resigned to a monopoly by the local station of all the tuning, and have given up its elimination as a bad job. By the use of wave-filters, however, much of the local interference, if not all of it, can be successfully cut out when receiving distant stations. I have recently been carrying out a number of experiments in this direction, and find that there are at least two methods which give really successful results. The first consists of placing in series with the aerial lead an oscillatory circuit consisting of a capacity and an inductance (the values will be given later), and the second method (in my opinion the better) of inductively coupling such a current to the aerial. Neither method is new, and both have the advantage of being applicable to any B.B.C. set, but, as very few practical details have yet been given to amateurs, perhaps a few notes on both methods will be welcome here.

The series "wave-trap," "wave-filter," "acceptor circuit," or whatever we like to call it, is quite simple to construct. All we need is a variable condenser of maximum capacity of, say, 0.0005 μF, a plug socket,

(Below) How to use type B filter with a two-coil holder. This arrangement represents the author's preference in trap circuits. Used with a tuned anode set with reaction on the anode, it enables 2LO to be cut out and Cardiff and Manchester clearly received as close as six miles to London.

Fig. 3.



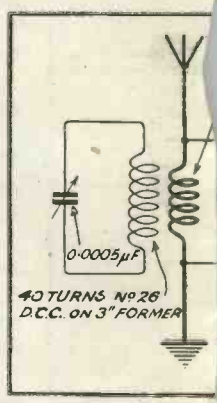


Fig.

(Above) Type C fil inductively coupled in shunt with very useful arr very widely known American writers is the best method the interference amateurs working the immediat

IOW TO USE THEM

RRIS, Staff Editor.

methods by which the interference of the local broadcasting en it is desired to listen to more distant transmissions. B.B.C. sets and experimental apparatus.

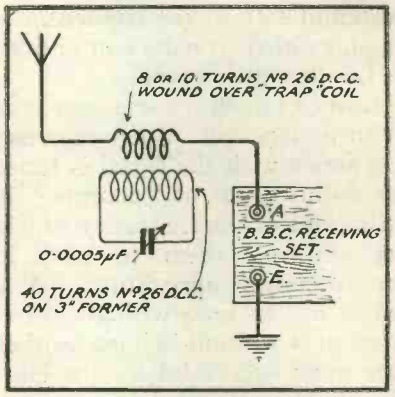
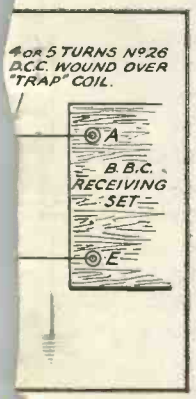
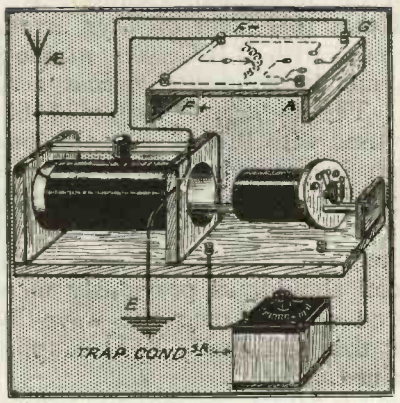


Fig. 2.—Type B filter. This consists of a similar oscillatory circuit coupled inductively to a coil placed in series with the aerial lead. In the case of a B.B.C. receiver this coil should consist of a very few turns tightly coupled to the trap coil.



(Below) How a sliding type of loose-coupler can be adapted to the type B filter. The coupling will need to be tighter than that which gives best signals with the ordinary loose coupling of circuits. The wire on the secondary should not be too fine—about No. 26 is quite fine enough.

Fig. 4.



er, a wave trap to a coil placed the tuner. A ngement not in this country. claim that it of eliminating caused by spark coils in vicinity.

and a plug-in coil of 50 turns. This latter may be any of the leading makes labelled "50," or a suitable coil can be wound of No. 26 double-cotton-covered wire on a 3in. former—40 turns being about right for the British broadcasting band. If it is desired to use this filter to reduce jamming from ships or a local wireless station working to ships (such as Cullercoats), about 60 turns will be required on the same sized former, or a 75 coil if plug-in coils are used. Any coil of the right inductance will do, but the plug-socket method makes a neat device in which we may very likely be able to use coils already on hand.

To use this trap one terminal is connected to the aerial lead-in and the other to the aerial terminal of the set, as shown in Fig. 1. Everything else is connected in the usual manner. It will be found, however, that any variation in tuning this trap will alter the aerial tuning slightly, and we shall need to increase either the inductance or else the capacity. Commercial forms of this wave-trap are already available, and one maker now sells his wave-meter with terminals by which it can be made to act as the wave-trap, with the special advantage that the calibration of the wave-meter

stands for the elimination as well. For example, if the wave-meter tunes to 2LO at 35 degrees, then by using the meter as a wave-trap and setting the condenser at 35 we shall be able either to reduce or entirely to cut out the London interference.

The theory of such a wave-trap is not very difficult to understand. When this oscillatory circuit in series with the aerial is tuned to the wave we do not *want*, it "accepts" for itself any oscillations of the frequency to which it is set, not allowing them to pass into the ordinary receiving apparatus. Any other wavelength not in tune with this circuit will pass through it without being absorbed. Such filters are most successful for the elimination of fairly sharply tuned telephony or C.W. signals, and are not so successful for spark interference, but they nevertheless will do a great deal in reducing even this latter.

Many readers of this paper have experimental licences and make use of tuners using plug-in coils. All such users are recommended to try the second wave-trap (Type B in the illustrations), which, as indicated above, consists of a similar oscillatory circuit, this time coupled inductively to the aerial.

If the reader is in the habit of using a two-coil holder, one for the aerial circuit and the other for the closed circuit, he is recommended to try using one of these coils as the acceptor circuit in the manner described in last week's "Random Technicalities."

Fig. 2 shows how this inductively coupled wave-trap can be used with a B.B.C. set of apparatus. Fig. 3 shows the use of a two-coil holder for this purpose, and Fig. 4 a loose coupler used in a similar way. Obviously any method which allows of fine adjustment of the couplings between one circuit and another can be applied in this connection. It will be found that the coupling must be fairly tight if good absorption is required.

The important point to remember in adjusting any of these wave-traps, whether directly or inductively coupled, is that the trap condenser should not be varied until the signals from the station we wish to receive have been tuned in to the maximum intensity.

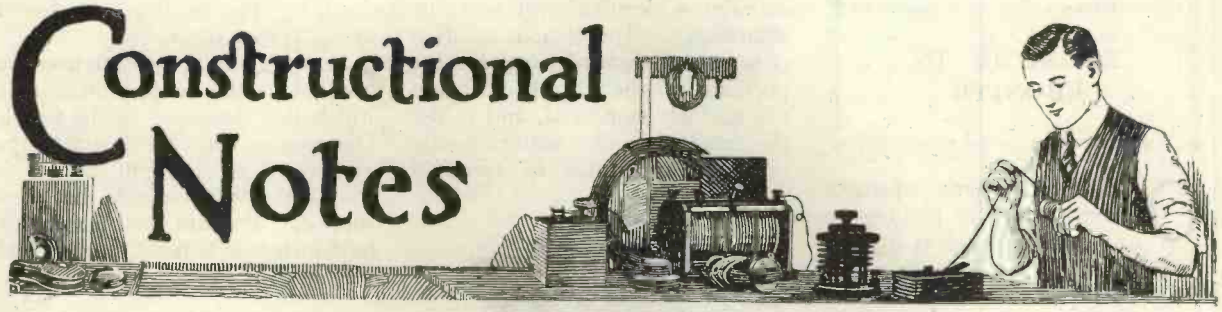
When the station we wish to receive has been tuned in clearly and sharply with maximum strength, quite without regard to the effect of the local interference, we should couple the wave-trap fairly tightly and then slowly vary the condenser until the local station seems to disappear. When this has been done a slight alteration of the tuning of the set may be necessary, and once more a slight alteration of the wave-trap. In the case of the series wave-filter, simultaneous adjustment of the filter and the aerial tuning inductance and condenser may be necessary as alterations in the wave-filter alter the aerial tuning. Whenever a good position has been found on both wave-trap and tuner, these should be carefully noted for future reference.

A third form of filter which is sometimes very useful, particularly for the elimination of spark jamming, is that shown in Fig. 5 as "type C." In this case the wave-filter is coupled to a coil which is placed in parallel with the receiver. This coil should consist of about four or five turns of No. 26 double cotton-covered wire, wound on top of a coil of about 40 turns of the same wire, the two coils being separated from one another by a layer of Empire tape, waxed paper, or some similar insulating substance.

I have not experimented to any great extent with this last form of filter, and I am not very well situated to do so, as there is practically no interference on my set from 600 meter spark signals. Residents in seaport towns who are troubled with spark jamming are recommended to try this circuit. It is of American origin and is stated to be extremely successful in eliminating such interference as is given by amateurs using spark coils in the immediate vicinity. It will be noticed that this form of filter arrangement can be used with B.B.C. sets, as the parallel coil is merely connected across aerial and earth. The inductively coupled filter can also be used with B.B.C. sets, the inductance of which is not available for coupling, by placing a coil of, say, 8 or 10 turns of wire in series with the aerial and coupling the wave-filter to this, as shown in Fig. 2. The aerial coil should, as previously mentioned, be wound directly over the wave-filter coil in order that sufficiently tight coupling may be obtained.

There is nothing to prevent several filters being used when interference comes from several stations.

Constructional Notes



A HOME-MADE TUNING BUZZER

A TUNING buzzer is required by everyone who uses a crystal, whether for general reception work or for occasional experiments. Its use saves a great deal of time, enabling adjustments to be made quickly as well as making it possible to be sure that the set is working at its maximum efficiency before the reception of

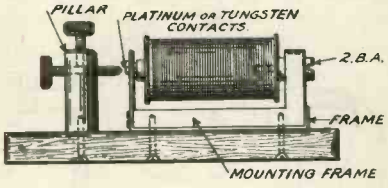


Fig. 1.—The complete buzzer.

signals, brought in by the aerial, is attempted. Tuning buzzers can be improvised in endless ways—even an electric bell with the gong removed can be pressed into service—but unless a high singing note is produced it is somewhat difficult to obtain a correct idea of the degree of signal strength obtained on different points of the crystal. Many of the instruments sold as tuning buzzers were not designed for this purpose at all, having as a rule a low pitched note making them, therefore, less satisfactory for the reason stated above.

A buzzer that works excellently can be made with no very great difficulty by anyone whose workshop contains only a small outfit of tools. The cost of constructing it is very small, and if we leave out the question of the platinum points needed, a modest amount should cover the outlay on materials. Platinum points are comparatively expensive, but one can sometimes rescue suitable old ones from discarded or broken pieces of apparatus in one's box of odds and ends.

The core for the bobbin consists of a piece of the best soft iron 1½in. long and ⅜in. in diameter. At one end a hole is drilled and tapped for a 2B.A. screw. This hole should be ½in. in depth. Over it is slipped a bobbin made of a 1in. length of stiff paper tubing, to which are glued two circular end-pieces 1in. in diameter, cut from stoutish cardboard. The bobbin should be given a good coating of shellac both inside and out. If it is placed on the core whilst still wet, the shellac, when dry, will hold it firmly in place. The core projects $\frac{1}{16}$in. at either end.

A short piece of 2B.A. screwed rod is inserted into the hole drilled in the core. This enables the bobbin to be mounted in the lathe for winding, or if a lathe is not available the rod can be fixed into the chuck of a breast drill held fast in a vice. The windings are made with No. 30 D.C.C. wire, the bobbin being wound full.

The mounting frame is of brass. If suitable tools are available it can be cut from the solid. If not, cut a stout piece of sheet brass $\frac{5}{16}$in. wide and beat it into the L shape shown in Fig. 1. The bobbin is secured in place by means of a 2B.A. screw.

The armature is made of a piece of clock spring, which must be annealed by being heated and allowed to cool slowly, before it can be worked. Two 6B.A. holes are drilled at one end to take the screws which secure it to the mounting. At a point which coincides with the middle of the core, a small hole is made. Into this is inserted a platinum rivet, which is flattened out by very gentle hammering. When the drilling has been done the armature is re-tempered by being heated in a bunsen flame and plunged into oil.

The contact pillar is a length of ⅜in. brass rod secured to the wooden panel by a 4B.A. screw driven into it from below. Through it is drilled and tapped a 4B.A. hole the centre of which must be in line with the platinum rivet in the armature. Another hole, also

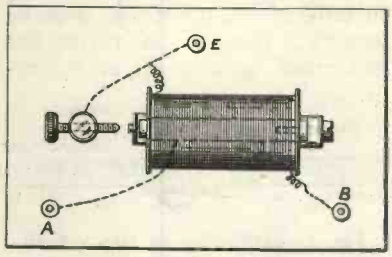


Fig. 2.—Showing connections of buzzer.

tapped 4B.A., runs from the top of the pillar into the first. The horizontal hole takes a 4B.A. platinum pointed screw with a milled head. That drilled vertically is for a setscrew.

Three terminals are mounted on the panel as shown in Fig. 2. One end of the winding goes to B, the other end being taken to the contact pillar. The brass frame is connected to A, the contact pillar to E. A dry battery is connected to A and B, a lead from E being taken to earth.

A very neat job can be made if the panel is mounted on a shallow polished case within which is a pocket flashlamp battery. A small switch can then be provided to throw the buzzer in or out of action.

R. W. H.

ECONOMY IN EBONITE

ONE of the many expensive items needed for making up any piece of wireless apparatus is the ebonite panel upon which the various parts are mounted. If, for example, we are engaged in constructing even a single valve panel measuring 6in. by 9in. by ¼in. thick, we are faced with a cost of about 4s. for ebonite alone. It is of no use to attempt to save a little by using fibre, for this material is so strongly hygroscopic that it becomes useless as an insulator of high-frequency currents in damp weather, since it collects moisture from the atmosphere. Teak and mahogany are fairly good in their way, but, on the whole, they are unreliable. Some people use slate, which is an excellent insulator so long as it does not contain, as it often does, metallic veins. Nothing is more annoying than to find after one has made up a panel at the ex-

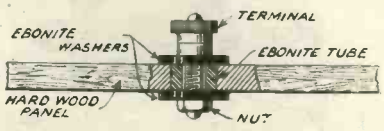


Fig. 3.—Illustrating an ebonite bush for wooden panels.

pense of considerable time and trouble that it will not work properly owing to the insulation being faulty.

It would seem, therefore, at first sight that we are between the devil of bad insulation and the deep sea of costliness. Fortunately, however, there is a way out.

If you come to think of it, about 95 per cent. of the ebonite of a large panel is serving no useful purpose whatever. If it is ¼in. thick a tiny distance is sufficient to insulate terminal from terminal or valve leg from valve leg. A little ring round each live piece of metal that passes through the panel is doing useful work by providing the necessary insulation; the remainder is electrically of no value whatsoever. The obvious solution is to substitute hard wood for the portions of the ebonite that are not usefully employed, and to use the more expensive material only in small quantities to surround metal parts.

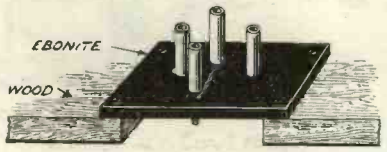


Fig. 4.—Arrangement of valve legs on wooden panels.

Fig. 3 shows one of the simplest and most effective ways of economising. A foot of ebonite tube, with an internal diameter of ⅛in. and an external of ¼in., is bought for 3d. This will make, allowing for waste in cutting, at least 40 bushes ¼in. long. The panel is made of hard wood. At each point where a terminal is to be inserted a ¼in. hole is drilled and an ebonite bush forced in. If ebonite washers ½in. in diameter cannot be bought they can be made very easily from tubing of ½in. outside diameter, which costs 8d. per foot. One of these is placed above the bush and one below. The terminal is then inserted and fixed in place. No part of it comes into contact with the panel.

Rheostats, condensers, and variometers may be mounted in the same way. Here we shall need tubing ⅜in. in diameter to take their bushes—this costs 9d. per foot—and the washers must be ¾in. across.

Quartets of valve legs can be mounted on a small ebonite block

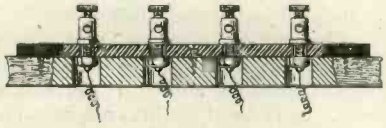


Fig. 5.—Showing how telephone terminals may be fitted upon an ebonite strip.

1½in. square. Beneath its centre a 1in. hole is made in the wooden panel to clear legs and nuts, and the block is fastened down by four small screws driven in one at each corner.

A very similar system may be applied to the rows of terminals which line the edges of the panel. One mounts them on ebonite strips 1in. wide and of length suitable to the number of terminals that they support. Beneath each terminal a half-inch hole is bored in the wood with a bit.

R. W. H.

AN IMPROVED VARIO-COUPLER

THE matter concerning the connections from the inner coil of a vario-coupler or variometer often presents a difficulty. The usual method is to solder short flexible leads to the ends of the winding and run these out over the top of the larger coil to the terminals on the baseboard. The result is a more or less clumsy joint, to say nothing of the unsightly appearance of the flexible leads themselves. The weight of these, too, will often pull the inner coil out of adjustment at an inopportune moment.

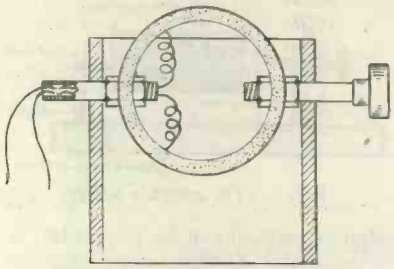


Fig. 6.—Suggestion for inner coil connections of a vario-coupler.

This difficulty may be easily overcome by providing a hollow shaft, preferably of ebonite tubing, as shown in the accompanying illustration, and running the ends of the coil winding through it to the terminals or direct to the circuit. If a metal tube is used it will be advisable to cover each end of the coil winding with insulating sleeving over that portion which passes through the tube.

O. J. R.

H.F. TRANSFORMERS

THERE is no doubt that, where only one stage of H.F. amplification is used for short-wave reception, there is nothing to hold a candle to the reactance-capacity method of coupling, which gives longer range and greater signal strength than any other. When, however, the number of H.F. valves is increased, the tuned-anode becomes increasingly difficult to handle, on account of its tendency to fall into self-oscillation. Two stages can be used by an expert; three make the set so unstable that, unless heavy damping is resorted to, it is almost impossible to use them without the occurrence of frequent and violent oscillation.

Though less efficient, the copper-wound transformer has the advantage of being not so liable to cause trouble. If, however, two or three tuned transformers are used, the tendency of self-oscillation will be marked.

The simplest solution of the difficulty is to use transformers wound, not with copper, but with

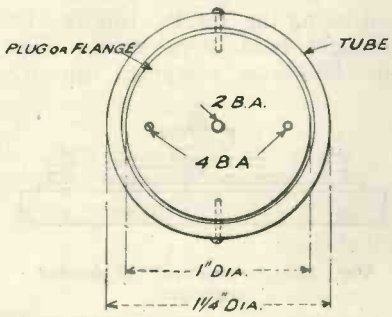


Fig. 7.—Dimensions for end pieces.

resistance wire. The introduction of a series resistance into an oscillatory circuit has the effect of flattening out the resonance curve; it also reduces the efficiency of the circuit to some extent owing to the resistance offered to oscillations not in resonance with it, for which in theory there should be an absolutely free path.

At first sight, then, the resistance-wound transformer would seem to entail loss of both selectivity and efficiency in amplification. In practice, however, neither of these effects is noticeable. Neither tuned anodes nor tuned transformers can be allowed to display their full powers on the

Fig. 8.—The complete winding.

multi-valve set. Selectivity is reduced by the necessity for detuning slightly in order to avoid oscillation, and efficiency as regards amplification suffers owing to the damping that must be introduced to control them.

The resistance-wound transformer has an optimum wavelength, but as its resonance curve is very flat, there is no marked "peak," and it will work efficiently over a wide band. Since it has practically no tendency towards oscillation, hardly any damping is necessary, so that each transformer can be allowed to give its fullest measure of amplification. Thus for long-distance reception on the shorter wavelengths three or even four H.F. valves can be used with no great difficulty, potentiometer control being all that is needed.

The writer does not know of any firm from whom resistance-wound transformers can be purchased ready-made, but they are so extremely simple to construct that anyone can make them up at home. The wire used is No. 42 H.R. double silk covered "Eureka." The price, £2 10s. per lb., looks at first formidable, but as it runs something over three miles to the pound, and each transformer for broadcast wavelengths requires only about fifty yards, a single ounce will suffice for making quite a number.

The former consists of a 3in. length of ebonite tube with an external diameter of 1¼in. and an internal diameter of 1in. Two end pieces are made from ¼in. ebonite; it does not matter in the least whether they are made as plugs to fit into the tube, or as flanges fixed to its ends. In either case each must have a central hole to take a 2B.A. rod, and two others for 4B.A. screws or small terminals (see Fig. 7). The end pieces are fixed in position by means of a couple of 4B.A. screws.

A 5in. length of 2B.A. screwed rod is now passed through the central holes in the end pieces and secured in place by means of a nut at each end.

The former can now be mounted in the lathe for winding. If a lathe is not available, fix the breast drill in the vice by means of its lug or horizontal handle, and

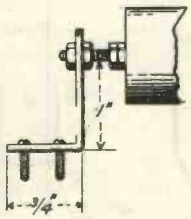


Fig. 9.—Clip for mounting the transformer.

insert one end of the 2B.A. rod into its chuck.

Attach the end of the reel of wire to one of the screws on the end piece and wind on 250 turns as closely and as evenly as possible. Snip off the wire and attach it to the screw on the far end-piece corresponding to the "in" end on the near one. As this winding will occupy about 2in., it may be started ½in. from the end of the tube. To prevent the wire slipping, it should be given a thin coat of shallac varnish.

Next, cover the primary winding with a layer of fine sewing silk. This will provide good insulation between the windings. The secondary, which has 300 turns, is wound over the primary in the same direction. It will begin and end about ⅛in. nearer to each end. Its ends are attached to the two remaining screws. To make all

secure, the windings should be shellac varnished and may be wound over with silk to give a neat finish. The completed instrument is shown in Fig. 8.

The projecting ends of the brass rod provide a convenient means of mounting the transformer on the underside of the panel. A pair of clips, as shown in Fig. 9, can be made from sheet brass.

If it is desired to make transformers of various sizes which can be slipped easily into place, the spindle may be removed when the winding has been done and a different mounting made. Fig. 10 shows the details of this.

The windings given have an optimum wavelength of about 400 metres; they will deal quite effectively with transmissions on wavelengths from 300 to 500 metres and may be found to cover an even

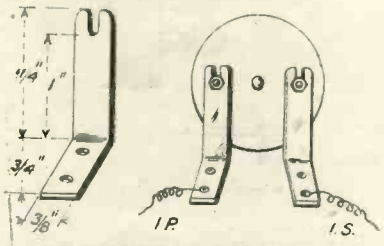


Fig. 10.—An alternative arrangement of clips.

wider band. The following table shows the primary windings necessary for higher wavelengths; the secondary will usually contain about 20 per cent. more. The reader may find that his particular set requires either rather fewer or rather more turns than those given, for much depends upon the capacities existing in the set itself and upon the valves used.

It is as well, therefore, to make a few experiments when the first transformer is being wound. It may contain a slightly greater number of turns than here stated, and the effect of stripping off a few may be tried until the best arrangement is found. Once this has been ascertained the table may be used by adding or deducting the percentage found as the result of these experiments. It is very important that each set of transformers used simultaneously in a multi-valve set should be identical, otherwise they will tend to hinder rather than to assist each other's action.

Optimum Wavelength	*Turns on Primary.*
600	350
900	550
1200	800
1500	1000

R. W. H.

VARYING THE FIXED CONDENSER

A SMALL condenser of the fixed type having a mica dielectric is arranged to function in a similar way as the vernier variable type with air dielectric. Variable capacity is obtained by means of compression applied between the plates. Two thin spring brass foils each 2½in. long and 1½in. wide are cut out to the shape indicated in Fig. 11. A ⅜in. hole is drilled through the centre of each, the centre being measured between the shoulder of the tag and the opposite edge. A piece of thin mica 2⅛in. by 1⅞in., with a ⅜in. hole drilled through the centre is secured to one of the foils by means of some thick shellac varnish. The hole should be directly over the hole in the foil, so that a small portion of the mica will overlap the foil along both sides and over the end opposite the tag. These are now placed on the table under a moderately heated flat-iron and left until the iron cools, when the mica will be securely fixed to the foil. An ebonite or fibre base 3½in. long by 2in. wide and ½in. thick is drilled through each end on a line with the centre to take two ordinary terminals. In the true centre a 2B.A. tapping hole is drilled to a depth of about ⅜in., and this hole is carefully threaded by means of a 2B.A. plug tap. A 1½in. length of 2B.A. screwed rod is

Fig. 11.—Illustrating shape of brass foils.

screwed down into this hole very tightly and an ebonite knob, drilled through and tapped 2B.A., is made to fit easily over the other end. The foil with the mica attached is slipped over the projecting rod with the mica uppermost. The tag is then secured firmly in position under the shoulder of the left-hand terminal. The other foil is bent at the tag, as shown at Fig. 12, and secured in the same way under the shoulder of the right-hand terminal. Great care should be taken to see that the edges of the holes are well separated from the upright rod. The threaded ebonite knob is now screwed on, and by adjusting this the top foil may be brought hard down on the mica to obtain the maximum capacity

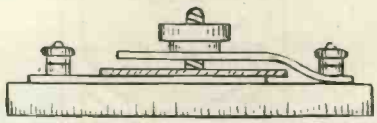
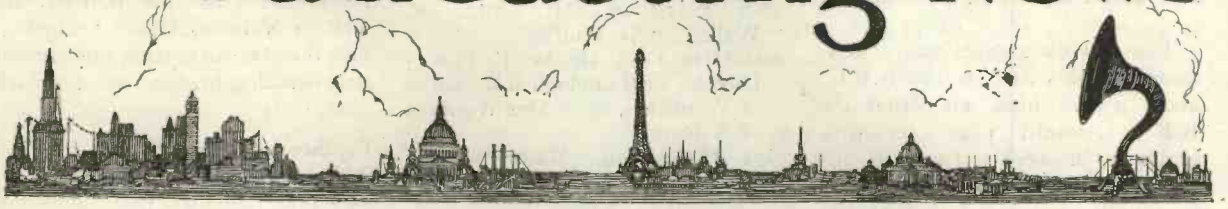


Fig. 12.—Arrangement of finished condenser.

of the condenser. By varying the degree of compression the capacity is also varied, and as the foils are of a useful size the condenser may be used with advantage for a variety of purposes. O. J. R.

In our last issue, on page 188, it was inadvertently stated that Messrs. C. F. Elwell, Ltd., employ "Talite" as the crystal in their crystal receiver. This should have read "Tellite." Talite is a proprietary rectifying crystal marketed by Messrs. Harding, Holland & Fry, Ltd.

Broadcasting News



BY OUR SPECIAL CORRESPONDENTS.

LONDON.—Writing last week one was inclined to be fairly confident that the long promised report of the House of Commons Committee would have been out ere this, because one had in view the fact that the report would possibly be presented to the House before it rose.

◇ ◇ ◇

That did not happen, however, and now there seems no particular reason why it should not be still further delayed because of the holidays and the members of the Committee not being anxious to remain in London any longer. Possibly, too, when it does come out a good many people will wonder why it should have taken anything like the time it has.

◇ ◇ ◇

On the occasion of his retiral from the B.B.C. Major Anderson, the late secretary of the company, received a handsome presentation from his colleagues, which took the form of a solid silver inkstand, etc. Mr. Reith, the general manager, in making the presentation, said that perhaps he realised better than anyone else the tremendous amount of work Major Anderson had put in during exceptionally trying circumstances. Mr. Reith remarked, with a significant smile, that in the course of a few weeks perhaps some of them would be envying Major Anderson his freedom. Major Anderson briefly and suitably replied.

◇ ◇ ◇

The last Station Directors' Conference of the B.B.C. was most interesting, and finished up with a pleasant little dinner. If ever the various officials of the B.B.C. have to turn out into the wilderness, as perhaps they may after this marvellous report comes out, they could form an excellent group of entertainers of their own.

◇ ◇ ◇

Mr. Palmer, the director of 2LO, is an excellent singer. Mr. Carruthers, of 5SC, is an accomplished all-round musician, being especially brilliant on the piano. Mr. Edgar would be a serious rival to Bransby Williams as an interpreter of Dickens. Mr. Corbet Smith, of Cardiff, is a veritable one-man band; he is probably the most versatile official in the employ of the B.B.C. Mr. Godfrey, of Manchester, is, of course, a musician to his fingertips, and Mr. Fryer, of Newcastle, is an old theatrical.

◇ ◇ ◇

Everyone knows what Captain Eckersley can do in the entertaining line, and, of course, there is no need to speak of Mr. Jefferies or of Mr. Percy Pitt. But even in unsuspected quarters there is ability lurking. For instance, the engineer at 2LO, Mr. Litt, is a splendid pianist, and when he is testing the microphone he puts over real classical stuff for his colleagues to hear so that they may know exactly how the music will go over.

◇ ◇ ◇

There will be nothing very sensational at 2LO during the holiday month. Shakespeare will get his holiday like his lesser brethren, and there will be no special stunts. The music will be light and cheerful and suitable to the summer season. About the middle of September things will get busy again.

Talking of Shakespeare reminds one of a serious charge against the experimenters. It is said that whenever they know that a Shakespearean stunt is coming on they arrange that night to go in for experimental work and cut out 2LO altogether.

◇ ◇ ◇

The London programmes have of late been excellent. Mr. Croxted Smith's talk on "Dogs" was most informative, while Major Harry Barnes's talk on "Modern London Buildings" was very *à propos*.

◇ ◇ ◇

Professor Ireland's talk on "Episodes in the History of England" was full of life and interest. Then, too, we had the advantage of hearing Mr. Mackenzie, war correspondent, just back from Moscow. The writer always thinks it is a decided advantage to hear someone speak about stirring historic events, rather than to sit down and read about them, feeling somewhat uncertain as to the amount of censorship that has been exercised before such news is allowed to be published, and feeling also, perhaps, that it is often more or less inspired; whereas, to hear a war correspondent *teil* a plain, unvarnished story is much more satisfactory and carries with it conviction; not that such views are always to be taken as strictly correct and orthodox, but, at any rate, they are first-hand impressions.

◇ ◇ ◇

"Meum et tuum."—The address by Canon Burton, of the Westminster Cathedral, was very good indeed, and his explanation

of "Prayer" must have brought home to many that only too often prayers are but begging petitions and too infrequently thanksgivings.

◇ ◇ ◇

Every week a great many well-meaning souls write to the B.B.C. about a new idea, viz., that the B.B.C. should issue its programmes in weekly form in advance. Every person who writes is profoundly convinced that he has hit upon something good and original. For a time the B.B.C. sent out printed slips in acknowledgment, but they seem to have run out of these now, and once more typewritten acknowledgments are being sent.

This is one of the things that has been hung up owing to the non-appearance of the report, but whenever that is settled something of the kind will be done. There seems to be a very big demand for a weekly detailed programme, but even when it does appear it can only be approximately accurate, as so many things are apt to happen between the booking of an item and its being broadcast.

◇ ◇ ◇

It is rather strange that although Mr. Wm. Boosey has repeatedly said that artists who broadcast will never, no, never, sing at any of the concerts over which he has any control, yet the printed programme of the Queen's Hall Promenade Concerts indicates that on Friday, September 7th, Miss Daisy Kennedy will appear. Miss Kennedy has a long contract with the B.B.C. It seems rather hard lines on the artists of the British Broadcasting National Opera Company who only broadcast indirectly that they should be banned from the concerts.

Forthcoming Events

AUGUST.

15th (WED.).—7.15, Mr. Archibald Haddon, "Dramatic Criticism." 9, Prof. A. J. Ireland, M.A., I.L.M.

16th (THURS.).—7.15, Mr. Percy Scholes, "Musical Criticism."

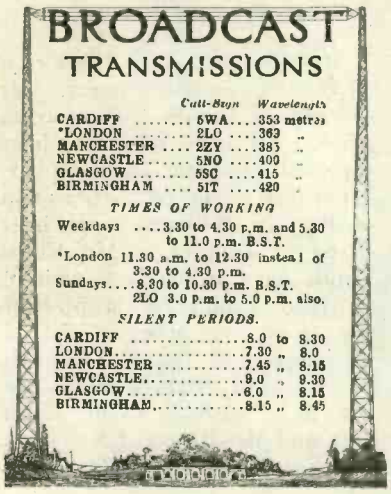
17th (FRI.).—Victoria and Albert Museum. 7.15, Mr. G. A. Atkinson, "Cinema Criticism." 9, Mr. F. G. Bristow, F.C.I.S., general secretary of the Commercial Motor Users Association, on "The Relation of Broadcasting to the Motor Industry."

18th (SAT.).—9, Mr. Allen S. Walker, "St. Paul's."

20th (MON.).—9, Dr. W. E. Pullin, Director of Radiological Research at Woolwich, on "The Wonders of X-Rays."

21st (TUES.).—9, Major G. C. Horne, F.S.A., Scotland, on "Roman Britain."

22nd (WED.).—6.45, Mr. Ed. Salmon, Editor of the official publication of the Royal Colonial Institute, Topical Empire Chat. 7.15, Mr. Archibald Haddon, "Dramatic Criticism." 9, Mr.



D. Holden Shipway, L.D.S., R.C.E., "Industrial Dentistry."

23rd (THURS.).—7.15, Mr. Percy Scholes, "Musical Criticism."

◇ ◇ ◇

BIRMINGHAM.—Mr. Joseph Lewis, the new musical director at Birmingham, has lost no time in getting to grips with his task. He is forming a large band of singers who will act as a broadcast choir and give part-songs, glees, madrigals, etc., and who will also be the local chorus for the British National Opera Company when it goes on tour.

This work of Mr. Lewis is of importance to all the broadcasting stations, and Mr. Percy Pitt hopes to be able to find gentlemen like Mr. Lewis in all the broadcasting centres. Needless to say this will be a very difficult matter, for men like Mr. Lewis are few and far between. However, Mr. Pitt is sanguine that he will be successful. This will be an excellent move, good for the B.B.C., the British National Opera Company, and the ever-increasing numbers on the listening-in side of the business.

Forthcoming Events

AUGUST.

15th (WED.).—First performance of the Station Repertoire Company. Land-line transmission of the Orchestra of the Lozells Picture House.

17th (FRI.).—An augmented orchestra will give an Elgar programme.

18th (SAT.).—First performance of the Station Military Band.

20th (MON.).—Miss Doris Lemon, soprano; Mr. Wm. Michael, of the British National Opera Company.

21st (TUES.).—Dance programme.

◇ ◇ ◇

CARDIFF.

Forthcoming Events

AUGUST

15th (WED.).—Mr. Phillip Middlemiss, entertainer.

16th (THURS.).—Cory Silver Band. Songs by Mr. Morgan Morgan.

19th (SUN.).—Special Mozart programme. Songs by Miss Doris Lemon (soprano) and Mr. William Michael (bass).

◇ ◇ ◇

GLASGOW.

Forthcoming Events

AUGUST.

15th (WED.). — Miss Winifred Fisher, soprano; Mr. Lyell Johnston, bass. Most of the items this evening are to be devoted to the works of Saint-Saëns, who was born in Paris on October 9th, 1835.

16th (THURS.). — Miss Beatrice Miranda, soprano; Mr. William Anderson, bass.

17th (FRI.).—Mr. George Cunningham, baritone; Miss Rhoda Graham, contralto; the Barrhead Silver Prize Band.

18th (SAT.).—Miss Elsie Black, contralto; Mr. John Morton, bass.

19th (SUN.).—The Rev. Archibald Montgomery, of Dumbarton, to deliver a short address; Miss M. Burden, soprano; Mr. James Newall, tenor.

THE CONSTRUCTION OF A REINARTZ RECEIVER

By STANLEY G. RATTEE, Staff Editor.

The following article gives full constructional details of a two-valve receiver embodying the Reinartz circuit.

FOR simplicity of construction and operation this receiver has many attractive features.

Though, strange to say, the Reinartz circuit has never risen to that state of popularity so familiar with other circuits, those experimenters who have used it, with few exceptions, praise its merits.

The receiver is one of the regenerative type, employing electro-magnetic reaction, that is to say, reaction on to the aerial circuit.

It is particularly efficient in the reception of continuous waves, in that it oscillates freely and that reaction is not greatly affected by change of wavelength.

Relatively coarse adjustments of reaction are provided by a tapped inductance, while a condenser in the same circuit allows of finer adjustment for tuning.

The photograph, Fig. 1, shows the complete instrument with a hinged side of the containing box open to show the interior. In actual fact, the purpose of the hinged side is to allow of access to the valves and other parts of the apparatus.

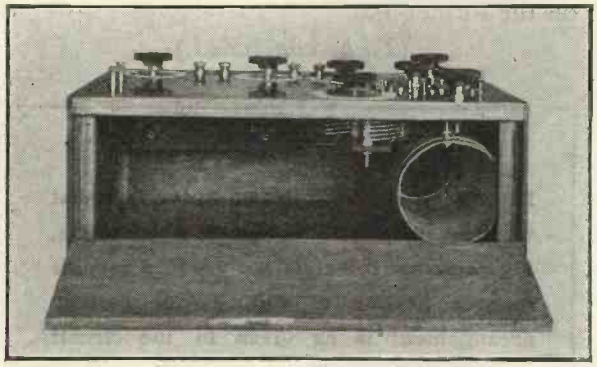


Fig. 1.—Photograph of the complete instrument.

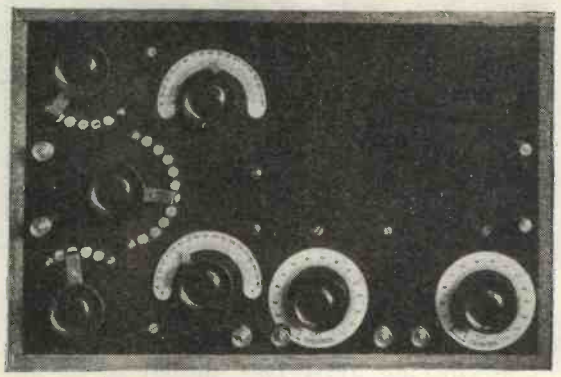


Fig. 2.—Plan of instrument.

Fig. 2 is a plan of the complete instrument showing the positions of the various switches and valve windows. The four-point switch at the left and on the bottom of the panel varies the number of turns in the plate coil, the ten-point switch in the middle controls the inductance of the aerial circuit, while the five-point switch at the top and on the left of the panel varies the number of turns in the grid circuit.

The two knobs in the centre of the panel, with semi-circular scales, are two condensers of 0.0005 μF; the top one being the reaction condenser, while the lower one is used for aerial tuning.

The other two knobs encircled by scales are filament resistances for controlling the filaments of the detector and low-frequency valves.

The two terminals on the left are for the aerial and earth connections; the four terminals seen on the bottom of the panel (Fig. 2) are, reading from the left, for the L.T. negative, L.T. positive, H.T. negative, and H.T. positive. The two terminals on the

right-hand side of the panel are for the telephones.

The photograph, Fig. 3, shows a back-of-panel view, from which will be clearly seen the arrangement of the various components.

Materials and Components Required

Exclusive of the containing box, the follow-

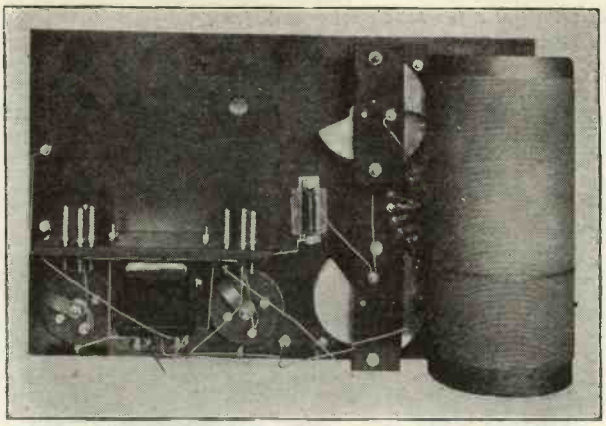


Fig. 3.—Back of panel view.

ing components and materials are required for assembling a receiver similar to the one described herein :—

One ebonite panel, 14in. × 9in. × ¼in. thick, (a thickness of less than ¼in. is not recommended in view of the area of the panel).

Two variable condensers for panel mounting, each of 0.0005 μF, or, if preferred, the separate parts for building such condensers, using 15 fixed and 14 movable vanes.

Two standard valve-holders complete.

Three laminated switches with knobs.

Nineteen brass studs.

Two ebonite knobs for condensers, with dials or as in the set under description, knobs with brass pointers and separate engraved scales.

Eight brass terminals.

Two filament resistances, complete with engraved scales.

One low-frequency transformer.

One cardboard or ebonite tube, measuring 3½in. in diameter by 8in. long.

One piece of ebonite 6in. × 2½in. × ¼in.

One fixed condenser of 0.0003 μF.

One gridleak of 2 megohms resistance, with clips.

½ lb. (approx.) No. 22 s.w.g. d.c.c. copper wire for the inductances.

A supply of No. 18 or No. 20 s.w.g. tinned copper wire for connecting up.

All these components were obtained from the Crayford Radio Supplies.

The Inductance

The only part of this receiver which is likely to give trouble in construction is the tuner, and, though there are actually two inductances in the Reinartz circuit, both are wound on the same former.

Before commencing the winding, drill two ⅛in. holes, ¼in. from each end of the tube, the dimensions of which as before stated are 3½in. in diameter by 8in. long.

Secure at one end, ⅝in. from the end of the former, the wire with which the inductance is to be wound, by drilling two small holes and threading the wire through one hole and out of the other, leaving a loose end of about 6in. This loose end will be required subsequently for connecting, so not less than 6in. should remain free. At this point commence the winding and wind for 20 turns, when a tapping is made. Another tapping is effected after 35 turns, and the coil ended at 50 turns.

The wire is now cut and the end secured to the former as before, leaving about 6in. of loose wire for connecting purposes.

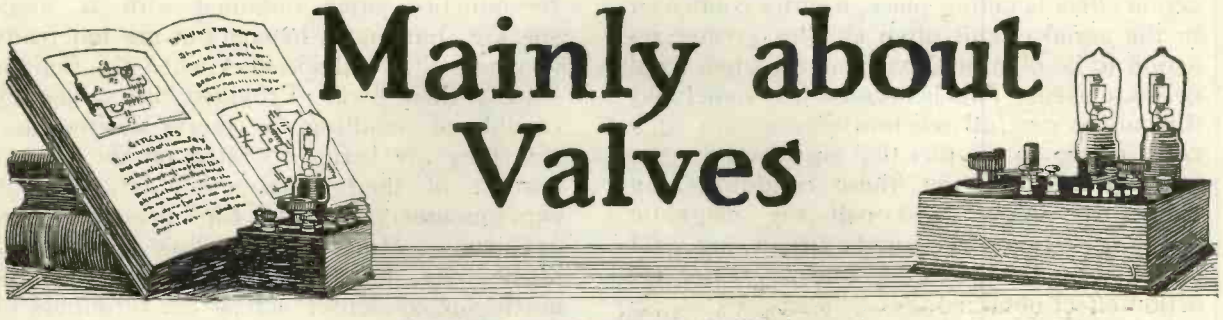
The next consideration is the winding of the second inductance. Leave a space of about ⅛in. on the former and commence the next winding after securing the wire and leaving a free end of about 6in. as before.

In this section of the inductance tappings are made after the following number of turns :—1, 2, 3, 4, 5, 6, 7, 8, 12, 30, 38, 52, 75, 100, thus making the total number of turns on the former 150.

(To be concluded.)

PLEASE NOTE.

Readers attention is drawn to the fact that whereas on page 100, Vol. 2, No. 3 issue, Fig. 2 shows the H.T. battery in a reverse manner to that of Fig. 1, the correct arrangement is as given in the circuit diagram, Fig. 1, page 99.



Mainly about Valves

Our weekly causerie written by the Editor.

Simplifying the Flewelling Circuit

THERE has been a great deal of interest shown in the Flewelling circuit, and especially in the recent simplified circuit published exclusively in *Wireless Weekly*. Only a 0.006 μF condenser is required to change the ordinary reaction circuit into a Flewelling, and when we consider the principle of operation of the Flewelling circuit it seems not improbable that even this condenser might be eliminated. By using suitable values of grid condenser and gridleak and increasing the reaction until the valve buzzes in an intermittent manner, it might be possible to get the Flewelling effect.

The Flewelling circuit seems to be a super-regenerative receiver in which the periodical stopping and starting of the self-oscillation phenomenon is accomplished by a charge and discharge of the grid condenser.

Testing when Accumulators are Running Down

A good quality of accumulator will generally hold its charge up to the end and then suddenly becomes temporarily useless. Shaking the accumulator sometimes enables you to get a few more minutes' worth of current from it, but in any case it is very disconcerting to find that an accumulator has run down during, say, a demonstration. Even, however, though one may not be able to tell very readily by noting the filament brightness when an accumulator is running down, yet a useful tip is, when two or more valves are being used, to pull one of them out, or to switch off the current to it suddenly. If the other valve, or valves, brighten appreciably, it is a sure indication that the accumulator is running down. If, however, it makes very little difference to the other valves whether one is switched in or out of circuit, it may be assumed that the accumulator is well charged.

Series or Parallel?

A great deal of difference of opinion exists with reference to the use of a series or parallel condenser for tuning in an aerial circuit. My own experience is that when a series condenser is connected in the aerial circuit (and it should be connected on the aerial side of the aerial inductance), its value should never be less than 0.00025 μF for wavelengths up to 600 metres. As the wavelength is increased, a larger series condenser should be used, but in my opinion a series condenser should never be used when the wavelength to be received is 600 metres or over.

A technical point in connection with a series condenser is that there is only one single oscillation circuit constituting the aerial circuit, whereas when a parallel condenser is used there is, owing to the inductance of the aerial, a complex circuit. This, of course, is perfectly true, but owing to the negligible inductance of the aerial in the average case, the aerial may be treated as a capacity in parallel with the inductance, and the whole circuit may be treated as a single circuit. In any case, there do not seem to be any particular technical merits about having a pure single circuit constituting the receiving aerial circuit.

When working on short wavelengths, however, especially when the capacity of the aerial is fairly large, better results are often obtained by using a series condenser for tuning purposes. This enables more inductance to be connected across the detector or across the grid and filament of the amplifying valve. Greater potential differences are thus established across the inductance. On the other hand, there are losses in the series condenser which may outweigh any advantage gained

in the other direction. In circuits where a reaction effect is taking place, a series condenser in the aerial circuit often enables greater reaction to be obtained, particularly when fixed coils are used. This is because it is sometimes difficult to get full reaction effects with such coils, owing to the fact that tight coupling is not possible. Under these conditions, by using the larger grid coil the magnetic coupling between the anode circuit and grid circuit may be increased, and a greater reaction effect obtained.

I think that, on the whole, if sufficient reaction can be obtained, it is better to use the condenser in parallel, but to keep its value very small.

Improving the Tone of Loud-speakers

Probably nothing has done more to interfere with the progress of broadcasting than poor demonstrations with loud-speakers. Listeners have been disgusted with the tinny reproduction often obtained with a loud-speaker, but many listeners-in are too ready to blame the loud-speakers when the fault is usually their own. Provided the valves are capable of handling the power desired, and that they are being operated on the correct portion of their characteristic curves, the experimenter has taken the principal precautions. Much more mellow speech and music may, however, be obtained by connecting a condenser across the terminals of the loud-speaker. The value of this condenser will depend, to a certain extent, on the impedance of the anode circuit of the last valve, but a condenser having a capacity of about $\frac{1}{8}$th to $\frac{1}{4}$ of a microfarad should be tried. A couple of $\frac{1}{2}$ microfarads Mansbridge condensers are always useful to have, and they may be connected in series to give $\frac{1}{4}$ microfarad, or in parallel to give 1 microfarad.

THE AMATEUR ORGANISATION

(Continued from page 213.)

SOUTHERN GROUP

Bath, Battersea, Bermondsey, Brighton, Bristol, Bromley, City and Guilds, Kensington Coll., City of London Electric, Cowes, Croydon, Dartford, Ealing, Eastbourne, East Sheen, Erith, Exeter, Folkestone, Fulham, Greenwich, Guildford, Hounslow, Kensington, Kingston, Lambeth Coll., L.C.C., Lyons' Radio, Maidenhead, Newbury, Paddington, Plymouth, Ramsgate, Reading, Redhill, Southampton, South London, Streatham, Sussex (Brighton), Sutton, Sydenham, Trafalgar, Vauxhall Metr. Gas, Wandsworth, Weston-super-Mare, Wireless and Exp. Assn., Woolwich, Worthing.

EASTERN GROUP

(London to Luton, Northampton, Leicester, Derby to the Peak, putting the whole of Yorkshire in the Eastern Group, Durham, Northumberland also.)

Aquarius, E.C.1, Barnsley, Bedford, Birkbeck College, Bishop's Stortford, Bradford, Cambridge, Cambridge (Leys School), Chesterfield, Derby, Dewsbury, Durham, East London, Felixstowe, Grays (Essex), Grimsby, Hackney, Halifax, Harrogate, Heckmondwike, Hertford, Highgate, Holloway, Hornsey, Huddersfield, Hull, Ilford, Ilkley, Ingatestone, Ipswich, Leeds, Leicester, Lincoln, Luton, Middlesbrough, Newcastle-on-Tyne, Northampton, North Lincs., Norwich, Nottingham (Boots), St. Bride's (Fleet Street), Sheffield, Southend, South Shields, South Woodford, Sunderland, Sunderland (Scient. Assn.), Tottenham, Tynemouth, Wakefield, Walthamstow, Wanstead, Whitby, Working Men's College, N.W., York.

FORTHCOMING EVENTS

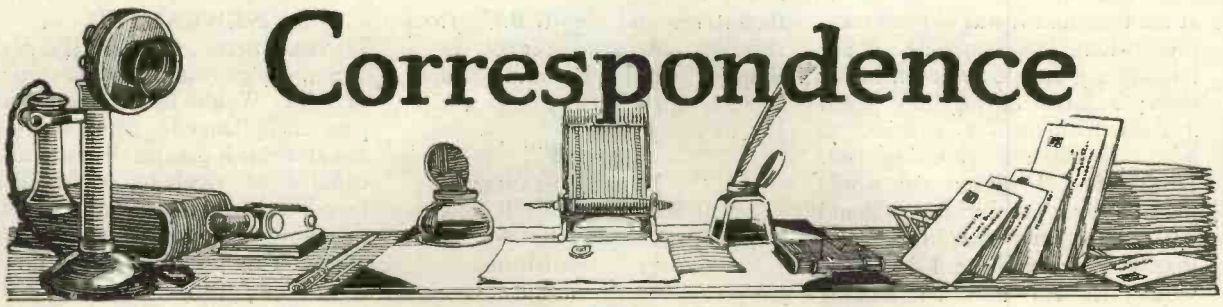
AUGUST.

17th (FRI.).—Hull and District Wireless Society. At 7.30 p.m. Mr. G. E. Steel will read a paper on "Magnetism" at the Co-operative Social Institute, Jarratt Street.

18th (SAT.).—Hornsey and District Wireless Society will visit the Research Laboratories of the General Electric Co. at Wembley.

18th (SAT.).—Hull and District Wireless Society will hold a field day in the neighbourhood of Cottingham.

18th (SAT.).—Ipswich and District Radio Society will visit Felixstowe by invitation from the Felixstowe Wireless Society.



COAST RECEPTION

To the Editor, *Wireless Weekly*.

Sir,—May I be permitted a few lines to reply to Mr. E. J. Williams's correspondence on "Interference" in your August 1st issue?

At his suggestion I have re-read his article, and, of course, every amateur knows that selectivity is at the root of the question, and my previous letter was to show how easily this may be obtained and endeavour to dispel the thought common to many about here that GCC is rather an overpowering proposition. His article seemed to accentuate this rather than its remedy.

Re the unceasing operation for two hours, I still think he means intermittent operation; even navigation warnings rarely extend over five minutes' sparking. What about the silent periods he has for receiving ships which are working with him? It must be remembered he is not a duplex working station.

As to the practical advice, surely the ordinary loose coupled tuner is a simpler method than ST100, which is admitted to be good.

With regard to the mild sarcasm at using three note magnifiers, I distinctly stated the word "or" in my letter; two is quite enough to work even an improvised loud-speaker, which consists of a single earpiece at the base of a wooden horn; a small Amplion is inclined to be too noisy. The object of stating a third stage was simply to show even with this number (above which I don't think the majority of amateurs go) no trouble was given by the coast station.

I think Mr. Williams will agree with me when I say that the disturbance, however small, if strong enough to operate the detector, will be magnified in proportion by each stage of L.F.

I trust these remarks have cleared his points and will assist in dispelling the misunderstanding. I am, etc.,

David G. Aird.

South Shields.

5NO

To the Editor, *Wireless Weekly*.

Sir,—I am rather surprised to see such drastic criticism of 5NO as that offered by "A Would-Be Helper" in your issue of August 1st.

Like this correspondent, I am about 80 miles from Newcastle and use a home-made 2-valve set. To describe the music transmitted from this station as "terrible" seems to suggest that "A Would-Be Helper" is difficult to please, and that he is anything but a good judge. While no one would suggest—not even its own musical director—that 5NO's programmes are all they might be, I venture to assert that they will compare favourably with those of any other British station.

Many first-rate vocalists are to be heard from this station, and the excerpts we get from operas and musical plays by Madame Grant's party and others are really enjoyable, and a credit to the performers.

It has given us the opportunity of hearing such fine bands as St. Hilda's Colliery, the Grenadier Guards, and others, while Mr. W. A. Crosse's instrumentalists are all players of merit. Mr. Crosse himself is a brilliant performer, and his piano and clarinet solos are amongst the most enjoyable items. I am not a lover of the noises that go to make up jazz tunes, but I have heard infinitely worse jazz than that played by Mr. Crosse's orchestra, which, in this line, tries to give us the best of a bad lot.

The programme outlined by "A Would-Be Helper" is all right, but if he is a regular listener he will have already heard many items such as he names. No doubt we shall get some Gilbert and Sullivan in good time.

I have more than once been moved to congratulate 5NO upon the excellence of its programmes, as no doubt have many others who, like myself, would feel genuine regret when they heard the announcement that its musical director was likely to be moved to Bournemouth. I am, etc.,

A. Inkpen.

Cockermouth.

"LOUD-SPEAKING OUT-OF-DOORS"

To the Editor, *Wireless Weekly*.

Sir,—Your valuable journal is constantly drawing attention to the bad effect caused by so-called demonstrations of broadcast reception by means of overloaded loud-speakers, and in this connection I should like to mention a case which should receive immediate attention.

At Teddington recently, while a Regatta was in progress, a large number of the punts and launches on the water were grinding out gramophone tunes. I remarked

at the time that it was beyond comprehension how anyone could tolerate a gramophone, even in the open air, after having once heard a good loud-speaker attached to a good wireless receiving set. Hardly had I spoken the words than a most excruciating sound burst upon my ears, far worse than any gramophone I had previously heard, and on looking round amongst the neighbouring punts to find the offending instrument I perceived that the "music" emanated from two large loud-speakers installed on a launch which boldly displayed a banner bearing the word "Wireless." At the stern of the vessel was a flag on which was written the name of a well-known daily paper.

I listened to the remarks made by people around me, and I can truthfully say that everybody was disgusted with the performance. I know from personal experience the great difficulties of reproducing a large volume of undistorted speech in the open air when only a small aerial is available, but I also know from my own experience that it is quite possible to produce excellent results under such conditions. In any case, since the object of the demonstration in question was publicity, either on behalf of the daily paper or of broadcasting, or both, the promoters should be careful not to let anything loose on an audience of some hundreds, if not thousands, of people until they are sure they are achieving their end in the desired direction.

If this letter should come to the notice of those responsible for the demonstration I should like to assure them that I am expressing not only my personal views, but also those of a very large number of people, many of whom, having heard the painful results obtained, have perhaps decided not to take up wireless "until it sounds less like a bad gramophone."

In conclusion, I strongly recommend the operators on board this demonstration launch to read *Wireless Weekly*, thus saving themselves and the B.B.C. from ridicule. A loud-speaker is a thing of beauty when under proper control, but otherwise it is a killjoy to everybody.

I am, etc.,
JOHN F. STANLEY,
B.Sc., A.C.G.I., F.R.A.
Highgate, N.6.

CRYSTAL RECEPTION

TO THE EDITOR, *Wireless Weekly*.

SIR,—I see in *Wireless Weekly* No. 3 that Mr. Osman, of Leigh-on-Sea, has suggested that contact may have been made by means of minute portions of crystal which remained in the cup after using the ordinary method of crystal reception.

This had occurred to me, and I purchased several new crystal cups and tested the idea on them before any crystal had been placed near them, and obtained quite satisfactory results.

Since my previous letter I have had an opportunity of pursuing the matter and have had success with cat-whiskers of the following metals:—

> Gold, silver, German silver, copper, steel, brass, iron and platinum, and have also had more or less satisfactory results from lead out of an ordinary H.B. pencil, and all this on the new brass crystal cups.

Results can also be obtained with mercury, provided fine adjustment is made on the top of the metal.

I should be glad to hear of any other results obtained in this line, particularly as I recently obtained good results from the platinum cat-whisker, using a piece of "lighter" flint which was still rough and unworn.

I am, etc.,
S. JESSOP.
Battersea, S.W.11.

[The result obtained is quite independent of any crystal, and is no doubt due to an oxidised contact. This form of wireless detector was probably the first kind ever used.—ED.]

NEWCASTLE

TO THE EDITOR, *Wireless Weekly*.

SIR,—I cannot allow the letter of "A Would-Be Helper" to pass unchallenged. Situated as I am at a much greater distance and capable of receiving all British broadcasting, I must say I prefer the Newcastle programme to any other. I receive all its items quite clearly and distinctly. I have already congratulated them upon the production of "The Lily of Killarney." I am at a loss to understand your correspondent's remarks regarding the Announcer. He is as English to me as 2LO; in fact, more so than our Manchester friend; and, in conclusion, I only wish the other stations would give us as varied a programme as Newcastle, and not so much of the "dud" stuff played by their Radio Orchestras. Trusting you will find space for this letter. I am, etc.,
Newry. VALVE.

FUNNY!

TO THE EDITOR, *Wireless Weekly*.

SIR,—Last Sunday week, as I expected friends to hear a broadcast concert, I went to my set at 8 o'clock to assure myself that it was in order.

Hearing faint music, I tightened the coupling, and it came in fairly clear, but as it was only a gramophone record I switched off again.

On going to my window I was surprised to hear the same tune being "gramophoned" from a house down the road. To make sure that I was not mistaken, I went to the set again, and sure enough it was coming through quite distinctly. I used reaction and got it stronger.

Since then, on two occasions, I have been able to tune in this particular house, and hear most of the household noises, laughing of the children, the rattle of the teacups and even parts of conversation.

I should very much like to have an explanation of this happening; perhaps other readers have had a similar experience.

I am, etc.,
Barnsbury. J. C. LANE.

Information Department

Conducted by J. H. T. ROBERTS, D.Sc., F.Inst.P., assisted by A. L. M. DOUGLAS.

In this section will appear only selected replies to queries of general interest or arising from articles in "Wireless Weekly," "Modern Wireless" or from any Radio Press Handbook.

All queries will be replied to by post, usually by return, providing the following conditions are complied with.

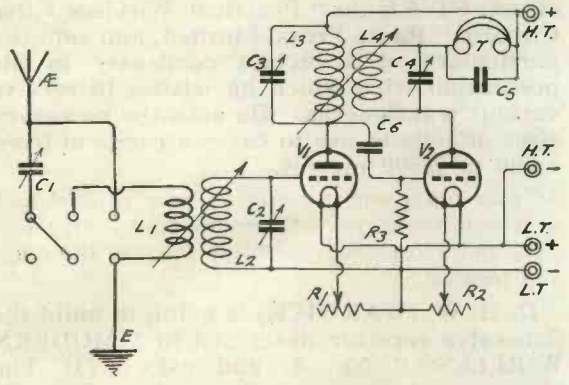
1. A Postal Order to the value of 1s. for each question must be enclosed, together with the Coupon from the current issue, and a stamped addressed envelope.

2. Not more than three questions will be answered at once.

3. Queries should be forwarded in an envelope marked "Query" in the top left-hand corner and addressed to Information Dept., Radio Press, Limited, Devereux Court, Strand, London, W.C.2.

T. H. F. (SHEFFIELD) asks (1) What sort of results might be obtained with a two-valve set using a high-frequency and a detector valve with an aerial 20 feet high and 15 feet long. (2) How many turns of No. 26 gauge enamelled copper wire would be required to cover the broadcast wavelength if wound on a 3in. former.

(1) Under these conditions you should receive Manchester, and, of course, the local relay station, and possibly Birmingham and Newcastle, although these latter two are doubtful. Try to increase the height of your aerial, using two wires separated by 6ft. spreaders if no increase in length is possible. (2) Seventy turns, with tappings at 40, 50, and 60 turns.



We give herewith a suitable circuit diagram for your purpose, showing how a two-valve receiver may be arranged in the most efficient manner. The values for the various components for receiving British broadcasting might be as follows:—

L_1.—A No. 35 or 50 Igranic coil.
L_2.—A No. 50 or 75 ,, ,,
L_3.—A No. 50 or 75 ,, ,,
L_4.—A No. 35 or 50 ,, ,,
C_1.—0.001 μF.
C_2.—0.0005 μF.
C_3.—0.00025 μF.
C_4.—0.00025 μF.
C_5.—0.002 μF.
C_6.—0.0003 μF.
R_1 and R_2.—6 ohms.
R_3.—2 megohms.

The valves V_1 and V_2 should be hard, and the telephones may have a resistance of not less than 2,000 ohms.

J. F. T. (GLASGOW) sends us a description of his crystal receiver, which he proposes to use with an indoor aerial, and asks for criticism.

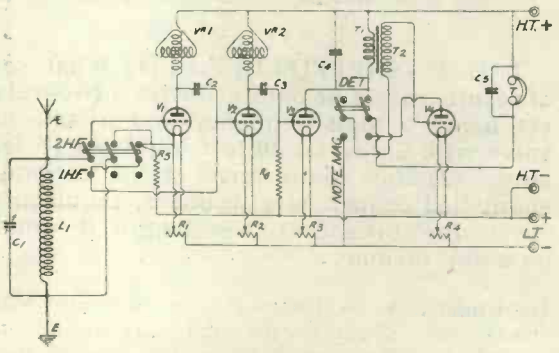
So far as your receiver itself goes, the proposed arrangements are quite good, for the instrument is well designed. We do not think, however, that you will obtain very good results with the indoor aerial which you suggest, and you have omitted to give us any details of your earthing arrangements. We should strongly advise you not to adopt the device of fastening the aerial wire for a considerable distance to the wall of the house by means of staples, even though it is well insulated. You should be able to hear 5SC quite satisfactorily with

this arrangement, but we think that a shorter aerial having several wires in parallel would be more suitable than one wire taken from one room to another in the manner suggested.

H. R. T. (GRANGECOURT) has made up a four-valve set as described in "MODERN WIRELESS," No. 4, and desires information with regard to the use of the last valve as a power amplifier.

The arrangement suggested is quite feasible, but, for really satisfactory results, a special power valve should be employed to the anode, of which a positive potential of from 150 to 200 volts can be applied, whilst provision should also be made for applying a suitable negative potential to the grid of the power valve. The actual anode and grid potential will, of course, vary with different types of valve, and particulars will be supplied by the valve manufacturers.

J. T. R. (COLNE) submits a circuit which he proposes to use for the reception of British broadcasting and asks whether it is suitable.



The arrangement you indicate should ensure satisfactory results, but the condensers coupling the anode coils are much too large. These should have a value not greater than 0·00025 μF, and be arranged as shown in diagram above.

N. G. (WEST HARTLEPOOL) is using circuit ST45 from "Practical Wireless Valve Circuits," Radio Press, Limited, and submits particulars of a certain condenser in his possession with which he wishes to receive various wavelengths. He asks the necessary sizes of coils to use to cover a range of from 1,000 to 2,500 metres.

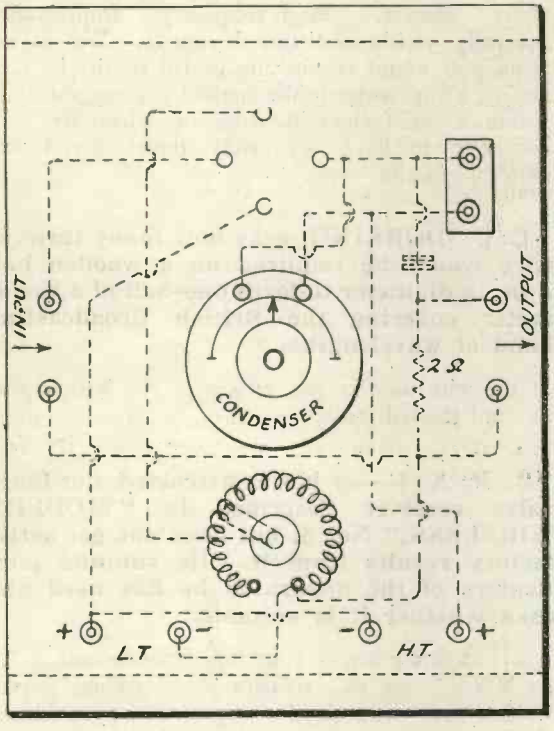
If your aerial tuning condenser is in parallel with your inductance, you will require coils having 100, 150, and 250 turns respectively to cover the range you mention.

D. H. W. (WARWICK) is going to build the five-valve receiver described in "MODERN WIRELESS," No. 4, and asks: (1) The capacity of two small condensers. (2) Whether a 2-megohm gridleak would be satisfactory. (3) What stations he might expect to hear from Warwick.

(1) The capacity of the small condensers should be 0·0003 μF each. (2) Two megohms is a very

good value. (3) Under favourable circumstances you should hear all the broadcasting stations.

H. A. V. (LINCOLN'S INN) asks what components he would require to construct an H.F. amplifying panel.



We give herewith a sketch showing how a suitable amplifier may be assembled. You will require the following :—

1 ebonite panel. 1 var. condenser 0.0003 μF.
1 filament rheostat.
1 coil plug, and valve holder.
A number of terminals, and copper wire for wiring up.
1 fixed condenser 0.0003 μF.
1 gridleak, 2 megohms.

T. R. R. (FUNCHAL, MADEIRA) writes enquiring with regard to the wavelength and powers employed by some of the long wave telephone transmitting stations.

The only high-power telephony stations at present working regularly on the Continent which are of use to you are as follows :—

Paris (Radiola), 1,780 metres, 4 kilowatts.
Paris, 2,600 metres, 4 kilowatts.
Berlin, 2,800 metres, 5 kilowatts.
Rome, 3,200 metres, 4 kilowatts.

Rome and Berlin frequently transmit gramophone records during the morning between 10 and 12 o'clock, whilst the latter station works intermittently during the afternoon and evening. Radiola usually works between 9 and 10 p.m., and transmits a dance programme from 9.35 to 10.30 on Thursdays, and a concert from 2 to 3 p.m. on Sundays. Rome may usually be heard daily between 11 a.m. and 12 noon.

W. T. H. (STOCKPORT) has a crystal receiver and asks us whether clearer signals would be obtained if he attached a two-valve low-frequency amplifier to this receiver.

The results would be much louder, but not necessarily clearer. High-frequency amplification generally yields undistorted signals. We do not think you would obtain any useful results by connecting a variometer in the method you suggest. To obtain a satisfactory measure of selectivity it is necessary to have separately tuned aerial and detector circuits.

C. C. (DORKING) asks how many turns of wire would be required on a wooden ball 2½in. in diameter to form one-half of a variometer covering the British Broadcasting band of wavelengths.

If the wire used is No. 26 s.w.g. you will require to wind the ball full.

J. P. A. (——) has constructed the four-valve receiver described in "MODERN WIRELESS," No. 3, but does not get satisfactory results from it. He submits particulars of the apparatus he has used and asks whether it is suitable.

The condenser across your tuned anode coil is far too large, and this renders sharp tuning impossible. This is probably why you are unable to obtain any great measure of selectivity. The condenser should have a value, as is repeatedly stated in these columns, of not more than 0.00025 μF.

H. F. L. (LONDON, N.W.2) is contemplating building a crystal receiver and asks whether he would obtain better results from (1) an inductively coupled crystal receiving set described in "WIRELESS WEEKLY," No. 5, or (2) a universal tuner described in "WIRELESS WEEKLY," No. 6, together with a crystal rectifier.

If it is your desire to cover a very wide range of wavelengths, the universal tuner would naturally be more suitable for your purpose. If, on the other hand, you simply wish to listen to broadcasting and shipping, the inductively coupled crystal receiver is an exceedingly efficient apparatus, and can be thoroughly recommended.

G. H. (GLASGOW) refers to the illustration on page 217 of "MODERN WIRELESS," No. 3, and asks the purpose of the fifth terminal of the valve panel.

This terminal, which was on the panel when obtained from the manufacturers, has no bearing whatever on the construction of the apparatus under consideration, and therefore only the four terminals similar to those on the second valve panel need be taken into account.

An Experimenter's Licence is well worth having.

This is what the P.M.G. said

"In order to ascertain my position I felt it my duty to place the whole facts before the Law Officers of the Crown, and I have just received the opinions of the Attorney-General and the Solicitor-General.
These are that I am not only entitled, but compelled by law to issue an Experimenter's Licence to those applicants in regard to whom I am honestly satisfied that they are genuin experimenters.
This being so, while it would be wrong to issue an Experimenter's Licence to the man who is obviously merely a broadcast listener-in, it would be equally wrong to decline to issue such licences on a wholesale scale."

To a Representative of the Press

UNDOUBTEDLY a very large number of wireless enthusiasts are contravening the present regulations regarding licences. Some through ignorance, others wilfully because their applications for Experimental Licences have been turned down

If you are a genuine Experimenter prepared to take up Wireless as a serious hobby and not merely as a means of passing a pleasant hour in listening to broadcast Concerts, then you are **entitled** to an Experimenter's Licence

Many applications for Licences have been turned down by the authorities because the applicants were not fully aware of the necessary requirements which had to be fulfilled

This little book by E. Redpath (assistant Editor of Wireless Weekly) has been written to explain exactly what an Experimenter should know and how he should set about obtaining his Licence

Remember this important point—even if a Constructor's Licence is issued, it is practically certain to contain special restrictions regarding the use of Receiving Sets and Circuits. With an Experimenter's Licence your work is practically unhampered Why not get a copy of this book to-day and legalise your position at once and for always?

Gilbert Ad.

RADIO PRESS Series No. 11

Radio Press, Ltd
PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
DEVEREUX COURT. STRAND. W.C.2.

1/-

From all Booksellers & Newsagents, or 1/1½ post free direct.

Printed for the Proprietors. RADIO PRESS, LTD., Devereux Court, Strand, W.C.2, by THE CORNWALL PRESS, LTD., Paris Garden, Stamford Street, London, S.E.1. Published on Wednesday of each week at 3, Bolt Court, Fleet Street, London, E.C.4. Address for Subscriptions and Editorial communications:—Devereux Court, Strand, London, W.C.2. Advertisement Managers:—THE SCHEFF PUBLICITY ORGANISATION, LTD., 125, Pall Mall, London, S.W.1. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates:—32/6 per annum, 16/3 for six months, post free. Sole Agents for Australasia:—GORDON & GOTCH (Australasia), LTD. For Canada:—IMPERIAL NEWS LTD. For South Africa:—CENTRAL NEWS AGENCY, LTD.

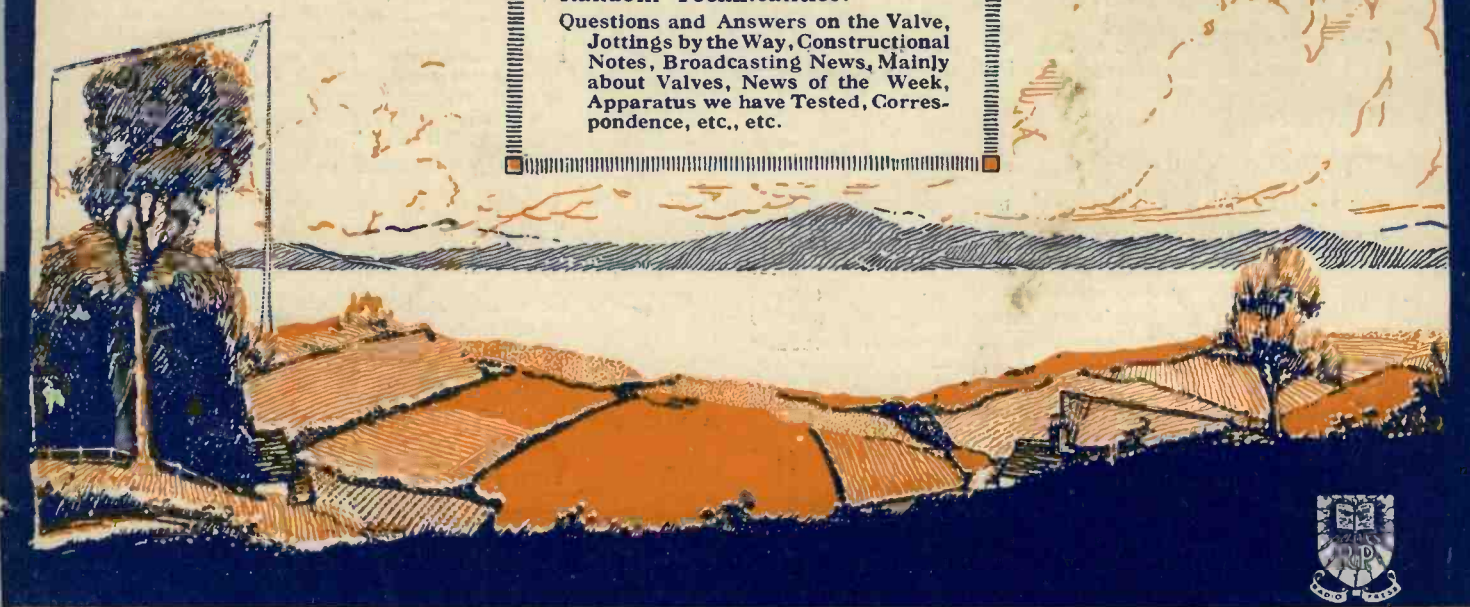
Wednesday, 6d. Net. Vol. 2. No. 6. August 22nd, 1923.

Wireless Weekly

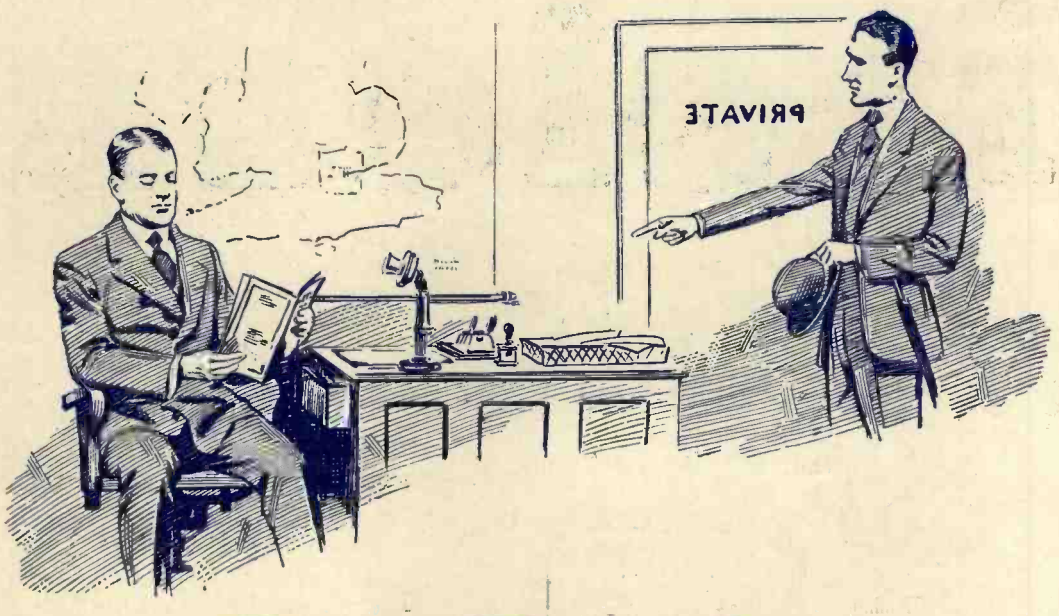
and The Wireless Constructor

Vol. 2.
No. 6.

CONTENTS



The Construction of a 3-circuit Tuner.



Talks with the Wireless Advertiser No. 6

Get Ready

Advertiser : I thought I told you not to broach the subject of advertising until September.

" W.W. " : Sorry, and all that, but I can't help it.

Advertiser : Can't help what——?

" W.W. " : I must remind you that we can now see round the corner and there are good things ahead

Advertiser : What, in the middle of August?

" W.W." : I am bound to say " Yes " because my paper is a sort of barometer of the wireless business——

Advertiser : Oh! Really!

" W.W." : And there are abundant evidences of a " rise."

Advertiser : Ah! But it may be only temporary——

" W.W. " : Look here, Sir! (*shewing advertisement pages of current issue*) these firms are getting ready for the autumn business. They are buying space in the best seller among the weekly wireless papers and impressing their names and products upon an improving market——

Advertiser : Yes, but with what result?

" W.W. " : Will you kindly read this — one of many testimonials?

Advertiser *reads the following :*

Copy of Letter from The Peto-Scott Co., Ltd., Featherstone House, 64, High Holborn, London, W.C.1

Messrs. The Scheff Publicity Organisation, Ltd., 125, Pall Mall, London, S.W.1. 11th July, 1923

Dear Sirs,

We understand from our Agents that our Contract for 13 full-page insertions has expired with the current issue. Because we are so pleased with the results obtained from advertising in " Wireless Weekly " we have instructed them to place with you a further series order of full pages.

In our opinion, the reader of " Wireless Weekly " is just the class of customer we desire to do business with, and we have been able to trace a very considerable portion of our business directly to our advertising in that magazine

Permit us to congratulate Messrs. The Radio Press, Ltd., on the production of such a magnificent weekly wireless magazine.

Yours faithfully, PETO-SCOTT CO. LTD.,
W. Scott Worthington (Managing Director)

—That is a splendid testimonial

" W.W." : And it is genuinely representative of my WIRELESS WEEKLY advertisers.

Advertiser : I really think I ought to wait until September.

" W.W." : As you please, but I'll vouch for it you'll lose a lot of business now and the cumulative effect of much more. Do not forget that " ads." in good papers have a " goodwill " value!

Advertiser : All right; I'll start with a half-page fortnightly, and if it pulls I will increase the space

" W.W." : Thanks! I am confident of the results.

All enquiries for Advertising space in "Wireless Weekly" should be addressed to :—

Scheff Publicity Organisation, Limited, 125, Pall Mall, London, S.W.1.

'Phone—Regent 2440 (2 lines).

Wireless Weekly

Vol. 2, No. 6.
Aug. 22, 1923.

CONTENTS

Editor: JOHN SCOTT-TAGGART, F.Inst.P.

Assistant Editors { E. REDPATH. P. W. HARRIS.

Scientific Adviser:
Prof. G. W. O. HOWE, D.Sc., M.I.E.E.
Advisory Editors:
Prof. R. WHIDDINGTON, M.A., D.Sc.
Prof. C. L. FORTESCUE, M.A., M.I.E.E.

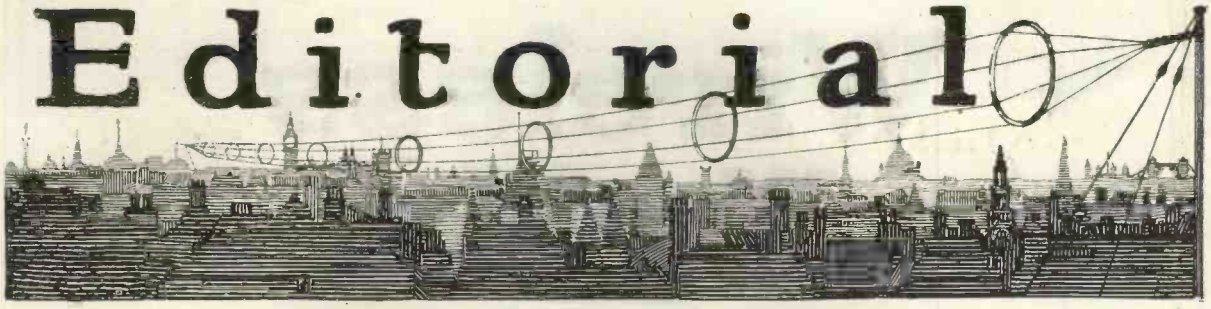
Radio Press, Ltd.
Publishers of Authoritative Wireless Literature
DEVEREUX COURT, STRAND, W.C 2
Tel.—Central 3763.

Advertisement Managers: { SCHEFF PUBLICITY ORGANIZATION, LTD., 125, Pall Mall, London, S.W.1. *Tel.—Regent* 2440.

Staff Editors:
J. H. T. ROBERTS, D.Sc., F.Inst.P.
E. H. CHAPMAN, M.A., D.Sc
A. D. COWPER, M.Sc.
G. P. KENDALL, B.Sc.
A. L. M. DOUGLAS.
R. W. HALLOWS, M.A.
S. G. RATTEE.

All correspondence relating to contributions is to be addressed to the Editor of "Wireless Weekly."

Editorial



The Idea of a Central Broadcasting Studio

WE will be interested to hear the views of our readers in our correspondence columns on the possibility of having a central studio from which concerts would be broadcast, not from a central station, but from the existing stations. Signals might be sent by line to the different broadcasting stations dotted about the country, and radiated from them.

The idea has many merits from the economic point of view. It would be possible to have the very finest programme possible and to dispense with the artistes at the different centres.

The chief disadvantage of the arrangement would be that listeners-in would not be able to make a selection from the different broadcasting stations. As a matter of fact, there are very few indeed who at present listen-in regularly to different broadcasting stations. We have, of course, always heard of the delights of being able to switch over from Glasgow to Cardiff and other stations, but there must be very few in this country who are able to do this effectively. This would be done better if the power of the broadcasting stations was increased.

Apart from this, music which might sound very sweet to the ears of the Londoners would not equally impress the folk in the Highlands of Scotland who would probably want stronger meat. Likewise, the Welshman would probably show no interest in a bagpipe selection.

There are considerable advantages of the present system which, however, would be improved by increasing the power of the different stations and also connecting up London with these provincial stations so that any special item of particular interest could be sent out when required simultaneously from all the centres. The experiments now being conducted by the engineers of the B.B.C. will show what the possibilities are in this direction

Announcers and Their Choice

The absence of familiar voices from 2LO raises a point which is of interest, not only to the B.B.C., but to the tens of thousands who have learnt to appreciate the pleasant voices of the three chief uncles.

During the past week we have been listening to a cultured, clear and refined voice from 2LO, but a voice which lacks youthfulness, personality and enthusiasm.

The announcer is just as much a performer as any artiste. The work of announcing is not, or should not be, merely a mechanical drone. The announcer at 2LO, to thousands of listeners, represents the British Broadcasting Company; in fact, he *is* the British Broadcasting Company. He is the only one with whom the public are in touch. He should be sympathetic, cheerful and, above all, interested in his work. He should possess a sense of humour, and what is best described as a young voice. We cannot see the announcer; our whole impression of him is gained by the quality of his voice. The voice of Mr. Burrows, for example, carries with it an impression of virility, keenness, and a suggestion of fresh breezes on the moors. Mr. Palmer and Captain Lewis also possess attractive voices, but the new voice which has appeared leaves us cold. We suspect that the B.B.C. are trying to train a permanent announcer for 2LO. Captain Eckersley objects to "whiskers on the modulation"; for modulation read "announcer" and you have our views on the matter.

Comments might be made about announcers at other centres. Meanwhile, we hope the B.B.C. will bear in mind the importance of very carefully choosing their announcers and preferably choosing their men from the locality they serve. A Londoner speaking from Manchester might be criticised on the ground of "talking well-off."

WIRELESS RECEPTION IN DENMARK

The following letter has been received from a reader in Denmark. The details regarding the various Continental telephony transmissions are very interesting and afford British experimenters an opportunity of attempting to receive from the stations mentioned.

AS a keen reader of *Modern Wireless* and *Wireless Weekly* I take the liberty of writing you. Here in Denmark we have to build our sets for the purpose of long-distance receiving, and consequently your recent article in *Wireless Weekly*, Vol. 2, No. 3, is of great interest to us.

I work with 2H-D-2L and anode coupling, the first anode coil being fixed, the second anode coil and the aerial coil movable on each side of a fixed reaction coil in the centre. In that way I have obtained the most efficient set for hearing Copenhagen, Berlin (Konigswusterhausen-Eberswalde), Paris (Eiffel Tower-Radiola), and—last, but not least—the British stations.

It means that we here have to work with distances not under 100 miles (Copenhagen), and usually at 600-700 miles (Paris and London). We are able to obtain a regular reception, and of all the foreign stations we appreciate 2LO as the best one. Without paying any kind of tax or royalty or any other modern British kind of invention, we listen to Mr. Burrows's mellow voice and the busy drumsticks of the wireless band.

We get 2LO easy on three valves (H-D-L), more steady on four (2H-D-L), and for loud-speaker we add the second L. The B.S.T. is a nuisance to us, as reception is out of the question before it is dark, which means that we cannot get good reception before 9.30 p.m. at present.

Working with a long-distance receiver, it is wonderful to experience how much more we get out of a high-frequency amplifier than of a low-frequency one. I read that the Americans use up to 5H, but until now I have not found any article in your magazines dealing with more than two stages. It should be interesting to read a little more about the matter, and no doubt many of the experimental licence holders would be able to assist me.

From Copenhagen we occasionally receive good concerts, either from Lyngby Radio or from "Teknologisk Institut" in Copenhagen. Moreover, there is a daily connection of wireless telephony between the island of Bornholm and Copenhagen, and all these stations work at fairly high power, so that we can hear them on one valve here, which is over 100 miles away.

I cannot understand why the experimenters always turn their ears to the West for U.S.A., and why they always report the results from a distance of about 3,000-4,000 miles, and never has one mentioned that he has heard Denmark which is only 600 miles away.

If we can hear London every night, then the British receivers should pick up our stations. Telephone conversation can be heard to Bornholm any day at about 2,400 metres wavelength. Even if the language cannot be understood, it must be possible to pick up the words: "Here is Lyngby, hello," or "Here is Ronne" (a town on the island of Bornholm), or "Here is Amager" (the telephone central in Copenhagen), etc. I live at Aarhus, in Jutland, about 150 miles from Bornholm (on the way to England), and I can hear these telephone conversations on only one D, and very clearly on H-D-L.

It should be more interesting to listen to the concerts from Copenhagen and Lyngby, especially from "Teknologisk Institut," as we get very fine concerts; they use a splendid microphone, which makes the transmission unusually clear and fine. They have no regular service, but usually transmit about twice a week from 8-9 p.m. (B.S.T.), until the Swedish station Karlsborg (SAJ) jams it all out. Occasionally there has been a microphone put on the big orchestra in the Copenhagen Tivoli, and first-class concerts transmitted. They work on 2,400 metres. At 10.30 a.m., 4.30 p.m., and 9.45 p.m. (when Karlsborg has ceased) you may hear weather forecasts from Lyngby Radio (2,400 metres).

The German stations are now working more regularly. From 11 a.m. to 1 p.m. every Sunday Konigswusterhausen transmit good concerts, and a very fine clarinet plays good music accompanied by an organ (wavelength 3,200 and 4,000 metres and sometimes 300 metres). During the weekdays we hear (about 400 miles distance) concerts from Konigswusterhausen 4-5 p.m., and in the evenings from 8-9 p.m., and from 10-10.30 p.m. Eberswalde gives good concerts (2,900 metres).

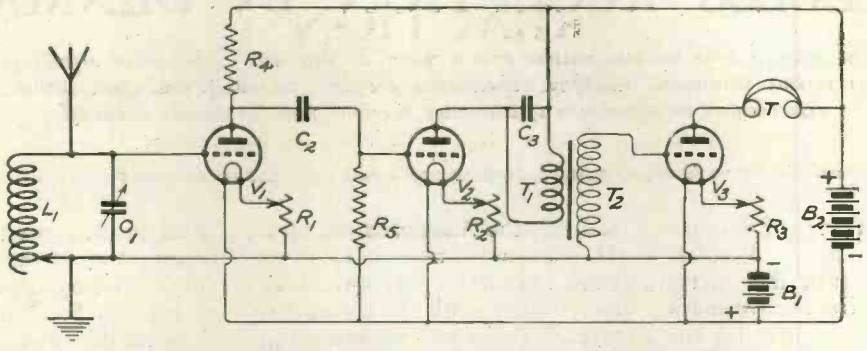
I have not been able to get anything from Russia, although I understand that there are two broadcasting stations in the vicinity of Moscow. The transatlantic receivers might be able to receive these stations, as the distance is shorter.

In conclusion, I thank the British broadcasting stations for the pleasure they bring me every night.

HERMAN NIELSEN.

Aabyhoj, Denmark.

"WIRELESS WEEKLY" CIRCUITS—No. 19



COMPONENTS REQUIRED

L_1 : A variable inductance.

C_1 : A variable condenser, 0.001 μF capacity.

R_4 : A non-inductive resistance about 70,000 ohms.

C_2 : A fixed condenser, 0.0005 μF capacity.

R_5 : A gridleak 4 megohms resistance.

T_1, T_2 : A step-up intervalve transformer.

C_3 : A fixed condenser, 0.002 μF capacity.

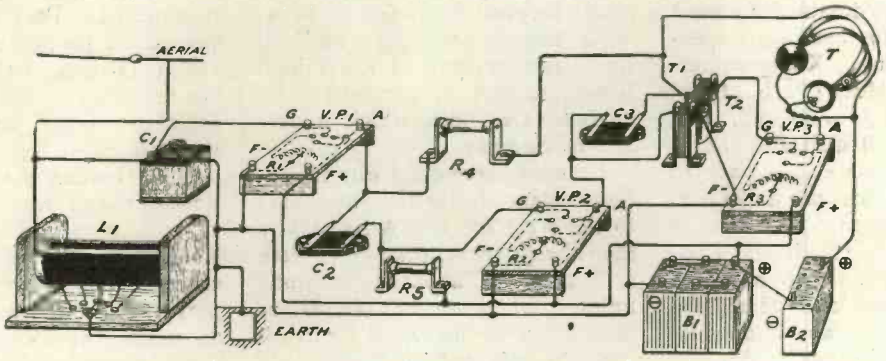
T : High-resistance telephone receivers.

B_1 : Six-volt accumulator.

B_2 : High-tension battery, about 100 volts.

GENERAL REMARKS

This circuit is a very simple one to use, and may be recommended for the reception of Eiffel Tower time signals and telephony. It is not very effective for wavelengths below 1,000 metres.



PRACTICAL WIRELESS NOTES—No. 1

ACCUMULATORS

are always classified according to their voltage and capacity. For instance, a 6-volt 40-ampere accumulator would consist of three 2-volt cells, and would be capable of an output varying from 1 ampere for 40 hours to 4 amperes for 10 hours. The average current consumption of a valve being about .75 ampere, a 40-ampere accumulator should operate a 4-valve set for about 13 hours.

Accumulators should be recharged promptly when the voltage falls to 1.8 volts per cell. The liquid in the cells, known as the electrolyte, should completely cover the plates, any loss due to evaporation being made up by the addition of distilled water. Losses due to spilling should be made up by the addition of sulphuric acid, of specific gravity 1.2 (known commercially as 1200).

The charging rate for an accumulator may be taken to be one-tenth the ampere-hour capacity. To charge an accumulator, the *positive* terminal must be connected (through a suitable current limiting resistance such as a group of carbon filament lamps capable of passing the required current) to the *positive* direct current main. Alternating current mains may be used provided a suitable rectifier is introduced, or, as another alternative, a low-voltage, direct current dynamo may be employed.

INTERVALVE COUPLING AND REACTION

By JOHN SCOTT-TAGGART, F.Inst.P.

This is Part XVII of "Questions and Answers on the Valve."

(Continued from Vol. 2, No. 5, page 200.)

What are the Advantages and Disadvantages of Resistance Coupled Amplification?

Unless special precautions are taken, resistance amplification cannot be carried out efficiently on wavelengths below about 1,000 metres. In any case, the degree of amplification obtained by this method of coupling is not as great as that obtained with the tuned anode method. Resistance coupling (or resistance-capacity coupling, as it is sometimes called—the capacity being the grid condenser of the second valve) has the great advantage that there is no tuning whatever required in the intervalve circuit. In this respect, resistance coupling is even better than reactance-capacity coupling. On the other hand, resistance coupling has the disadvantage that not only is the efficiency not quite as high, but the selectivity is not improved in any way, whereas, in the case of tuned methods of intervalve coupling, the selectivity is greatly improved.

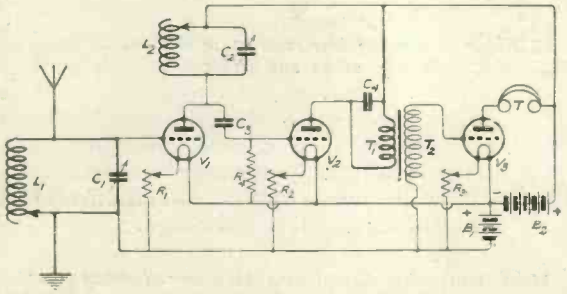


Fig. 1.—A three-valve tuned anode receiving circuit.

Draw and Explain the Action of a Three-valve Circuit in which the first Valve acts as a High-frequency Amplifier, the second as a Detector, and the third as a Low-frequency Amplifier.

Such a circuit is given in Fig. 1. In the anode circuit of the first valve is a tuned oscillation circuit L_2 C_2. A grid condenser, C_3, and gridleak, R_1, are connected in the grid circuit of the second valve, which acts as a detector. The rectified signals pass through the primary T_1 of the step-up intervalve transformer T_1 T_2, the secondary of which is in the grid circuit of the third valve, which acts as a low-frequency amplifier. The tuned oscillation circuit L_2 C_2 is adjusted to the same wavelength as the incoming signals.

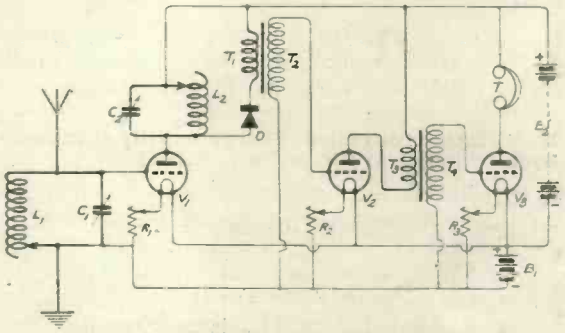


Fig. 2.—A three-valve tuned anode receiver employing a crystal detector.

Draw and Explain the Action of a Three-valve Circuit in which the first Valve acts as a High-frequency Amplifier, followed by a Crystal Detector and two Note Magnifiers.

Such a circuit is shown in Fig. 2. It will be seen that a tuned anode circuit L_2 C_2 is provided, a crystal detector and the primary of a step-up intervalve transformer T_1 T_2 being connected across the inductance L_2. The crystal, it is to be noticed, should have one terminal connected to the anode of the valve. The secondary T_2 of the transformer T_1 T_2 is in the grid circuit of the second valve, which acts as a low-frequency amplifier, as does the third valve.

What is Reaction?

Reaction is a phenomenon by means of which the amplified energy in the output circuit of a valve is, in part, transferred back to the input side to strengthen the currents existing there. Reaction is obtainable whenever a valve is used as a high-frequency amplifier or detector.

Fig. 3 shows a simple amplifier circuit in which the valve has, in its anode circuit, an oscillation circuit L_2 C_2 tuned to the same wavelength as the circuit L_1 C_1. When incoming signals are being received, they are amplified by the valve, the amplified oscillations appearing in the circuit L_2 C_2. These oscillatory currents may be seven times as large as those in the grid circuit. The signals in the

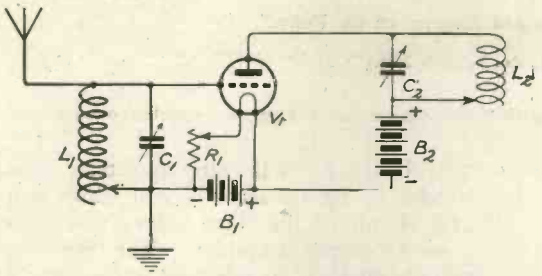


Fig. 3.—A simple amplifier circuit without reaction.

grid circuit may now be greatly strengthened by transferring some of the energy in the anode circuit back into the grid circuit.

How is the Amplified Energy usually transferred back to the Grid Circuit of a Valve?

This is usually done by coupling an inductance in the anode circuit of the valve to the inductance in the grid circuit.

Fig. 4 shows how this may be done. The circuit is exactly the same as Fig. 3, except that the inductance L_2 is now coupled, in a variable manner, to the aerial inductance L_1. The circuit is not a wireless receiver, but is merely intended to help in the explanation of reaction. As we bring the inductance L_2 closer to L_1, some of the oscillatory energy in the circuit L_2 C_2 is transferred into the circuit L_1 C_1. Owing to the coupling between L_2 and L_1, the inductance L_2 induces oscillations into the inductance L_1, and these, if they coincide with the oscillations in the grid circuit, due to the incoming wireless waves, will strengthen the oscillations existing in the grid circuit. In this way the oscillations in the grid circuit are built up to a much higher value than would otherwise be possible.

What is the name given to the Inductance in the Anode Circuit of the Valve?

When the inductance is coupled to the grid circuit to obtain reaction, the coil is known as the "reaction coil."

Why is it important to see that the Reaction Coil is coupled the right way round to the Grid Circuit Inductance?

It is important to see that the high-frequency oscillations induced from the anode circuit of the valve to the grid circuit coincide with, and therefore help, the oscillations existing in the grid circuit. Thus, when the oscillations in the grid circuit, due to the incoming waves, make the grid positive, it is important to see that the extra oscillations induced in the grid circuit by the reaction coil also tend to make the grid positive. Likewise, when the grid is being made negative by the existing oscillations, the induced oscillations from the anode circuit should also make the grid negative, the joint effect being therefore much greater than would ordinarily be the case. If the reaction coil is reversed, either by turning the coil the other way round or by reversing the leads going to the coil, the oscil-

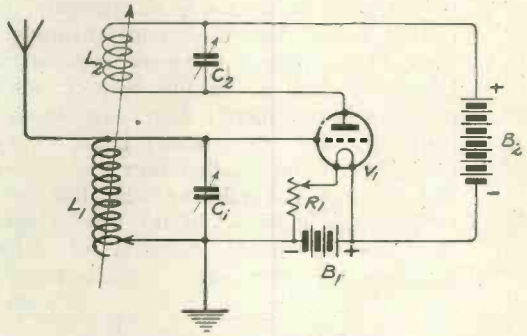


Fig. 4.—Showing how reaction is obtained by coupling anode and grid coils.

lations induced into the grid circuit will tend to oppose the existing oscillations, and instead of there being an amplification effect, the circuit will usually work less effectively than without any reaction coil at all.

How may the Amplified High-frequency Oscillations which have been strengthened by Reaction be Detected?

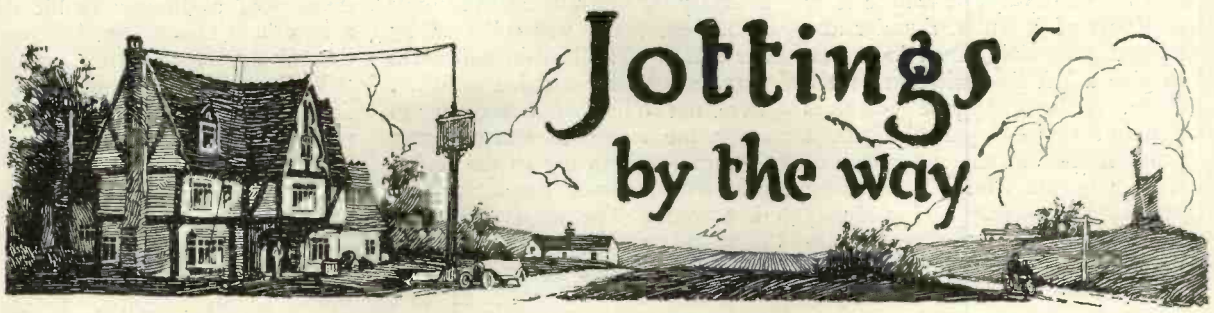
They may be detected either by a separate crystal detector or they may be detected by the valve itself.

IN OUR NEXT ISSUE will appear

"AN EXTREMELY SELECTIVE DUAL CIRCUIT"

By A. D. COWPER, M.Sc.

This article will prove of especial value to readers who experience difficulty in receiving from distant stations owing to interference from a near-by broadcasting station.



Fetters of Convention

ARE we too hide-bound by rules and laws that we accept and obey merely because others tell us that they are so? I often wonder. Of the golden rules laid down by the greatest experts nearly every one can be violated at times with complete impunity. Many of these things were said long ago; they have been accepted as a kind of gospel and handed down to us. We believe them and practise them just because they are so constantly drummed into us as fundamental truths. You can prove the soundness of any one of them in theory, but in practice they don't always work out. Here is an instance. We read everywhere that for short-wave reception the aerial tuning condenser should always be in series. Theoretically nothing should command more respect, for the effect of capacity upon a tuned circuit is like that of the presence of a strait-laced clergyman at a smoking concert: it damps. By all calculations you should reduce signal strength if you try to receive distant broadcasting stations with the condenser in parallel. In actual fact do you? Try it and see. Provided that the inductance is of good design and well made, you will be hard put to it when blindfold whether the condenser is in series or in parallel. For myself, I frankly and freely admit that I can detect no difference whatsoever.

Smoggsmith

Near me dwells one whom I will call Smoggsmith. He became quite a convert to wireless, and, following the guiding principle of his life, he decided that if the thing were worth doing at all it was worth doing well. I may mention that he successfully applied the same maxim to the Government during the war when he saw service as a contractor. So well did he do them that when the wireless boom came along he was able to install not a crystal, but a five-valver rigged up in a wonderful Louis XV. cabinet. His aerial towered to the heavens; for his earth, men delved down an appreciable distance towards the antipodes. Insulators ranged themselves upon the guys like swallows on telegraph wires. His lead-in tube was a masterpiece of efficient insulation Yet all was not well with the 200-guinea "Welkinrender" that graced his drawing-room. London was a still small voice. Birmingham was even stiller and smaller; Manchester and Newcastle could be enticed into the loud-speaker only at the rarest of rare intervals. Smoggsmith is not the sort of man to be easily beaten. To him the performances of other local enthusiasts were as gall and wormwood. He had paid the best price, therefore he must have the best set. He summoned one at the mention of whose name all real wireless men take off their hats. The master demanded an exorbitant fee, hoping that by doing so he would choke Smoggsmith off. He received a cheque by return of post. On his arrival he quickly diagnosed the trouble. Smoggsmith had but six insulators at each end of his aerial; three more were obviously required. His earth lead was of 7/22's; let him install 7/18's forthwith; Smoggsmith heard and obeyed. He added the insulators and renewed his earth lead. His results are now perfect. What I want to know is why an insulator here or there, or a trifling alteration in the gauge of the earth wire, should make all the difference to Smoggsmith's set, whilst the friend I referred to in *Wireless Weekly*, Vol. 1, No. 14, can get all the results that he or any reasonable being could desire on apparatus that would make the consultant's hair turn grey in a few seconds. Do you think that the deity who presides over wireless—it must be Mercury, the winged messenger of the gods, about whom some strange tales are told—is taking it out of Smoggsmith by making him do really well the thing that is worth doing?

A Foolish Deed

Some queer happenings took place during the great thunderstorms which raged towards the middle of July. One of the most amazing spectacles was that presented by dripping figures arrayed in pyjamas, who struggled upon countless roofs in London town amidst rain that came down in torrents, and lightning that flashed at almost every second, to dismantle their aerials for fear that they should attract one of Jove's thunderbolts and bring dire destruction upon the house and all that it contained. If you, reader, were one of the pyjama-clad toilers you will forgive me if I say that you could have done no more foolish thing. When such storms are about, the aerial, if not connected to earth, may become charged to a very high potential,

and he who essays to handle it or any part of it whilst thunder and lightning are doing their level best to give a lifelike imitation of the Zepp. raids of bygone years, is risking a very saucy kind of shock even if he is not actually endangering his life. Earth your aerial and you may feel perfectly safe, for it forms as fine a lightning conductor as you could wish to have.

The Proof of the Pudding

I happened to be talking this matter over early in the month with one who has every right to call himself an expert of the first order. He expressed the opinion that the aerial was undoubtedly a protection, but he was inclined to be a little sceptical of the idea that it provided a complete safeguard.

On the following evening one of the worst storms on record burst over the little town where I live and move and have my being. Many trees were struck, and dozens of flashes went to earth in the high-lying fields. Whilst Nature's artillery practice was at its height I chanced to look through the field glasses that I was using at a house belonging to a friend which stands high above the town on the 500ft. contour line. Suddenly his aerial was outlined in fire; the parallel wires appeared to be white hot, and vivid brush discharges were visible across the insulators. This firework display continued for several seconds.

Next morning I met the friend at the station, and as we waited for the up train to make its appearance I told him what I had seen. "Yes," he said, "the aerial has absolutely gone west; but there can't be any kind of doubt that if it hadn't been there the house would have been struck." What happened was certainly that a discharge which in ordinary circumstances would have struck the house was collected by the aerial. The lead-in and earth wire, which were coupled together, were not quite stout enough to carry the enormous charge away to earth and, owing to the resistance encountered, the aerial was destroyed. The masts were not damaged, and surely it's worth while to avoid a calamity at the cost of five bobs' worth of wire and a few insulators!

The Moral

The lesson to be learnt from this seems to be that if you earth your aerial you are quite safe in a thunderstorm so long as lead-in and earth wire are of heavy gauge. His were 7/22's. Probably if they had been of 7/18's or perhaps rather stouter wire little or no damage would have been done. Either provide a good, solidly made earthing switch and mount it on porcelain outside the house or, better still, connect the two wires together and let them swing right away from the building. You may then retire to your couch, and even if the noise keeps you awake you need have no apprehension about the danger of your abode being struck.

Wrecked by Radio

Rather a painful little episode occurred in Little Puddleton the other day. The Snaggsbys had asked the Grubworthys in to tea. Now it so happened that, unthinkingly, Mrs. Snaggsby had selected the time of dead low water—that is to say, the period immediately before quarter day, when her husband's banking account had shrunk to proportions that would have been invisible to even the most powerful microscope. She desired to make rather a splash over the tea, but when she approached her spouse his summing up of the situation and the production of a threepenny bit with a hole in it and a bent halfpenny dashed her hopes to the ground. "Well, can't be helped," said he finally, "they'll have to have a rotten tea, but thank goodness we'll be able to take their minds off it by having the wireless set working."

This was a consoling thought, and it appeared that everything would go off according to plan. Mrs. Grubworthy was immensely interested in the woman's hour, which led off with a talk on fashions, followed by a discourse on how to remove freckles, or something of that kind. Grubworthy was not particularly interested in ninon or beige, and he felt no pressing need to rid himself of his freckles. But he had never heard wireless before, and he was loud in his expressions of admiration. Both guests mopped up bread and butter as though it had been the richest cake. The situation appeared to be saved. Snaggsby had just winked knowingly at his wife and received an answering smile when the blow fell.

"And now," said the voice, "I will give you some of Mrs. Squeal's ideas for dainty afternoon teas. The first is . . . ." But what the first was no one heard, for, with commendable presence of mind, Snaggsby flicked out a high-tension battery plug and announced a breakdown. He had been quick, but not quick enough. The Grubworthys deprived of the distraction, and, with appetites whetted by those unfortunate remarks, turned again to the tea table, whose nakedness now became strikingly apparent. There was an air of constraint about the subsequent conversation, and when they left Mrs. Snaggsby burst into scalding tears. Really those broadcasting people should be a little more careful.

WIRELESS WAYFARER.

DESIGNING SIMPLE CRYSTAL RECEIVERS

By E. REDPATH, Assistant Editor.

The first part of this article, which appeared in last week's issue, dealt with the general principles governing the design of crystal receivers, and the construction of a single-slide tuner. In the present article the construction and use of two-slide and tapped inductances are dealt with.

(Continued from Vol. 2, No. 5, page 203.)

Double-Slide Tuning Inductances

MERELY for the cost of another brass rod and slider, and the slight trouble of fitting it as shown in Fig. 6, considerably improved results, particularly with regard to the tuning, may be obtained.

The modified circuit arrangement to be employed in this case is shown in Fig. 7. It will be noted that we now have two tuned circuits. The aerial circuit, comprising the aerial itself, those turns of the A.T.I. included between the aerial terminal and the slider S_1, and the earth connection; and a closed oscillatory circuit comprising those turns of the A.T.I. between the aerial terminal and the slider S_2 and the variable condenser C.

This variable condenser need not be of large capacity, and, if built up from the standard plates and fittings now on the market, should consist of six fixed and five

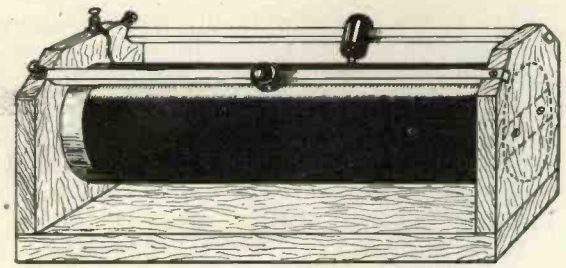


Fig. 6.—A simple but effective tuner employing two sliders.

movable plates. Alternatively a tubular condenser may be used consisting of two metal tubes, $\frac{3}{4}$in. outside and $\frac{7}{8}$in. inside diameter respectively, the smaller tube being wrapped with two or three thicknesses of wax-impregnated typewriting paper and arranged to slide smoothly inside the larger tube. An insulating knob should be attached to the inner tube and flexible wire conductors should be soldered to each tube.

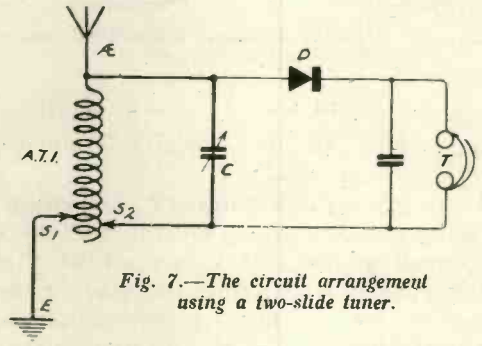


Fig. 7.—The circuit arrangement using a two-slide tuner.

A simple form of tubular condenser may readily be made from a cylindrical lamp glass or test tube coated with tinfoil on the outer side, whilst a metal tube or a tinfoil-coated wooden rod is arranged to slide inside it.

The advantages of this circuit arrangement are, firstly, the tuning is more selective, and, secondly, higher potentials can be applied to the crystal detector D owing to the fact that more turns of the A.T.I. may be included in the secondary circuit than in the aerial circuit, thus giving a "step-up" effect.

The actual windings of the tuning inductance for various ranges of wavelengths were given in the last article. Reference to Fig. 6 will show that three terminals are now required to be fitted upon one of the wooden end pieces which hold the coil and slider rods in position. The central terminal is directly connected to the end of the winding, whilst the other two are attached to the

slider rods, one to each, and may conveniently take the place of the usual securing screw.

From the circuit diagram, Fig. 7, it will be obvious that, as the slider S_1 is moved along the coil, more or less turns of the inductance are included in the aerial circuit, thus varying the wavelength of that circuit. The position of the slider S_2 determines the number of coils included in the closed oscillatory circuit, and, for the best results, the number

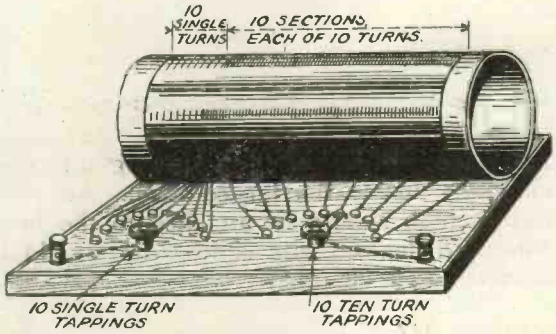


Fig. 8.—A tuning inductance with multiple and sub-multiple tappings.

of turns should be as large as possible and the capacity of the variable condenser C should be kept small.

During any preliminary searching for signals, this condenser may be set to about a quarter of its full value, whilst the two sliders are moved along the coil practically opposite one another. Upon signals being received, the slider S_1 should first be adjusted to give the best results; then the slider S_2 and the variable condenser C should be varied, and, finally, a slight readjustment of the slider S_1 should be tried.

Anyone who has made and used the single-slide inductance previously described, which, with its single adjustment, enables signals to be received with comparative ease, will find it very instructive to modify his set in accordance with the foregoing particulars and note the improvement obtainable, both as regards strength of signals and selectivity.

Tapped Inductances

This name is given to a form of inductance coil in which variation of the number of turns in circuit is effected by making permanent connections at various points along the coil, with a number of contact studs over which a suitable contact arm rotates, thus selecting the point on the coil where the current shall enter or leave it.

The connections upon the coil are known as "tappings," and the rotating switch arm with contact studs as a tuning switch. This arrangement enables positive contact to be made with any of the selected points on the coil, and, if properly made and fitted, is particularly smooth and quiet in operation, on account of which it is adopted by many in preference to the slider pattern.

Multiple and Sub-multiple Tappings

Suppose I have decided to wind a small inductance coil suitable for the reception of broadcasting, to consist of 110 turns of wire. If I divide the coil into eleven sections each of 10 turns, connect one end of the coil to the aerial terminal, and connect each of the "tapping points" and the other end of the coil to one of the contact studs of a 10-point tuning switch, it will be obvious that at each movement of the switch I shall vary the inductance in jumps of 10 turns at a time, and accordingly will require a variable condenser of fair capacity in order to obtain continuously variable tuning, or, in other words, to tune in between any two adjacent tappings.

Large-capacity variable condensers, however, are to be avoided as much as possible in receiving sets, and particularly in crystal receiving sets, where it is more than ever necessary to make the utmost use of the potentials available.

If I take the first section of 10 turns and subdivide it, connecting each individual turn to a contact stud of a second ten-point switch in the manner shown in Fig. 8, I can vary the inductance included in circuit from 1 turn to 110 turns, progressing one turn at a time if necessary. In Fig. 8, for instance, the right-hand switch includes 50 turns, there is one turn between the adjacent end contact stud of each switch, and the left-hand switch is just being moved from the fourth to the fifth stud. The total inductance, therefore, is just being increased from 54 to 55 turns.

With this arrangement variable condensers may be dispensed with altogether if desired, and the tuning effected accurately to the nearest single turn, by means of the two tuning switches alone. Alternatively a variable condenser, which need be of small capacity only (say, 0.0001 μF), may be connected in parallel across the active portion of the inductance.

(To be continued.)

News of the Week

WE learn from a French correspondent of the formation of the Radio Club d'Anvers, and take this opportunity of wishing its members every success. Any interested reader should communicate with the secretary, Mr. Maurice Meeus, 17, Place de la Comédie, Anvers.

◇ ◇ ◇

An interesting field day was spent on August 4th at Levington Bridge by the Ipswich and District Radio Society and the Felixstowe Wireless Club. Experiments were carried out with kite aerials and various apparatus belonging to members of the respective clubs. It suggests itself to us that during the summer such outdoor meetings hold considerable attraction.

◇ ◇ ◇

We learn that the headquarters of the Radio Association have been removed to Sentinel House, Southampton Row, London, W.C. The president of the Association is the Hon. Sir Arthur Stanley, C.B.E., C.B., M.V.O. Full particulars regarding membership and fellowship of the Radio Association are obtainable from the hon. secretary, Mr. S. Landman, M.A., Sentinel House, Southampton Row, London, W.C.

◇ ◇ ◇

We are given to understand by a correspondent that a gang of sharp-witted, smartly dressed rascals are just now reaping a rich harvest from pawnbrokers in Dublin and other Irish cities. Their *modus operandi* is to pledge wireless crystal sets, and in some cases, by producing faked receipted accounts alleging as much as fifteen guineas to have been paid for their apparatus, they have been able to induce confiding pawnbrokers to advance up to £7 and £10 for each.

◇ ◇ ◇

In recognition of his services rendered to American shipping during the war, Commander Schofield, of the Wireless Training College, Cardiff and Bournemouth, has been elected an Associate of the Radio Section of the New York College, thus becoming an Associate Member of the Institute of Radio Engineers.

Members of the Ipswich and District Radio Society and the Felixstowe Wireless Club on the occasion of their field day at Levington Bridge on August 4th.

◇ ◇ ◇

During the war Commander Schofield supplied the United States Shipping Board with wireless operators and allowed operators of the U.S. Navy, which had a base at Cardiff, to attend his Cardiff College for lectures, without charge.

◇ ◇ ◇

It appears that complaints are being made by Cornish listeners-in that French ships are constantly interfering with their reception of the Cardiff Broadcasting Station. These vessels are French trawlers fitted with wireless for the purpose of indicating to other vessels of the fleet when a good patch has been found in the shipping ground. We would suggest to these listeners-in that they experiment with Mr. Harris's wave-trap described in our last issue.

◇ ◇ ◇

A somewhat unusual prosecution engaged the attention of the Neath (Glamorgan) Borough magistrates recently, when the defendant, Mr. Neville Thomas, a chemist who is an agent for wireless sets, was summoned for causing a street obstruction. Evidence was given by a police constable that Mr. Thomas was providing a wireless concert at his shop which resulted in a crowd of some 300 people collecting outside. The officer said that when he spoke to the defendant the concert was stopped. The Justices held that an offence had been committed, but since this was the first prosecution of its kind they recorded no conviction, the summons being dismissed on payment of costs.

◇ ◇ ◇

A demonstration of the use of wireless telephony on aircraft was given to Sir Samuel Hoare, Secretary of State for Air, and Lady Hoare, when they recently flew to Gothenburg, Sweden, for the International Air Exhibition. The Daimler Airway Napier D.H.4 aeroplane in which they travelled was fitted with the Marconi A.D.2 wireless telephone set, the apparatus with which all British commercial machines are equipped, and extra telephones were provided to enable Sir William and Lady Hoare to listen to the conversation with the ground stations during the voyage. Leaving the

Croydon aerodrome they reached Gothenburg the following day, having inspected part of the London-Berlin airway *en route*

◇ ◇ ◇

A new wireless company entitled "The Svenska Rundradiobolaget" is being founded at Stockholm with a capital of 100,000 crowns minimum and 300,000 crowns maximum. This new concern intends applying for a broadcasting concession.

◇ ◇ ◇

We learn that Major-General Sir F. H. Sykes, C.B.E., K.C.B., C.M.G., Chairman of the Broadcasting Committee, has been elected to the Board of the *Daily Express* Remembering this newspaper's previous energetic action in wireless matters, we trust the new environment will result in the early publication of the long-awaited report.

◇ ◇ ◇

The problem of fitting an aircraft carrier—that is, a vessel with a perfectly flat top deck—with an aerial has been solved by installing 50ft. masts which can be raised and lowered by hand. There is also an auxiliary aerial slung out on davits for use when aircraft are about to "land" on board.

◇ ◇ ◇

We understand from the *Hull Daily News* that, according to American statistics, there are now 4,000 wireless manufacturing concerns in the United States, employing 75,000 workmen.

◇ ◇ ◇

Undoubtedly the recent action of the London station in amending its wavelength during morning concerts to 400 metres is much appreciated by listeners in Northern Ireland, but similar improvement is much needed for reception generally, as most items are still indiscernible until after 9.30 in the evenings. Birmingham, since the removal to the new station, has become as distinct as Manchester

◇ ◇ ◇

With reference to the paragraph appearing in our last week's issue in regard to Messrs. Gent & Co., Ltd., Faraday Works, Leicester, the system of electric clocks, made and supplied by this firm, should have read "Pulsynetic" Electric Impulse Clocks.

◇ ◇ ◇

Dublin Horse Show usually constitutes a festival of attractions, and this year proved no exception; the Marconi wireless concerts in the West Hall during the afternoons almost rivalled the horse jumping and dress parade in the beautiful gardens. In fact, it was an entertainment in itself to overhear the admiration and comments of the listeners.

Our photograph shows the band of the Royal Air Force at the new studio of the Birmingham Broadcasting Station.

Aviation, wireless telegraphy, and domestic subjects are included in the series of lectures arranged by the L.C.C. Education Department for teachers. Poetry and the drama will be dealt with by such well-known experts as Sir Israel Gollancz, Sir Johnston Forbes-Robertson, and Mr. St. John Ervine.

◇ ◇ ◇

A Cambridgeshire vicar recently shortened his service by cutting out the sermon, saying there was to be a good sermon to be heard on the loud-speaker at the village institute.

SOME NOTES ON VALVE MANUFACTURE

By Dr. J. H. T. ROBERTS, D.Sc., F.Inst.P., Staff Editor (Physics).

A brief explanation of the various physics of the valve.

Use of Tungsten for Valve Filaments

THE employment of tungsten for the filaments of valves is a natural consequence of the experience which had been gained of the use of this metal for the filaments of incandescent electric lamps. A substance when heated to a sufficiently high temperature will yield a thermionic emission, but, as already explained, the emission increases enormously as the temperature reaches a white heat; it is therefore advantageous to employ a material which is capable of being raised to a very high temperature. The thermionic emission from carbon at a white heat is very considerable, and the phenomenon of the surrounding electrification was first observed by Edison in connection with the carbon filament of an electric lamp.

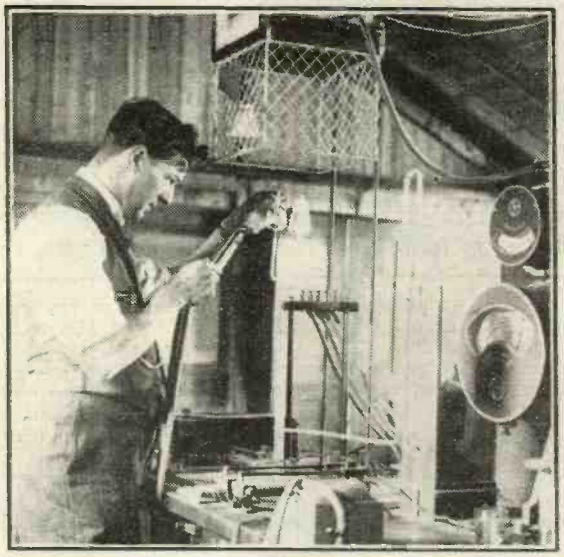
About 1904, however, the highly refractory properties of tungsten filaments began to be realised, and in 1906 the process of drawing tungsten wire was perfected by the General Electric Company of America. Previously tungsten filaments had been produced by squirting threads of tungsten powder, held together by means of a binder which was eliminated in the subsequent heating.

Tungsten is an exceedingly refractory substance, and has a melting point in the neighbourhood of 3,300° C., but the practical operating temperature in a vacuum is round about 2,000° C. If a tungsten filament is run at a much higher temperature than this, the metal disintegrates and volatilises, the volatilisation being indicated by the blackening of the bulb.

It will thus be seen that whilst tungsten when raised to a temperature in the region of 2,000° C. gives a sufficient thermionic emission, it is at the same time a long way from its disintegrating and melting points: it is, therefore, particularly suitable for employment in the manufacture of valve filaments.

The Pressure in a "Hard" Valve

Theoretically the gas pressure in a "hard" valve should be zero, but in practice it is impossible to produce an absolute vacuum. In fact, it is not entirely necessary; the point



The final process in making a valve. The air in the bulb is exhausted through a glass tube. A blowpipe is finally used to seal off the tube at the pip.

is that the collisions of the gas molecules with the emitted electrons and with the filament shall be negligible. In a really highly exhausted valve the pressure is probably between 0.00001 and 0.0001 millimetre of mercury. If the pressure rises as high as 0.005 millimetre, ionisation of the gas will cause bombardment of the filament, with the result that the latter will soon be destroyed.

Not only must a very high vacuum be

obtained when a valve is manufactured, but this vacuum must be maintained during the life of the valve. Traces of water-vapour are particularly objectionable: the water-vapour becomes dissociated at high temperatures in the vicinity of the filament, the oxygen combining with the tungsten and forming tungsten oxide, which is thrown off from the filament and subsequently reduced by the hydrogen; in this way a film of metallic tungsten is deposited upon the walls of the bulb and the water-vapour remains to carry on the same process indefinitely. It thus acts as a catalyst in the vaporisation of the filament.*

Occluded gas must also be removed from the metal electrodes (filament, grid, anode) and from the glass walls of the vessel. The bombardment of the anode and grid and the prolonged heating of the filament have already been referred to. Owing to the comparatively large area of the glass bulb, the latter is an important reservoir of occluded gas. This gas may be partially removed by heating the bulb to a temperature of about 400° C. during the evacuation. In order to prevent the glass from collapsing (owing to the air-pressure outside and the vacuum inside) at a temperature of 400° or somewhat higher, a special low-pressure heating chamber is sometimes employed, in which the pressure can be reduced to a few millimetres of mercury whilst the heating of the bulb takes place; the full atmospheric pressure is thus kept away from the bulb until the latter has been allowed to cool down.

The various pumps and other appliances employed in the production of high vacua will be dealt with later on. One very useful discovery which has been made in this connection is that a small quantity of phosphorus introduced into the bulb has the property, particularly under the influence of electrification, of absorbing or "cleaning up" a considerable quantity of residual gas. Phosphorus is not unique in this respect—other substances may be used for the purpose—but it is probably the most reliable. It may be mentioned that although this little manufacturing dodge is so simple, the nature of the action of the phosphorus is quite obscure. The practical result of the use of an agent of this kind is that the last traces of gas need not be extracted from the bulb before the sealing off; the only condition is that the remaining gas, together with that which is occluded on the walls and in the metal parts, is within the absorbing capacity of the phosphorus. This "cleaning-up" agent is frequently used in connection with the manufacture of electric lamps. It must be remembered, however, that the exhaustion of "hard" wireless valves requires to be much more complete than that of electric lamps, and the exhaustion is carried as far as commercially practicable before the valves are sealed off from the pumps, the latter including in the final stages rotary molecular or diffusion pumps.

* Effects of this kind were the subject of a research published in 1912 on the "Disintegration of Metals at High Temperatures" by the writer, who first established theoretically and experimentally the effect of oxygen as a catalytic carrier in certain cases of apparent volatilisation. Since then many industrial difficulties connected with this cause have been successfully understood and overcome.

BOOK NOTES

The Wireless Telephone: What it is, and How it Works. By P. R. Coursey. (The Wireless Press, Ltd., 12-13, Henrietta St., W.C.2.) 112 pp. Price 2s. 6d.

This volume contains a short descriptive account of the apparatus employed in wireless telephony. The book commences with a discussion of sound-waves and the fundamental principles of radio-telephony, which are simply and intelligently described; the component parts of the apparatus, such as condensers, inductances, etc., are next described and illustrated, and a layout of a crystal receiver is given. The construction of the three-electrode valve is fully described and illustrated, and the various parts of a valve receiving apparatus are given, together with picture-wiring-diagrams. Loud-speakers also receive attention, and the employment of wireless on aeroplanes, on trains, and in other special cases is considered. The book is principally descriptive, but in the final chapter short instructions are given for the making of a three-valve receiving set. The book is well illustrated and should prove equally interesting to the intending and to the accomplished wireless experimenter.

THE CONSTRUCTION OF A REINARTZ RECEIVER

By STANLEY G. RATTEE, Staff Editor.

This article, concluded from No. 5 issue, deals with the connecting up and operation of the receiver.

The Ebonite Panel

THE positions of the holes for drilling should be determined by means of intercepting lines made with the aid of scribers on the underside of the panel, and at the point to be drilled a centre punch should be used to start the hole. The positions of the drill holes, together with all necessary panel dimensions, are shown in Fig. 4, and for that reason no further explanation is needed. With the positions of the holes correctly marked, the panel should be placed face downwards on a flat surface for drilling, and in this connection particular attention is called to the fact that every care should be exercised not to use too great a pressure on the drill when it is about to come through, otherwise considerable disfigurement to the panel will result by the ebonite becoming chipped round the holes.

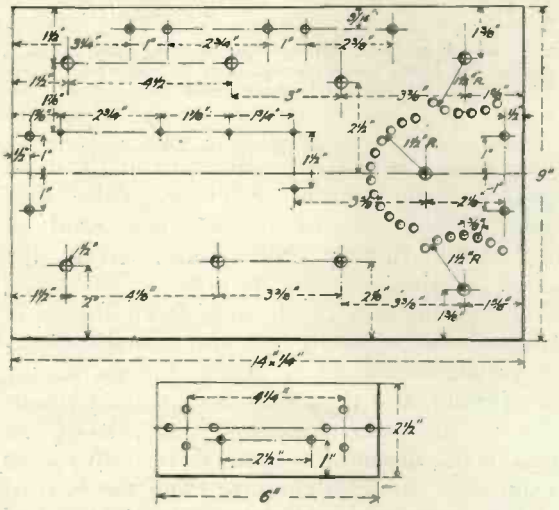


Fig. 4.—Showing dimensions and drill sizes of main and valve panels.

When the drilling is completed the whole panel should be rubbed on both sides with fine emery paper in order to remove the glossy but undesirable surface.

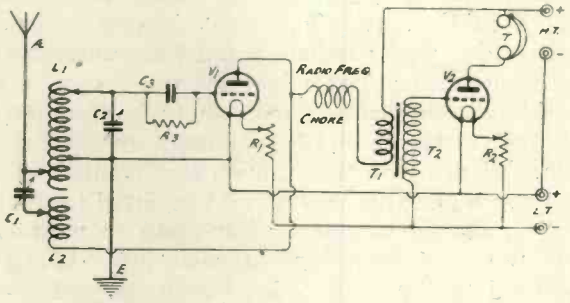


Fig. 5.—A theoretical circuit diagram of the receiver.

Assembling the Parts

Before finally mounting the various components on the panel and connecting them up it is suggested that they be laid out on the table and connected in accordance with the circuit diagram given in Fig. 5. By this means any constructional error can be detected before the final assembly and so save both time and labour.

Assuming everything to be satisfactory, the next step is to secure 6 "stops" for the inductance switches and 19 contact studs to which are taken the inductance tappings.

Before proceeding further secure the inductance coil to the panel by means of brass pillar supports 2in. long, fastening the former by means of nuts on both the outside and inside. The leads to the contact studs should be as short as possible and should be soldered to give a lasting connection.

Starting with the small coil, the loose end or beginning of the winding is connected to the first of the four studs to be controlled by the reaction switch, or in other words, the

first stud of the four shown at the left hand on the bottom of Fig. 2. The first tapping is made to the second stud, the second to the third, the third or 50th turn to the fourth.

The loose end or start of the big coil is now connected to the first of the 10 studs intended for aerial tuning, or, referring to Fig. 2, the first stud of the 10 shown in the middle position.

The first tapping is made to the second stud, the second to the third, and so on until the 12th turn is connected to the 10th stud, which is earthed.

The 30th, 38th, 52nd, 75th and 100th turns are connected to the 5 points shown at the top and on the left of Fig. 2.

The two variable condensers should now be mounted in the positions shown in Figs. 2 and 3, the drilled holes for which are indicated in Fig. 4. The two filament resistances, and grid condenser and leak, may also be mounted as shown in Fig. 3.

Above the filament resistances is mounted the valve panel; this is of ebonite measuring 6in. × 2½in. × ¼in., as previously mentioned. Two sets of valve legs should be fitted to this panel, spaced sufficiently far apart to permit of the low-frequency transformer being secured to the other side; the actual dimensions of this panel are also indicated in Fig. 4.

It should be here mentioned that this panel should be treated in the same manner as the main panel, namely, the glossy surface should be removed by rubbing with fine emery cloth.

Connecting Up

All wiring should be carried out with No. 18 or No. 20 s.w.g. tinned copper wire and the leads should be kept as short as possible. The arrangement of the components is such that practically no two wires will run parallel to each other, and for this reason care must be taken to keep the wires perfectly straight except for right-angle bends, and so add to the general finish of the interior of the instrument.

When soldering, the minimum amount of flux should be used, a hot soldering iron and not too much solder.

Figs. 5 and 6 show the theoretical diagram and a wiring diagram illustrating the actual connections. So long as these instructions are carried out, little difficulty should be experienced even by the amateur making his first attempt at constructional work.

For the guidance of readers who are not familiar with the actual connecting up of receivers, the wiring should be executed in the following manner:—

Connections are made from the bottom switch to the plate of the detector valve; from the top condenser to the first of the four studs at the bottom of the panel; from the H.T. plus to the terminal marked O.P. on the low-frequency transformer and thence to the lower telephone terminal; from the plate of the detector valve to the I.P. of the low-frequency transformer; from the L.T. plus to the H.T. minus and to one side of the filament and thence to one side of the filament of the second valve; from the top left-hand switch to the bottom condenser, to the gridleak and condenser and thence to

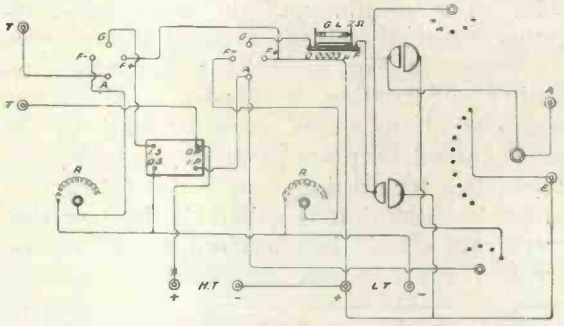


Fig. 6.—A pictorial arrangement showing the actual connections to the various components as seen from the underside of the panel.

the grid of the detector valve; from the L.T. positive to the bottom condenser, to the earth terminal and thence to the last stud of the aerial tuning inductance; from the aerial terminal to the middle switch, and thence to the top condenser; from the L.T. minus to the filament resistance of the detector valve, to the O.S. of the low-frequency transformer and thence to the filament resistance of the low-frequency valve; from the arms of the filament resistances of both valves to one side of the filaments; from the I.S. of the low-frequency transformer to the grid of the low-frequency valve; from the plate of the low-frequency valve to the top telephone terminal.

This completes the wiring of the instrument, and, subject to the instructions having

been carried out in the correct order, the instrument is now ready for testing.

First connect the accumulator, taking care before doing so that the filament resistances are in the "off" position, and test each valve. Subject to the filament brilliancy being consistent with the position of the arms of the resistances the H.T. battery may be now connected.

Next connect the aerial and earth to their respective terminals and the set is ready for operation. The switch shown at the top of Fig. 2 and the middle switch of the same illustration both control the wavelength of the set which, with the inductances described, may be anything between 150 and 800 metres, both figures being more or less approximate.

Operating the Receiver

To tune the apparatus set the reaction condenser to zero and the aerial tuning and grid inductance to an approximate position whereat the desired signal might be expected, bearing in mind, of course, the minimum and maximum wavelengths the set is capable of receiving. Now vary the aerial tuning condenser until the signal is being received at its best, or if the signal is not received at all, vary the inductance switch and try again with the condenser.

When signals are received vary the reaction condenser until the set gives the desired amount of amplification. If, on the other hand, there appears to be no position of the condenser at which the set will oscillate, increase the number of turns in the plate coil and readjust the condenser. With this adjusted to its optimum value, vary the aerial tuning inductance and aerial tuning condenser until the best signals are obtained. After a few experiments in tuning it will be observed that the adjustment of this coil (the aerial tuning inductance) is not by any means critical, and in the great majority of cases only a few turns will be in circuit.

The Containing Box

This may of course be shaped according to the particular wishes of the reader, but for the guidance of those who prefer to build a set similar in every detail to the one under description the dimensions, etc., are as follows:—

The box is made of $\frac{1}{4}$in. mahogany, the base being $10\frac{1}{4}$in. by $15\frac{1}{4}$in. The two sides are $9\frac{3}{4}$in. by $5\frac{1}{4}$in. high; the back is $14\frac{3}{4}$in. long by $5\frac{1}{4}$in. high; whilst the front is hinged to permit of access to the internal connections. To make this hinged front it is necessary to cut grooves in each of the two sides facing the front of cabinet, $\frac{1}{8}$in. wide by $\frac{1}{4}$in. deep by $5\frac{1}{4}$in. high. Into these grooves will fit the "door" when closed, the dimensions of this being $4\frac{1}{4}$in. by $14\frac{1}{2}$in. by $\frac{1}{4}$in. Along the base is fitted a support for the hinges $14\frac{1}{2}$in. long, $\frac{1}{2}$in. high by $\frac{1}{4}$in., to which the "door" is hinged. Along the top is fitted another similar piece of wood, and when the "door" is closed the cabinet has the appearance of being a completely enclosed case.

In the corners of the cabinet are glued four short struts for supporting the ebonite panel, which in this particular set is not screwed to the cabinet. These struts may be of any wood convenient to the experimenter, and should measure 5in. in height by $\frac{1}{4}$in. by $\frac{1}{4}$in.; their purpose will be more readily demonstrated when the panel is fitted to the containing box.

Radio-frequency Choke

When using the Reinartz circuit with low-frequency amplifiers it is sometimes found necessary to introduce into the output circuit of the detector what is commonly known as a radio-frequency choke, according to the characteristics of the transformer. Should the transformer chosen possess a low primary impedance, a choke consisting of a No. 75 Burndept coil should be added in the circuit as shown in Fig. 5.

With the transformer used in the set described this addition was experimented with without improvement, the transformer being an Elwell Ironclad. The writer is given to understand by a good authority on Reinartz receivers that the radio-frequency choke may also be omitted when most of the better-grade British transformers are used.

In conclusion, this receiver is particularly interesting in its operation, and gives for telephony exceptionally clear results.

With the strength of signals from the local broadcasting station—in this case the London station at 10 miles distance—the writer is able to use a loud-speaker, the volume produced being sufficiently loud to render the reception audible in any average-sized room.

THE NEW I
BROADCAST

An address given by
Director of the Radio

WITH the advent of broadcasting a large section of the public, who formerly had no knowledge of wireless, has become technically interested in the subject, and on the occasion of the opening of your new station it is perhaps not out of place to give a brief technical description of the plant which has been manufactured by my company for the British Broadcasting Company.

The design of a broadcasting telephone transmitter presents many interesting problems to the wireless engineer, and while a high degree of perfection has already been attained it is certain that we may expect in the future a continuous and steady progress in the development of the art.

The first aim in design is to obtain the most perfect articulation possible, that is to say, to reproduce in the form of the ether wave radiated from the station an absolute replica of the speech or music performed in the studio. In addition, the designer must provide for reliability in operation, ease of adjustment and control to meet the varying conditions of broadcast performances, and, lastly, provision must be made for a variety of safety devices to protect both operator and apparatus in the event of a fault developing in any section of the plant.

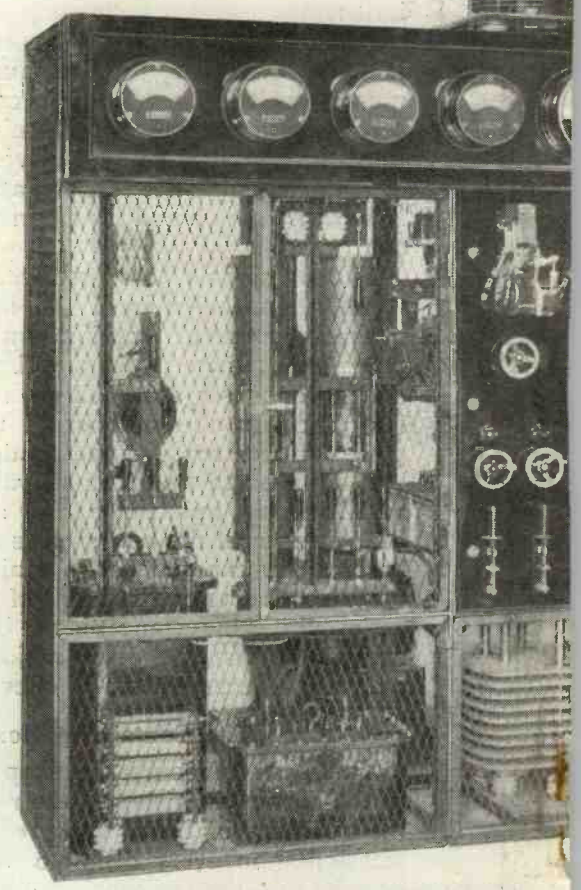
It is not an easy matter to give a detailed description of the complicated apparatus, by means of which I am now addressing you, for the reason that I am unable to employ either diagrams or the usual methods of practical demonstration.

The transmitter is situated in a room adjacent to the studio, and comprises a large steel framework about 10ft. long by 7ft. high and 3ft. deep. It is divided into three main sections, the left-hand portion containing all the speech amplifying, modulating circuits and valves. The centre section has a large slate panel carrying all the main controls, circuit breakers and valve filament rheostats, and the right-hand section contains the main high-frequency valve oscillators with their various coupled circuits and tuning adjustments.

Many of my listeners are probably familiar with the form of glass valve usually employed in wireless receivers and possibly also may have some knowledge of the larger types of glass valves employed for transmission.

The main power valves, however, in the Manchester transmitter are not constructed of glass, but have all the valve electrodes mounted in a bulb made of clear fused silica. Silica has many advantages over glass in that it possesses no coefficient of expansion, and, therefore, is not liable to crack if unevenly heated. In consequence, it is possible to allow these valves to carry a much heavier load and run at much higher temperatures than would be possible in the case of valves whose bulbs are constructed of glass. The fact, however, that silica possesses no coefficient of expansion presents difficulties where the lead-in wires are sealed into the bulb of the power valve, and to ensure a perfect vacuum it is necessary to employ very long seals, which are rendered airtight by pouring in a lead alloy between the silica and the lead-in wires. Owing to the use of lead the seals must not be allowed to become heated, and to provide effective cooling a blast of air is played on to the seals during transmission. Safety devices are provided whereby, in the event of any failure of the air blast, the whole transmitter is automatically shut down. Further, it is not possible to start transmission unless the air blast is first put into operation.

Five power valves are employed in the transmitter. To obtain good articulation, by what is known as the "choke" method of control, the power absorbed in the modulating valves has to approximately equal the power input to the aerial circuit. This places a



Our photograph shows the new transmitting apparatus by Manchester Br

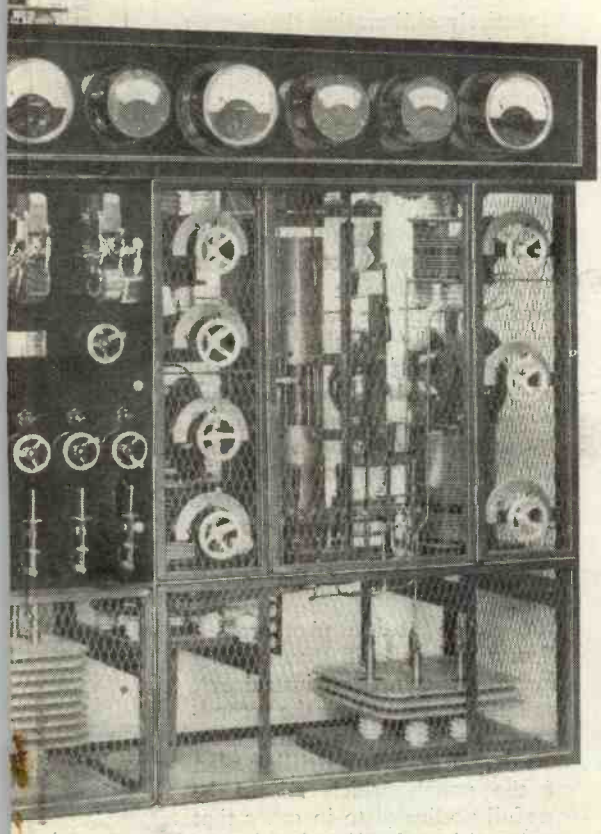
MANCHESTER ING STATION

Major Binyon, Managing Communication Co., Ltd.

great strain upon the modulating valves, since they have to be capable of dissipating energy in their anode circuits equal to the total input to the oscillating valves. For this reason two silica valves in parallel have to be employed in the modulating circuit, each capable of dissipating 2½ kw. at their anodes.

One large silica valve capable of dealing with 5 kw to 7 kw. is employed in the oscillating circuit; one ½-kw. glass valve is used for speech amplification, and one ½-kw. glass valve for exciting the grid circuit of the main oscillating silica valve. Separate excitation of the oscillating valve in this manner enables the wavelength of the station to be maintained exceedingly constant.

Power is supplied to the transmitter from duplicate sets of motor generators each having an output of 5 kw. at 5,000 volts direct current. The filaments of the valves are lighted from a large storage battery, and to ensure long life very robust filaments are employed in the silica power valves, the main oscillator valve having a filament current of approximately 40 amperes.



the Radio Communication Co., Ltd., now in use at the oadcasting Station.

Auxiliary machinery, all in duplicate, is also provided for charging the filament batteries and supplying the air blast previously referred to.

A number of precautions have been taken to ensure a high order of reliability and prevent disappointment to listeners by any interruption in the programme. To achieve this, every running part is provided in duplicate and all the valves are mounted in special holders, so that in the event of any valve failing, it may be withdrawn from the transmitter, complete with its mounting, in a few seconds, and a new one, which is always kept close at hand, instantly substituted. All the connections to the special valve holders are made by means of knife switches, and the total time required to change a valve is less than 30 seconds. The entire transmitter is provided with a number of safety devices and, as I have previously mentioned, every working part is enclosed in a steel metal frame which is earthed. This framework has various gates, all fitted with automatic switches, so that on the opening of any gate by the operator all high-tension circuits are instantly disconnected.

In conclusion I should like to say that from an engineering point of view I think one of the outstanding features of a modern broadcasting transmitter lies in the large number of changes or transformations which my voice now speaking to you has to pass through before it is ultimately reproduced in your own room. Any one of these transformation stages may be likened to a link in a chain all joined in series, and if any link should prove defective the ultimate result will be a failure. As an illustration of this I would remind you of the old-fashioned parlour game known as "Whispering." The players sit in a ring, and a message is whispered from one player to his neighbour until it has passed round the ring; the ultimate result, if at all intelligible, is usually ludicrous and totally different from the original.

In the Manchester set which I have just described, the voice, after being converted into electrical ripples by means of a microphone, has to be transformed and amplified in twelve successive stages before reaching the aerial, and when it is realised that distortion in any one of these stages will completely spoil the result, the wonder is that broadcasting can be accomplished at all. But I would add here a word of warning to those who are employing multi-valve receivers—a defect in any one of the stages of amplification in your own apparatus may ruin for you the most perfect transmission. Do not, therefore, be too ready to blame the British Broadcasting Co., remembering that the ultimate result is dependent on the perfection of every link in the chain.

THE CONSTRUCTION OF A THREE-CIRCUIT TUNER

By ALAN L. M. DOUGLAS, Staff Editor.

The following article describes a useful tuning unit which can easily be constructed by the average experimenter, and which is particularly efficient and selective.

IT is surprising if one examines the number of well-constructed experimental receivers throughout the country how, whilst particular care is devoted to receiving and amplifying apparatus, particularly where valves are employed, very often the tuner used in conjunction with this apparatus is of a very makeshift nature. This is no doubt partly due to the fact that, especially where high-frequency amplification is concerned, it is often difficult to find suitable combinations of coils to obtain the maximum resonance in the circuits, but is more probably brought about for the reason that there is no really complete three-circuit tuner capable of careful and fine adjustment to be obtained on the market at the present moment.

One or two manufacturers produce a highly finished article for which, however, the price is generally prohibitive. Why the apparent value of the tuning unit should be assessed at such a high figure when valve detectors and amplifiers can now be obtained for quite a reasonable sum is difficult to imagine.

Diversity in tuning units is even more marked than in the type of apparatus designed for work in conjunction with them, many experimenters having views entirely opposed to others where this subject is concerned. It is frequently thought that comparatively little care need be given to this part of the apparatus, as there is an idea current that deficiencies in the tuner are readily made up for by the amplification obtained in the receiver. This is quite an erroneous idea, and as a matter of fact it is impossible to obtain anything like the maximum results from an amplifier, especially if of an experimental pattern, unless perfect control can be exercised over the oscillatory circuits. For this

Fig. 1.—A front right-hand view of instrument.

reason it is essential that fully as much care be devoted to the tuning unit as to the construction of the rest of the apparatus, and the purpose of this article is to describe a useful little tuner which, when

Fig. 1a.—A left-hand view showing secondary condenser.

once constructed, can be used with any type of receiver whatsoever, either crystal or valve, and permits of single or double circuit working with reaction as required.

Experimenters, when constructing receiving apparatus employing high-frequency amplification, devote great care to the correct spacing of the components, as they have probably discovered by bitter experience that wires incorrectly placed in a multi-stage H.F. amplifier pick up stray currents which have sometimes the effect of entirely obliterating the signals instead of producing the expected results. If such attention is paid to the design of the amplifier, it stands to reason that in the tuner, where the incoming oscillatory currents are at high frequencies, equally great care should be devoted to the disposition of the component parts. For this reason, the actual laying out of the panel so as to obtain the best results requires a little thought, and it is not surprising that a complicated tuner, with half a dozen switches of the Dewar pattern mounted closely together in the centre and surrounded by innumerable coils and condensers, is very often almost impossible to operate owing to body capacity effects upsetting the manipulation of the instrument.

A glance at the photographs, Figs. 1 and 1A, will show a front view of the completed instrument, the latter showing how the secondary condenser is controlled from outside. Fig. 2 is a drilling plan of the panel, which should be carefully adhered to in order that results will not be disturbed by the presence of the hand when adjusting the apparatus. The sheet of ebonite from which the front is made should be carefully selected, and on account of its small size

may conveniently be of the very best quality of ebonite obtainable. The original polished surface should be carefully removed both back and front by rubbing with

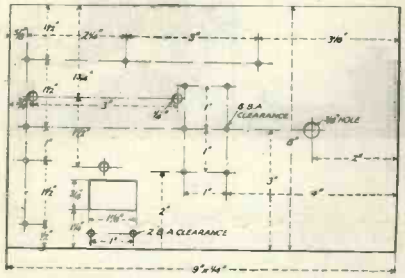


Fig. 2.—Dimensions of panel.

fine emery in the ordinary manner, and the exposed surface may subsequently be raised to any required degree of finish by rubbing with finer grades of emery, then rottenstone, and, if desired, finishing off with metal polish. Paraffin and oil should be avoided when dressing the surface of the panel, as otherwise small traces remaining in the ebonite have to be removed before the component parts can be finally assembled.

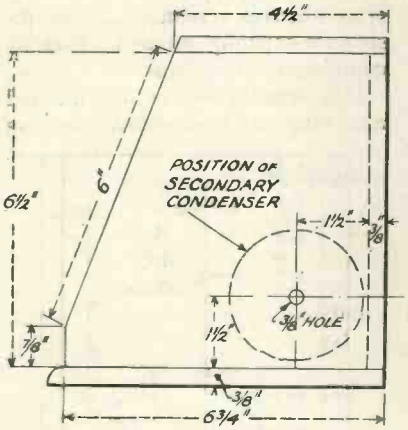


Fig. 3.—Dimensions of side of containing box

Care should be taken that the panel is a close fit in the case, chiefly for appearance' sake, but also to prevent the possibility of warping. Quarter-inch is a convenient thickness for the ebonite.

When this has been drilled and carefully finished, it will form a convenient guide for the trueing up of the case when completed. The construction of this latter should now be undertaken.

The chief details of this will be apparent from an examination of Figs. 3 and 4, the wood of which it is constructed being for preference teak or mahogany. Teak is probably the better wood, as the possibilities of warping are very slight. The sides, back, and underneath portions of the case may conveniently be made from ⅜in. stuff, and the small angle pieces used to afford support for the ebonite panel can be cut from ½in. wood. If the photographs are examined, it will be seen that there is no trace of the means by which the various portions of the case are held together, with the exception of two screws on each side for extra rigidity. These photographs have not been touched up, and serve to illustrate that a very neat finish can be obtained if the wood is pinned and the holes subsequently filled with putty.

The cutting of the wood and the finishing off of the case are best left to the experimenter's own particular taste, as the drawings are self-explanatory and are fully dimensioned. It is surprising how, with a little care, a very good finish may be obtained with few or no workshop facilities, but accuracy is essential, and the reader is recommended to try working a few pieces of scrap wood if he is not accustomed to carpentry.

The most important part of the actual tuner itself is the coil-holder and the stand by means of which this is attached to the panel. An examination of the sketch Fig. 5 will show all the details of this device, and should be more or less self-explanatory. The two semi-circular discs for holding the coil plugs themselves to the tuning panel may be cut from ¼in. sheet ebonite dimensioned in accordance with the figure. It is important that these sizes be adhered to in order that the complete device

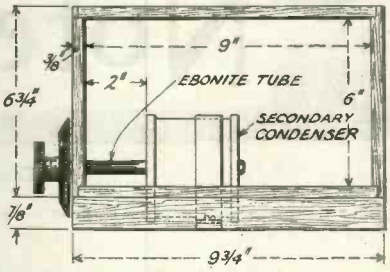


Fig. 4.—Arrangement for fitting the secondary condenser.

assembles accurately, and it is necessary to work very accurately when using ebonite. These side plates may be polished if desired, in the same manner as the panel, and in any case should have the corners rounded off so that a good appearance is presented.

The coil plugs themselves may be cut from ½in. ebonite sheet, three pieces 1in. by 1¼in. being required to mount the aerial, secondary, and reaction circuit coils on. It will be observed that the centres of the contact pins for the plugs are spaced $\frac{9}{16}$in. apart. That is necessary for any type of plug-in coil now on the market

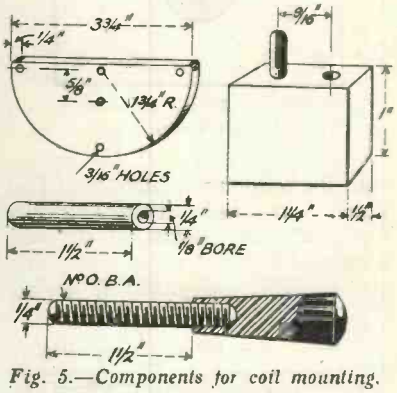
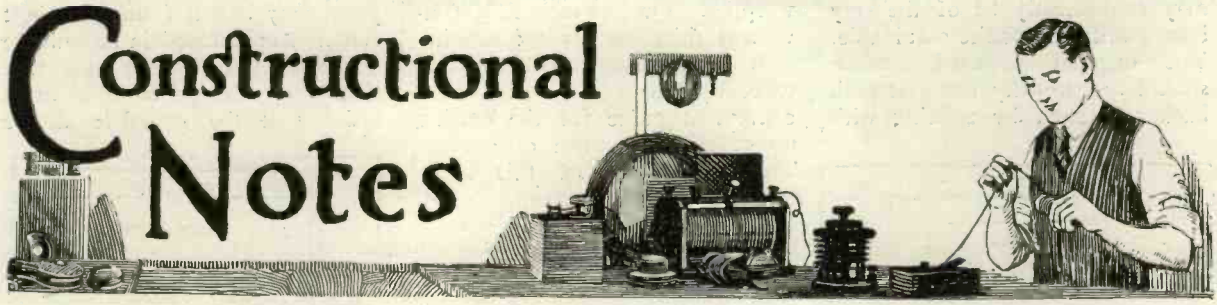


Fig. 5.—Components for coil mounting.

with the exception of the Burndept pattern, the centres of this latter being ⅝in.

(*To be continued.*)

Constructional Notes



Conducted by R. W. HALLOWS, M.A., Staff Editor.

AN EXPERIMENTER'S VALVE PANEL.

FOR the experimenter there can be no more useful piece of apparatus than a valve panel so designed and wired that it will allow any circuit to be made up with the minimum of trouble. The panel to be described has many special points which will commend themselves to those who are frequently engaged in trying out new ideas, since it can be used in any part of the set with the greatest ease. It contains a grid condenser, which may be thrown into or out of action in a moment by turning over a switch, and there is also a gridleak which a selector switch connects at will to positive or negative L.T., places in shunt with the condenser, or cuts out altogether.

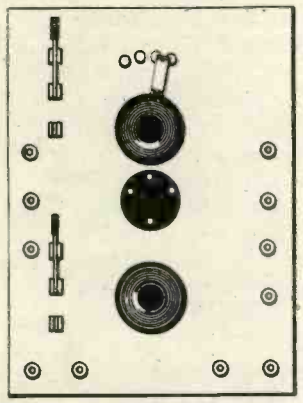


Fig. 1.—Plan of finished instrument.

Fig. 2.—The extra resistance.

An auxiliary resistance with a value of 10 ohms is available when required, so that dull-emitter valves, such as the Mullard L.F. ORA, the D.E.R., D.E.V. or D.E.Q., can be used without the necessity of making any changes in the accumulator connections. Last but by no means of least importance, the filament resistance is connected to the negative low-tension terminal.

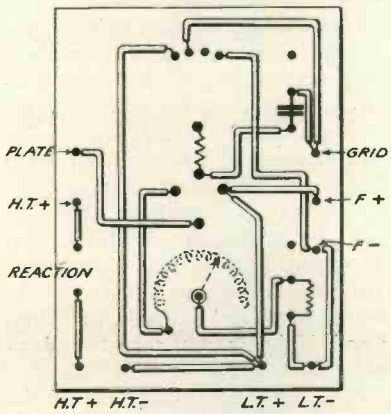


Fig. 3.—Wiring of Panel.

Fig. 1 shows the top of the finished panel. On the left are three input terminals, connected respectively to grid, L.T.+ and L.T.−. Usually the secondary of the tuning inductance stand, or of a transformer, is connected to grid and L.T.−; in some cases, however, it is an advantage to wire it to L.T.+ instead of to L.T.−.

On the right are four terminals. The top pair are connected to plate and H.T.+. The second pair, for reaction, can also be used for the inductance and condenser of a tuned anode circuit, or for a non-inductive resistance if the resistance-capacity method of H.F. coupling is under test.

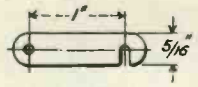


Fig. 4.—Shorting bar for reaction cut-out.

The selector switch, a laminated arm attached to a spindle moving in a brass bush, can be bought complete from advertisers in this journal for 1s. 6d. The two single pole double-throw switches seen on

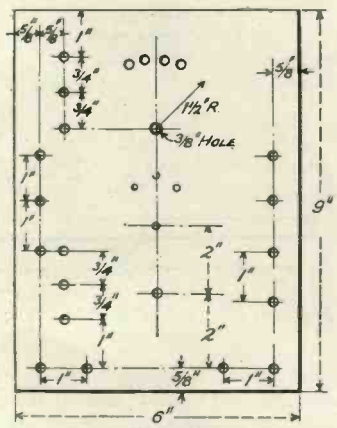


Fig. 5.—Dimensions of panel.

the left are of the midget type that has recently been placed on the market. These are neat and efficient little affairs which take up only a small amount of room on the panel.

The extra resistance, controlled by the lower switch, is very simply made. Fig. 2 shows its appearance and dimensions. It consists of a piece of ¼in. ebonite measuring 2½in. by ½in., upon which are wound about 2½ yards of No. 28 resistance wire. If Eureka wire is used, the total extra resistance available will be about 9 ohms; with Nichrome it will be rather over 10 ohms. As there are a good many makes of resistance wire with slightly different values for a given gauge, and as the rheostat mounted on the panel may have a resistance of anything from 4 to 7 ohms, the exact number of turns needed should be found by actual trial. If 2¾ yards of wire are wound on in the first instance, turns can be stripped off one by one until the happy mean is reached. Little brass tags secure the ends of the wire; these allow neat soldered connections to be made. The ebonite former is fixed to the panel by means of 4B.A. screws.

An examination of the wiring diagram (Fig. 3) will show that if the gridleak and condenser are brought into play the panel becomes a complete single-valve receiver. When the reaction terminals are not required, as, for example, when the panel is used for housing a transformer-coupled H.F. valve, the reaction terminals are shorted by means of a brass arm, details of which appear in Fig. 4.

Fig. 5 shows the drilling layout of the panel. It will be noticed that, with the exception of those for the bushes of selector switch arm and rheostat, all the holes are 4B.A. clearance. Use separate valve-legs for the holder, and not one of those moulded ebonite sockets which are popular because they save a little trouble. The grid-anode capacity in one of these holders is of the order of 0.000005 μF; this may seem a small amount, but it is quite sufficient to cause undesirable effects on the H.F. side of the set when short-wave reception is in progress. The holes for the legs can be drilled with the greatest ease if one of the templates printed in the July issue of *Modern Wireless* is used.

For making the connections of the panel, use stiff bare copper wire of No. 18 gauge, soldering every joint. When finished, the

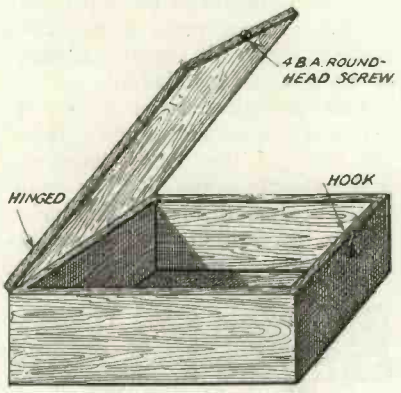


Fig. 6.—The containing box.

panel should be mounted on a neat little cabinet measuring 6in. by 9in. by 3in. in depth, made of ⅜in. oak. The most convenient method is not to screw the ebonite top to the cabinet, but to provide it with a pair of hinges at the top end, the fastening at the other end being a hook engaging with a screw (Fig. 6). If this is done, the interior of the panel is instantly accessible should any fault occur, or should it be desired to try gridleaks or condensers of various values.

R. W. H.

A HIGH-TENSION BATTERY FUSE.

THOSE who have burnt out a valve will appreciate the high-tension battery fuse as a safeguard of the filaments when experimenting with different connections. A piece of ebonite is obtained 2in. long × 1in. wide × ⅛in. thick. Two holes are drilled ¼in. from each end, and one hole is drilled in the centre. Small bolts are clamped by nuts in the outer holes with washers next to the ebonite.

Under the washers a narrow ribbon of tinfoil is held. The tinfoil is threaded through the hole in the middle. The reason for threading the ribbon through the hole is so that if the tinfoil melts, it cannot fall across the two terminals. The ribbon of tinfoil should be as narrow as can be conveniently handled. This fuse will "blow" at a very low amperage. It should be mounted on the high-tension battery itself if possible, as there might still be a short *behind* the fuse.

In multivalve circuits one of these fuses should be in each high-tension lead. After the fuse has blown a few times the experimenter will feel really grateful that he fitted one. Anyway, it is much cheaper than buying new valves. By experimenting, it is possible to find the correct measurements for a low-tension fuse. It should be remembered that the current-carrying power of the fuse is that of its thinnest part, therefore it is possible and convenient to have substantial end pieces.

R. N. P.

A NON-INDUCTIVE POTENTIOMETER.

MANY experimenters do not realise what an improvement a potentiometer makes when it is used to control high-frequency valves or to effect rectification instead of the usual leak.

The materials needed for the following non-inductive potentiometer are: One good quality graphite pencil (H.B.); ten condenser washers (⅛in.); three terminals; one 8in. length of ¼in. square brass rod; two 2in. lengths of screwed brass rod 2B.A.; one small strip of springy brass or copper; one piece of brass ⅓₂in. ×

1in. × 1in.; one small piece of fibre, 1in. × ¼in. × ¼in.; several washers and nuts. The outer casing of the pencil (an H.B.) is removed by boiling in water for a few minutes. As an H.B. pencil has a resistance somewhere in the neighbourhood of 300 ohms, this would be suitable. It should be borne in mind that the harder the graphite the lower the resistance.

Clips to hold down the resistance element are made of copper or brass. A ¼in. square rod is drilled ⅛in. from each side to take a 2in. length of 2B.A. rod. The slider is made by pressing the square inch of brass round the ¼in. rod. The fit should not be too tight, as the springy strip of brass for the contact is used as a packing between the rod and the slider. The piece of fibre is glued to the top of the slider for a knob. Great care should be taken in handling the graphite resistance element. The springy contact is curled round at the bottom to prevent the edge from scratching the graphite.

R. N. P.

NEATNESS IN COUNTERSINKING.

TO countersink screws in a panel so that they look neat and have a firm seating is not quite so simple a business as one might think at first sight. The common method is to select a drill whose diameter is rather larger than that of the screw's head and then to drive it into the ebonite until a hollow is made in which the head will lie flush.

The objection to this method is that the angle of the drill point is very seldom anything like the same as that of the underside of the screw's head. Hence by the time that a hollow has been made into which the screw will fall too much of the material has been removed. A glance at Fig. 7 will show that a screw so fitted has a very poor hold indeed, and that as the nut below it is tightened it will tend to squeeze its way more deeply into the hollow, and when it is tightened hard down its top will be a little below the surface of the panel. In this case the slope of the drill point is too straight to suit the screw.

Fig. 7 also shows what happens if the slope is too gradual. By the time that the hollow is deep enough to allow the screw to lie flush its diameter at the top is too great. Hence there is a small, unsightly gap all round the head between it and the ebonite.

Our last illustration shows a properly countersunk screw. Here the sides of the hollow have exactly the right slope. The head bears against them and the screw has a good hold. A screw so

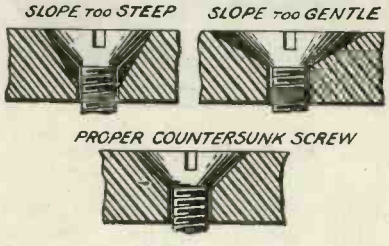


Fig. 7.—Illustrating correct and incorrect countersinks.

fitted will be flush with the surface of the ebonite, and will remain so.

Such perfection can be attained very easily if one cares to use only one make of screw and to grind a special set of drills for countersinking them. But not everyone wants to keep a set of drills that will be rarely used.

A simpler method, if your standard drills do not happen to have exactly the right slope, is to use two different drills for each countersinking operation. The first should have a diameter rather less than that of the screw's head. It is sunk to the full depth of the head. The second, which is larger, is used to enlarge the top of the hollow so that the screw will sink properly into it.

You may be worried when countersinking by the occurrence of "chatter marks." These are caused usually by applying too much pressure, which causes the drill to bite deeply and tear the ebonite. Should these be present in a countersink hollow they can be removed without difficulty. Place a round-headed screw head downwards in the drill stock, grease the head and dip it in knife powder. A few turns of the drill crank will grind out the offending marks.

R. W. H.

HOW TO USE A BRACE.

THE brace, owing to the number of uses to which it may be put, is one of the most useful tools one can possess. If properly used, it may serve for drilling ebonite panels, etc., the chief difficulty being to drill in a true vertical position. This is due to the fact that the bit is placed on the point where the hole is to be made, while the left hand is placed on the handle. It is held in a vertical or horizontal position in this manner, while the shank is turned round with the right hand. It will be seen that to keep a dead-true position in this way is almost impossible, owing to the motion of the body. To overcome this difficulty, attach an angle piece to the work bench. This angle piece should be made to fit the shank of the brace, and should be attached to the work bench in such a way as to make it possible to raise or lower it to any desired position. The auger bit is by far the best type for woodwork or drilling panels, but it should be remembered that if the bit is found to be working in an unwilling manner, it should not be forced, but gently coaxed, by means of taking a turn backwards and then proceeding in a forward direction until the difficulty is overcome by gentle persuasion. A screwdriver bit is very useful when used in a brace, as it makes the operation of putting in screws much quicker and easier.

H. B.

RANDOM TECHNICALITIES

By PERCY W. HARRIS, Assistant Editor.

Some notes regarding atmospherics. The virtues of ebonite as an insulating material.

IN those dim and distant days when I sailed the high seas in charge of an almost prehistoric wireless set, this time of the year was a great worry to all of us. Our standard receiving equipment, even if very reliable, was far less sensitive than the average broadcast crystal set of to-day, and the degree of sensitivity given by the modern valve receiver was beyond our wildest dreams. In some measure what we lacked in sensitiveness in the apparatus we gained in the large aerials possible on board ship, but this last advantage was not an unmixed blessing. These big ship aerials brought in atmospherics "something terrible." As a consequence the summer time was a daily horror for the reception of signals, for we had to strain every nerve to differentiate the weak signals from the bangs, crashes, roars, and cracks of the iniquitous "X." In the winter months there was very little trouble, but in the hot weather work was sometimes impossible for hours on end. Particularly was this the case in the tropics.

* * * *

This is really the first "radio summer" in this country, and I was expecting that a good many people would have to give up their reception for no other reason than the prevalence of atmospheric trouble during the hot weather. In the United States this has been the case each year, as you will see if you study the correspondence and general indications in the American radio magazines. The aerials used by listeners-in are very low compared with those erected on board ship, and England seems much more favourably situated in regard to the freedom of atmospheric noises than does America—at least on these wavelengths. The real thing which makes for success in wireless reception is not so much the *actual* strength of signals as the *relative* strength of signals compared with atmospherics, jamming and other disturbances. Even now if you wish to use many valves for the reception of distant signals, or even two or three valves on long wavelengths, you will find the crashes and roars are sometimes most distressing.

* * * *

The problem of the elimination of atmospherics is engaging the attention of numerous radio scientists throughout the world. If "atmospherics" or "X's" were of one kind only and came from one source we should have got rid of the trouble long ago. The actual facts, however, show us that there are all kinds and types of atmospherics coming from all quarters, and in many cases we have not the slightest idea what originates them. A recent paper before the Radio Society of Great Britain by Mr. Watson Watt threw a most interesting light upon the problem of atmospheric elimination and showed us that thunderstorms and lightning discharges are not, as some people think, the sole causes of the trouble. Strong atmospherics are often traced by direction-finding apparatus to quarters where the conditions are, to ordinary appearances, quite normal as far as the common indications of weather are concerned.

* * * *

The American experimenters are just rediscovering the particular virtues of ebonite as an insulator. This name, by the way, is a British one, and in America the substance is always referred to as "hard rubber." A glance through the advertisements in the radio magazines and the perusal of articles and books published on the other side of the Atlantic indicate that practically all of the panels used by experimenters for mounting their apparatus are made of one of the synthetic resin products. The choice of these substances is not dictated by economy, for all of them are dearer than ebonite, but these newer products have certain very distinct

virtues which carry great weight with the wireless amateur. For one thing they retain their glossy black appearance almost indefinitely and do not become greenish and dull, as is the case with ebonite if it is much exposed to the air. Furthermore, they are all less liable to warp and can be machined, moulded, drilled, engraved, etc., with great facility. An advantage possessed by these new substances, which will appeal strongly to the wireless amateur who makes many sets, is the fact that terminals, screws, etc., once made tight in the panels do not loosen in that irritating fashion when the soldering iron has been applied to them. A friend of mine recently built a remarkably fine looking amplifier, having many terminals for voltage tappings. Much to his disgust practically every one of these terminals loosened after the connections had been soldered to them, and there was no end of difficulty in making them tight again.

* * * *

Against some mechanical advantages possessed by these materials, which are all made from the same synthetic resins, must be set the fact that the electrical properties of ebonite are superior in several points. For instance, some tests recently made in the United States Bureau of Standard Laboratories and other places show that the absorption of moisture by some of these substances is fourteen times as great as with ebonite. This is, of course, important in radio work.

Another difference; the heating of the material when subjected to alternating fields is higher in the newer panels, and this has the effect of introducing losses in the circuit and diminishing the selectivity. Thus, whilst the phenolic resin insulating materials have the advantage of greater mechanical strength, resistance to high temperature and low frequency puncture strength, ebonite is superior in insulating properties and other important matters. It is interesting to notice that ebonite sheets in the form of panels are practically only half the price of the panel made from the new substances. The popularity of the latter materials amongst radio manufacturers is easily accounted for by the fact that they can be moulded into highly finished pieces of apparatus with or without metal inserts, and such moulding, of course, greatly reduces the cost of manufacture.

* * * *

From what I have been told by American radio experts visiting this country, the quality of ebonite generally available to the British amateur is far superior to that generally available in America. There is, however, a great deal of rubbish now on the market here, and some of the newer small manufacturers have been badly caught by buying their ebonite from unreliable sources. Old motor tyres, goloshes, and all kinds of rubber-containing refuse has been pressed into surface to yield flat panels in the wireless boom, and it has not been unusual for particles of metal to be found in the rubber so produced. I know one experimenter who found a large French nail when sawing up the sheet for the wireless panel.

* * * *

A recent article in the "India Rubber World" gives some rather useful hints on working ebonite. In panel making, says the article, satisfactory results are obtained by cutting with an ordinary hacksaw having 24 teeth to the inch. For drilling holes use a *straight fluted*, not twist, drill, slowly without great pressure, otherwise the substance may heat excessively and the drill run out of true. Ebonite is made in many grades and the quality can be judged by the softness of the shaving and by the facility with which it cuts and machines. The easier it machines, the better the quality and the more readily it will take a high polish.

* * * *

Many experimenters press too hard when drilling, and as a consequence break away the surface at the other side. It is always wise to keep an old piece of ebonite handy on which to drill, as if this is done and there are no shavings between the panel and the piece underneath, a good clean hole can be cut without any break-away. I have not found it necessary to use any lubricant, although some writers have found turpentine to be an advantage. I rather fancy that if they use the straight drill just referred to they will not find any necessity to use a lubricating substance.

Broadcasting News

By OUR SPECIAL CORRESPONDENTS.

LONDON.—The hot weather, even more than the non-appearance of the report, has had the effect of diverting people's attention to things other than wireless. Indeed, the hot weather has had a detrimental effect on long-distance reception. In view of this effect, the B.B.C. engineers thought that if 2LO's wavelength were to be raised from 369 metres to 400 metres long-distance reception might be improved. The Post Office Authorities granted the necessary permission for extending the wavelength, and last week the experiment was made.

◇ ◇ ◇

The results were surprising, and a great many letters were received to the effect that the reception was vastly improved by the new wavelength and asking that 2LO might be kept at that permanently. However, Captain Eckersley is not satisfied that the heat alone was responsible for the imperfect reception, but that some sets may tune more easily to 400 metres. All the same, the facts seemed to point to better transmission and reception on the longer wavelength during the hot spell.

◇ ◇ ◇

The musical talks of Mr. Percy Scholes, and the film criticism of Mr. Atkinson, all partake of the same nature—constructive rather than destructive. Mr. Scholes has been on holiday in Zug, in Switzerland. While there he witnessed a musical festival, and he wrote a critique on it which was read from 2LO. A large number of people were listening-in in Switzerland, and they heard the critique of their own music.

This little item of information was given to the daily press, as it was thought that this illustration of how the nations may be brought together by wireless was interesting "copy." Unfortunately at the same time the preliminary notice about the elephant was also given, and Mr. Scholes was crowded out completely by the elephant at the Zoo.

Forthcoming Events

AUGUST.

22nd (WED.).—6.45, Mr. E. Salmon, Topical Empire Chat. 7.15, News and Views of the Theatre by Archibald Haddon, the B.B.C. Dramatic Critic. 9, Mr. W. Halden Shipway, "Industrial Dentistry"; Regent Night.

23rd (THURS.). — Miss Winifred Fisher; Miss Elsie Herst, soprano. 7.15, Mr. Percy Scholes, "Musical Criticism."

24th (FRI.).—6.45, Mr. Ernest Esdaile, "Elocution." 7.15, "Seen on the Screen." 9, Dr. F. A. Bather, F.R.S., Natural History Museum. Mr. Robert Parker.

25th (SAT.).—Mr. Jean Cassola, tenor. 9, Major Harry Barnes, Second talk on "Modern London Buildings."

27th (MON.).—7.15, C. A. House, Chief of Staff of *Cage Birds*, on "Canaries." 9, A. Bertram, Official Lecturer of the National Portrait Gallery, on "Portrait Painting."

28th (TUES.).—7.15, H. A. Bromley, Examiner Supplies to H.M. Stationery Office, on "The Evolution of Paper Making." 9, H. E. Powell-Jones on "Mexico."

29th (WED.).—7.15, Dramatic Criticism. 9, Professor A. J. Ireland on "History."

BIRMINGHAM.—It was a happy little gathering that assembled in the cosy new studio of 5IT on the evening of Saturday, August 11th, when the official opening was performed by Sir Herbert Austin, M.P. There were present Sir William Noble, Mr. Arthur Burrows, Mr. J. C. W. Rieth (the general manager of the B.B.C.), representatives of the Western Electric Company, who have installed the new apparatus; and of course there was Mr. Percy Edgar, the station director, Mr. Joseph Lewis, Mr. Appleby Matthews, and all the station "uncles" and "aunts."

◇ ◇ ◇

During the evening the Royal Air Force Band contributed a splendid programme, and Capt. P. P. Eckersly, of 2LO, gave the Midlanders one of the breezy chats for which he became so well known in Writtle days. There is just one "finishing touch" to be put to the studio. It is nothing less than the installation of a Mustel pipe organ.

Forthcoming Events

AUGUST.

22nd (WED.).—Mr. Moses Baritz will lecture on "Faust." The station orchestra and the station choir under Mr. Lewis will contribute selections from the opera during the evening.

27th (MON.).—Mr Robert Parker, bass, of the British National Opera Co.

28th (TUES.).—Band of H.M. Irish Guards.

29th (WED.).—Miss May Blythe, soprano, of the British National Opera Company.

SEPTEMBER.

1st (SAT.).—Performance by the station military band, under Mr. Appleby Matthews.

◇ ◇ ◇

MANCHESTER.—By the time these notes are in print, comment on the closing of the old station in Trafford Park and the opening of the new one will no doubt appear belated. In the light of modern programmes, however, the varied entertainment which marked the conclusion of 2ZY's activities from its temporary home seemed rather quaint and carried us back to the early days. We were promised "stunts," and we had them in every shape and form, crowned at the close of the evening by the solemn declaration of our ghostly friend and the burying of the carrier wave.

◇ ◇ ◇

Listeners-in had the pleasure of a short address from Lord Gainford, followed by a breezy speech from Sir Edwin Stockton, who formally opened the station. Another interesting address was that by Major Binyon describing the details of what was stated to be the last thing in wireless transmission instruments—in short, the transmitting plant at 2ZY's new station. From Major Binyon's remarks it is evident that we now have a station of which we should be justly proud, a station in keeping with the traditions of Manchester musically, and a station in which expense and the utilising of the best brains in the country have not been spared in the slightest degree.

◇ ◇ ◇

The musical items were provided by the band of the Irish Guards, and whilst their playing was very enjoyable we are of the opinion that technical clearness was sacrificed to the exploiting of some very unusual tempos, whilst the balance and volume were not as good as we *have* heard from 2ZY.

In perusing the list of coming events and noting such renowned singers as Beatrice Miranda and William Anderson, whose performances from the operatic stage we have so much enjoyed, we feel constrained to remark, with sincerest apologies to our friend M. Coué, that every day and in every way 2ZY's programmes are getting better and better.

Forthcoming Events

AUGUST.

22nd (WED.).—Maurice Cole, pianist; Charles Wreford, humorist.

23rd (THURS.).—Victor Smythe in "Something New"; Jo Lamb,

violinist, and Eric Fogg, pianist; Edward Isaacs, the Manchester pianist.

24th (FRI.). — Leigh Howarth's Dance Orchestra; Owen Brangwyn, baritone.

25th (SAT.). — Florence Holding, soprano; John Wright, baritone.

26th (SUN.). — Olive English, soprano.

27th (MON.). — Sophie Rowlands, soprano; Tom Kinniburgh, bass; A. Holland, baritone.

28th (TUES.).—2nd Symphony Concert: May Blythe (soprano), Robert Parker (bass), of the British National Opera Company.

29th (WED.).—Jennie Lord, soprano; Tom Sherlock, baritone.

◇ ◇ ◇

NEWCASTLE-UPON-TYNE.—The transmission of musical comedies and operas is now becoming a regular feature of the 5NO programme. The production of the "Country Girl" last month by Madame May Grant and her party from Whitley Bay proved so successful that in response to many requests it was repeated on August 3rd.

◇ ◇ ◇

For the production of Act I. of "Maritana" on August 1st the chorus was provided by the Shipcote Harmonic Choir, of Gateshead, who have previously made several welcome appearances in the programme. With the principals, chorus and orchestra there could scarcely have been standing room in the studio, and the announcer must surely have had to sit on the mantelpiece or piano.

◇ ◇ ◇

The transmission was excellent, and we look forward to the repetition of Act I., together with Act II., on August 22nd, when Miss Doris Lemon and Mr. William Mitchell, of the British National Opera Company, will take principal parts. Another member of the B.N.O.C. to appear during August is Mr. Robert Parker, on the 29th, in "Romeo and Juliet."

◇ ◇ ◇

SHEFFIELD.—Work in the matter of the experimental relay station at Sheffield has progressed so far as the acquirement of two sites.

◇ ◇ ◇

The prediction that plenty of volunteers to face the microphone would turn up has been more than justified. Incidentally, some fine transmitting voices and subjects have been discovered.

◇ ◇ ◇

The Sunday night transmission has proved a success. It is hoped to get a minister of each denomination. Mr. Lloyd is approaching a Catholic pastor, and intends to invite the Chief Rabbi also.

Mainly about Valves

Our weekly causerie written by the Editor.

An Accidentally Discovered Circuit

QUITE a number of people have recently told me of a circuit which they have found to give excellent results, and which they believe gives the same effect as a tuned anode circuit, but with only one valve. One has even gone to the expense and trouble of attempting to obtain a patent for the circuit without realising that what he has achieved was something already well known and ordinary.

You will see below the different stages in the invention and how disappointing the final

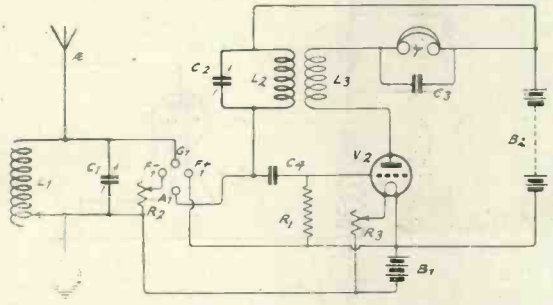


Fig. 1.—The ST34 circuit with the first valve removed.

circuit is. The original arrangement is shown in Fig. 1. This is an ST34 circuit (tuned anode with reaction). In Fig. 1 the first valve has been taken out of its socket, and anyone working with this type of circuit will find that if the condensers C_1 and C_2 are slightly readjusted signals will come in, not as loudly as before, but quite strongly. Hence the fallacious idea that there is a tuned anode coupling effect even though no valve exists. As a matter of fact, when the valve is taken out there is a capacity coupling between the valve holder socket G_1 and the anode socket A_1. A small condenser is formed, and this condenser serves to couple the circuit L_1 C_1 to the circuit L_2 C_2.

Fig. 2 shows how we can rearrange the circuit by substituting a small condenser C_3 having a capacity of, say, 0·0005 μF or considerably less to represent the grid to anode

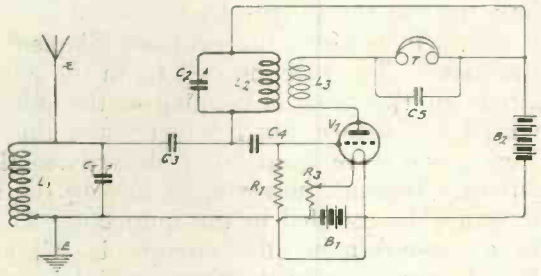


Fig. 2.—A rearrangement of the same circuit.

capacity. It will probably be found in the Fig. 1 circuit that if the filament current to the first valve is switched off and the valve left in its socket, signals will be still stronger, owing to the greater capacity coupling between the grid and anode electrodes in the valve itself. At any rate, in Fig. 2 we have replaced the valve by the condenser C_3, and we are still getting excellent signals. The

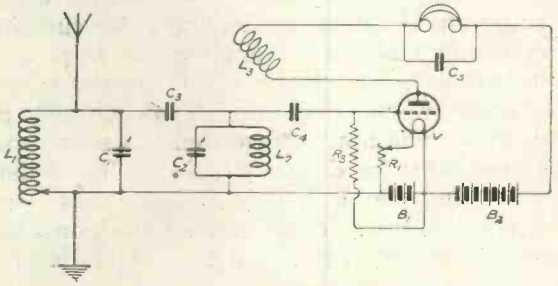


Fig. 3.—The final arrangement of the circuit.

circuit, moreover, is very selective. Although the circuit looks a very strange one, yet if a few connections are altered without affecting the operation of the circuit, its appearance be-

comes more conventional, and Fig. 3 shows the circuit as I have redrawn it. In Fig. 2 it will be seen that the top end of the inductance L_2 is connected to the positive terminal of the high-tension battery. Instead of making this connection, exactly the same effect will be obtained if the top end of L_2 is connected to the positive terminal or negative terminal of the filament accumulator, because, as regards high-frequency potentials, the positive terminal of the high-tension battery is at the same potential as the accumulator.

In Fig. 3 the top end of L_2 is now connected to the negative terminal of the filament accumulator, although what was formally the top of L_2 is now the bottom of L_2, because we have turned the circuit L_2 C_2 round so that it comes in between the grid and filament of the valve. The reaction coil L_3 in the anode circuit of the valve is coupled to the inductance L_2 as before, but it will be seen that in Fig. 3 we have quite an ordinary reaction circuit. Instead, however, of having the inductance L_2 coupled to the inductance L_1 as in a loose-coupler, the circuits L_1 C_1 and L_2 C_2 are coupled together by the small capacity C_3. It is, of course, well known that oscillation circuits may be coupled, either by means of a condenser or inductively (and even by resistance, but this is by the way).

The Fig. 3 circuit, or, if you like, the Fig. 1 circuit with the valve out, would certainly not be permitted by the Postmaster-General.

If you investigate the matter a little further, you will realise that there is really no technical border line where one begins to infringe the Postmaster-General's instructions regarding reaction. The circuit of Fig. 3, if the condenser C_3 is kept very small, is not a scrap worse than the ST34 circuit, as regards radiation. Nevertheless, some sort of line must be drawn which can be understood, and the P.M.G.'s decision has been a generous one. If he banned reaction altogether anywhere, it would be a black day for the listener-in. The consciences, however, of wireless experimenters are becoming notoriously flexible, a state of affairs due, in no small measure, to repression in the past.

The Static Leak

Although this has not very much to do with valves, yet the thundery weather reminds me that when a series condenser is used in the aerial circuit of the receiver, it is desirable to connect across it some form of static leak to allow any electrical charges which accumulate on the aerial to leak away to earth. If this is not done the condenser may be injured, owing to a breakdown due to the high potentials across it.

Fig. 4 shows one solution of the static leak problem. A 100,000 ohms resistance R is connected across the variable condenser C which tunes the aerial circuit. The high resistance allows the gradual accumulation of electricity on the aerial to leak away to earth.

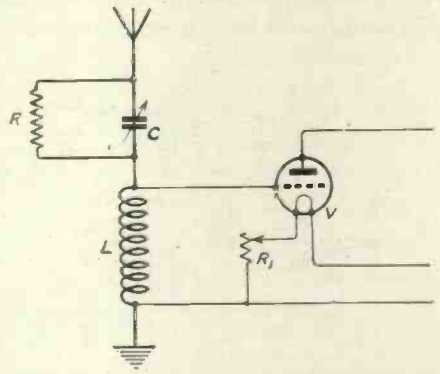
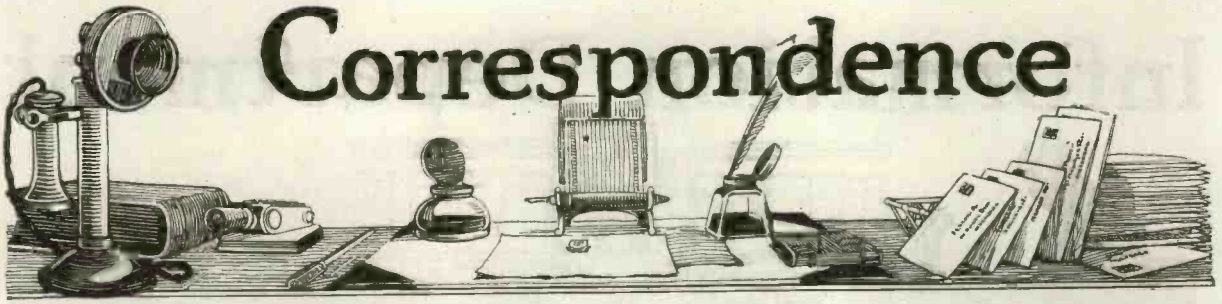


Fig. 4.—Illustrating the position of the static leak in relation to the aerial circuit.

Instead of using a high resistance, a choke coil may be employed. For example, the secondary of an intervalve transformer could be used, but I would not recommend it. If such a leak is to be employed it should have a minimum capacity to earth, and for this reason an anode resistance is fairly satisfactory.



RE CIRCUIT ST100

SIR,—With reference to the above circuit I wish to let you know that the results obtained by me are excellent and greatly exceed the very modest claims made for it in *Wireless Weekly*.

Prior to using the above circuit I was using another excellent one of yours, viz., Fig. 7—page 89 of No. 2 *Modern Wireless*; many wireless enthusiasts heard the results I got on this circuit, which were as good as obtained on many 4- or 5-valve sets, but the ST100 has improved my results by at least 50 per cent.

Since summer commenced it has been difficult to hear 2LO from Belfast; with the ST100 circuit I can now hear the music about 20 feet away from the telephones. FL and 5LP (Berlin) are even louder than 2LO; the volume of pure music is so great that it would be fearful wearing the headphones without lowering the filaments.

Thanking you for the many excellent articles published in *Wireless Weekly* and *Modern Wireless* and at the same time allow me to congratulate you on this excellent circuit.

I am, etc.,

Belfast. WM. C. HADDICK.

A SUGGESTION

SIR,—In your issue dated July 18th you state that you would welcome suggestions, etc., and accordingly I beg to forward one which I consider would help a large section of your readers which, incidentally, is a section that will be always with you, namely, the beginners.

As a reader of a popular photographic periodical, I remember the day when I asked a friend, who introduced me to that hobby, which periodical would suit me as a beginner, and his reply was, *The Amateur Photographer and Photography, because it gives an article exclusively for beginners each week*, and this same advice I have given to many of my friends. I may add that these articles are progressive, and when they have reached a certain stage they revert to the beginning again, and so the beginner is able to take up the more advanced articles and thoroughly understand them. I am certain that there are a large number of readers who desire to know a little more than how to operate a set; they require at least a slight technical knowledge, sufficient for them to understand the more technical articles which appear in your journal.

Of course, I am speaking as a beginner, and frankly admit that 75 per cent. of your matter is above me, but have taken the book regularly and hope that at some future date I shall be able to dig out the back numbers and revel in the intricacies of various circuits and technicalities which have appeared.

I am, etc.,

E.10. A. E. GOLDSMITH.

THERE'S A REASON

SIR,—As a regular reader of both *Wireless Weekly* and *Modern Wireless*, I have recently been testing various types of crystal receivers and have been unable to find one more efficient than Mr. Redpath's "compact broadcast receiver." Using "Talite" and No. 32 s.w.g. copper whisker, I have received low-power amateur telephony from North London, fourteen miles away, on a screened single aerial. With the addition of the H.F. units from Mr. Redpath's "Unit Receiver Book," I am able to enjoy the Birmingham broadcasting between 7.30 and 8.0. Last Wednesday evening, when 2LO closed down early, I heard the conclusion of 5NO's Men's Hour.

I must conclude by saying that all apparatus I have constructed from information obtained in your periodicals have always worked exactly as described.

I am, etc.,

S.W.19. B. DE F. WALLER.

[All apparatus, before being published in our periodicals, is carefully tested.—ED.]

CARDBOARD PANELS

SIR,—With regard to an article on page 128 of August 1st issue, I should like to give particulars of a material which I have found very satisfactory for panels, after having tried fibre and slate.

I have been using, for some time, a set mounted on $\frac{1}{8}$in. cardboard, which can be obtained from any bookbinder in thicknesses up to $\frac{1}{4}$in. The cardboard is boiled in paraffin wax in a sheet-iron tray to drive off any moisture, and is then a very good material for panels, being cheap, easy to work and strong. There may be sore losses in theory, but in practice I have found it satisfactory

In conclusion, I must congratulate you on your excellent paper, in which I am sure no alteration could be an improvement.

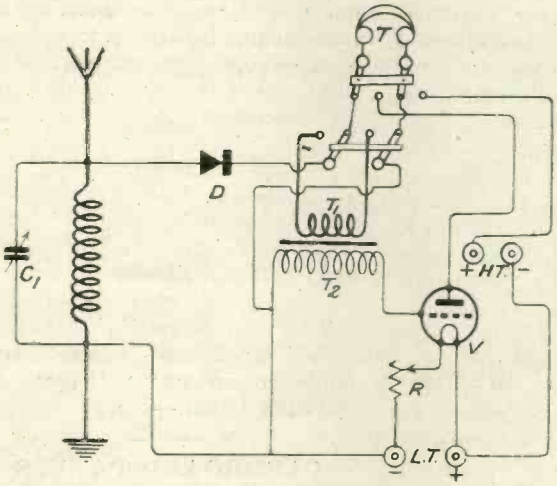
I am, etc.,

Colchester. V. O. GRECH.

Information Department

Conducted by J. H. T. ROBERTS, D.Sc., F.Inst.P., assisted by A. L. M. DOUGLAS.

J. C. (LIVERPOOL) asks for a circuit employing crystal rectification with an optional note magnifier, to be inserted by means of a switch.



We give herewith a suitable circuit diagram showing how this may be arranged.

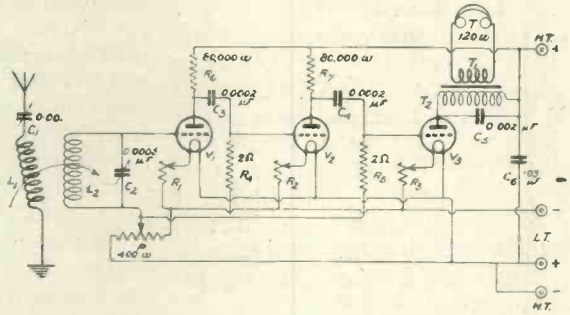
R. D. (WHITBY) has constructed a set employing the circuit shown on page 278 of "MODERN WIRELESS," No. 4. He desires to know how many turns of wire should be wound on the various coils to enable him to receive from the British broadcasting stations.

The coils L_1 and L_2 may each consist of 75 turns of No. 24 s.w.g. d.c.c. copper wire closely wound upon a former 3in. in diameter. The coil L_3 should consist of a similar number of turns of No. 26 s.w.g. d.c.c. wire upon a former 2½in. in diameter. If basket coils are to be used, try the same number of turns, the inner diameter of the coils being 2in.

W. B. (NORTHUMBERLAND) asks questions about extending the range of his apparatus so that he can hear daylight transmission.

We suggest you add another stage of high-frequency amplification on the principle you have described. The tuned anode method of high-frequency amplification is, of course, exceedingly selective, and with a three-circuit tuner you should have no difficulty in cutting out everything but the desired wavelength.

H. A. V. (EXETER) requires suitable values for a resistance-coupled receiver to give the maximum efficiency on long waves.



Herewith we indicate the wiring of such an amplifier, the values of the components being clearly marked.

G. H. B. (CHADWELL HEATH) asks with reference to the simple wireless telephone transmitter described in "MODERN WIRELESS," No. 1: (1) Would a greater range be covered using a small power valve and 230 volts anode current? (2) What coils would be suitable for the 720 metre wavelength? (3) In connection with a choke control transmitting circuit, what would be a suitable value for the choke?

(1) We do not think you would obtain a greatly increased range using such a valve. (2) An aerial circuit coil of 75 or 100 turns might be used for the 720 metre wave. (3) The value of the speech

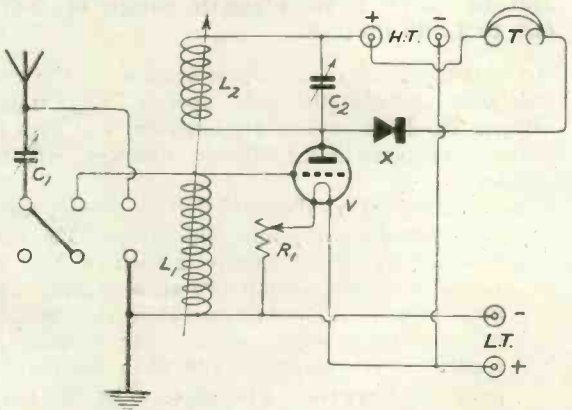
choke is not, as a rule, very critical, but should be about 6 henries. A suitable choke can be made by winding 20,000 turns of No. 40 s.w.g. single silk covered wire on an iron core ¾ of an inch in diameter and 4½in. long. The windings must, of course, be well insulated from the core, as the potential variations set up across the choke are very considerable, sometimes rising to double the normal anode voltage.

J. C. (RICHMOND) asks for the values of coils and condensers shown in Circuit No. 1 on page 206 of "MODERN WIRELESS," No. 3.

For the reception of British broadcasting, coil L_1 might have 50 turns, coil L_2 75 turns, coil L_3 75 turns, coil L_4 75 turns, and coil L_5 50 turns. The values of the condensers are as follows:—

C_1 ... 0·0005 µF.
C_2 ... 0·0002 µF
C_3 ... 0·0003 µF.
C_4 ... 0·002 µF.
C_5 ... 0·002 µF.
C_6 ... 0·002 µF

R. O. (EDINBURGH) wishes to know whether regenerative H.F. amplification can be effected with a valve-crystal receiver in a simple manner.



The appended diagram indicates how this may be carried out.

P. M. (BASLE) asks: (1) How to construct a frame aerial. (2) Whether an Armstrong receiver could be used for the reception of long wavelengths. (3) Whether Circuit ST100 would be effective on the Continent for the reception of British broadcasting.

(1) A description of an efficient frame aerial for general purposes was given in the June *Modern Wireless*, No. 5. (2) The Armstrong circuit falls off rapidly in efficiency as the wavelength is raised, and would not, therefore, be suitable for your purpose. A good circuit would be ST51, "Practical Wireless Valve Circuits," Radio Press, Limited. (3) We think you would obtain good results with the circuit ST100 as described in *Modern Wireless*, No. 6.

H. A. H. (BEDDINGTON) submits particulars of a valve receiver from which he obtains distressing crackling sounds at times, and asks whether this would be due to his high-tension battery or some other source.

As you state that you have tried a number of different high-tension batteries on this set, we do not think that this sound can be due to faulty anode supply. We rather suspect your gridleak, more particularly as occasionally you appear to obtain good reception.

A. M. (HELENSBURGH) proposes to build the two-valve receiver shown in "WIRELESS WEEKLY," May 2nd, and asks whether it is a useful circuit.

This receiver is exceptionally efficient for broadcasting, and we should imagine would give you very good results from 5SC. The direction of an outdoor aerial of the size allotted by the Post Office does not, as a rule, make any difference in the strength of signals received from any particular direction.

T. S. C. (BLACKHEATH) is constructing a valve receiver as described in "How to Make a Unit Wireless Receiver," Radio Press, Limited, but wishes to incorporate a tuner covering a wavelength range of from 150 to 30,000 metres in place of the variometer shown. He asks whether such a unit might be made up on the lines of the universal tuner described by A. Johnson in "WIRELESS WEEKLY," No. 6.

It would be quite possible to make up a tuning stand in the form of one of the units you describe, and whilst this would enable a wide range to be covered so far as the tuning side is concerned, it would necessitate redesigning of the high-frequency amplifier if this were to work over the same range.

G. J. B. (WINDSOR) asks a question about the amount of current passed through electric lamps used as resistances for charging accumulators and also for certain sizes of Burndept coils.

Without knowing the voltage of the circuit we are unable to tell you what current will pass through the lamps. If your supply voltage is 100 and the lamp is stamped 20 watts, then you will obtain 1/5th of an ampere. The short wave Burndept coils Nos. S1, S2, S3 and S4 will be suitable for your purpose.

J. E. D. (MAIDSTONE) wishes to construct a receiving set to give the maximum efficiency at a distance of 60 miles from 2LO with the minimum number of valves.

The two-valve broadcast receiver described in *Wireless Weekly*, No. 4, Vol. 1, will be found excellent for use at the distance you specify.

G. H. L. (LEEDS) refers to the three- and four-valve receivers described in "MODERN WIRELESS," No. 4, page 267, and asks the value of the condenser C_4.

A suitable value for this condenser would be 0·002 μF. The second valve might be used as an additional high-frequency valve, but not the fourth.

W. F. F. (DEVON) asks questions about obtaining licences.

"Wireless Licences and How to Obtain Them" (Radio Press, Ltd.) will give you full instructions for taking out experimental licences. We think your projected experiments will be acceptable to the Post Office.

N. G. P. (BIRMINGHAM) asks for particulars of a high-frequency plug-in transformer to comply with certain conditions and to cover a wavelength range of from 400 to 1,500 metres.

To obtain the maximum amplification on the two particular wavelengths you specify two transformers should be used. If, however, you wish to construct one instrument only the following will be suitable:—

Former 1½in. diameter by 1in. long, with four slots ⅜in. deep and 3/32in. wide. The first two slots to have 80 turns in each of No. 42 s.w.g. wire, the second two slots to have 130 turns in each. The first and third slots should be connected together and also the second and fourth, and a tapping taken from the middle point of these two windings. The first two slots will therefore constitute the primary and secondary of the transformer for 400 metres, and the four slots together will form a transformer for 1,500 metres.

P. E. H. (WINCHESTER) wishes to know how to construct a small spark coil giving a spark about 1-32nd in. long.

An iron wire core ⅜in. in diameter and 4in. long, composed of soft iron wires driven into a fibre tube, should be wound with 200 turns of No. 22 s.w.g. double cotton covered wire. Another thin fibre tube should be fitted over this, and 20,000 turns of No. 44 s.w.g. single silk covered wire wound on. This will give about 1/30in. spark with 2 volts. The make and break should be shunted by a condenser of not less than 1 μF.

An Experimenter's Licence is well worth having.

This is what the P.M.G. said

"In order to ascertain my position I felt it my duty to place the whole facts before the Law Officers of the Crown, and I have just received the opinions of the Attorney General and the Solicitor General.
These are that I am not only entitled, but compelled by law to issue an Experimenter's Licence to those applicants in regard to whom I am honestly satisfied that they are genuin experimenters.
This being so, while it would be wrong to issue an Experimenter's Licence to the man who is obviously merely a broadcast listener-in, it would be equally wrong to decline to issue such licences on a whole sale scale."

To a R presentative of the Press

UNDOUBTEDLY a very large number of wireless enthusiasts are contravening the present regulations regarding licences. Some through ignorance, others wilfully because their applications for Experimental Licences have been turned down.

If you are a genuine Experimenter, prepared to take up Wireless as a serious hobby and not merely as a means of passing a pleasant hour in listening to broadcast Concerts, then you are **entitled** to an Experimenter's Licence.

Many applications for Licences have been turned down by the authorities because the applicants were not fully aware of the necessary requirements which had to be fulfilled.

This little book by E. Redpath (assistant Editor of Wireless Weekly) has been written to explain exactly what an Experimenter should know and how he should set about obtaining his Licence.

Remember this important point—even if a Constructor's Licence is issued, it is practically certain to contain special restrictions regarding the use of Receiving Sets and Circuits. With an Experimenter's Licence your work is practically unhampered. Why not get a copy of this book to-day and legalise your position at once and for always?

Gilbert Ad

RADIO PRESS Series No. 11.

Radio Press, Ltd
PUBLISHERS OF AUTHORITATIVE WIRELESS LITERATURE
DEVEREUX COURT, STRAND, W.C.2.

1/-

From all Booksellers & Newsagents, or 1/1½ post free direct.

Printed for the Proprietors. RADIO PRESS, LTD., Devereux Court, Strand, W.C.2, by THE CORNWALL PRESS, LTD., Paris Garden, Stamford Street, London, S.E.1. Published on Wednesday of each week at 3, Bolt Court, Fleet Street, London, E.C.4. Address for Subscriptions and Editorial communications:—Devereux Court, Strand. London, W.C.2. Advertisement Managers:—THE SCHEFF PUBLICITY ORGANISATION, LTD., 125, Pall Mall, London, S.W.1. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates:—32/6 per annum, 16/3 for six months, post free. Sole Agents for Australasia:—GORDON & GOTCH (Australasia), LTD. For Canada:—IMPERIAL NEWS LTD. For South Africa:—CENTRAL NEWS AGENCY, LTD.

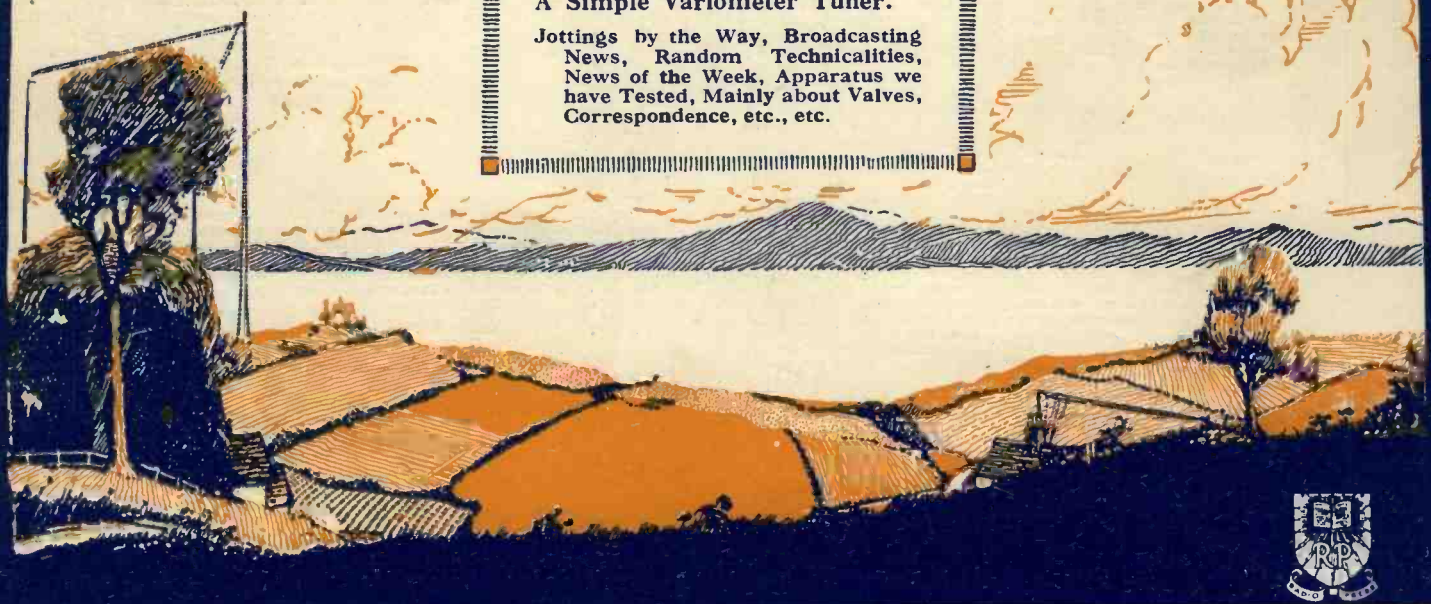
Wednesday, 6d. Net. Vol. 2. No. 7. August 29th, 1923.

Wireless Weekly

and The Wireless Constructor

Vol. 2. No. 7.

CONTENTS



An Extremely Selective Dual Circuit—By A. D. Cowper, M.Sc.

Wireless Weekly

Vol. 2, No. 7.
Aug. 29, 1923

CONTENTS

Editor: JOHN SCOTT-TAGGART, F.Inst.P.

Assistant Editors { E. REDPATH. P. W. HARRIS.

Scientific Adviser:
Prof. G. W. O. HOWE, D.Sc., M.I.E.E.
Advisory Editors:
Prof. R. WHIDDINGTON, M.A., D.Sc.
Prof. C. L. FORTESCUE, M.A., M.I.E.E.

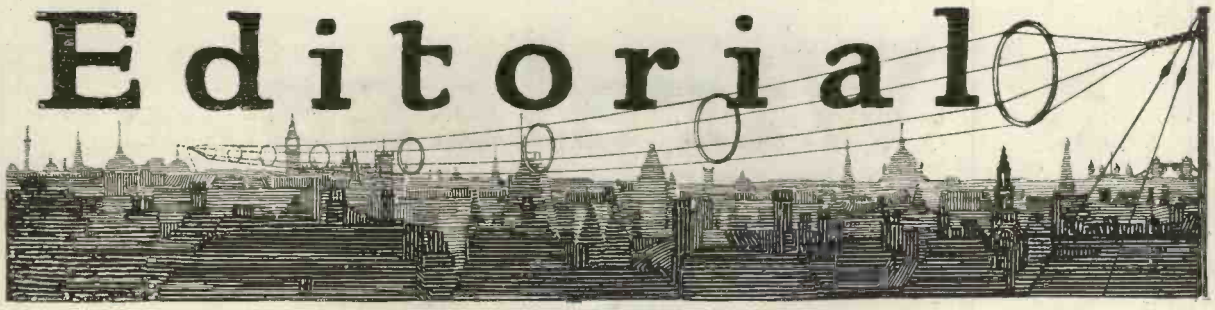
Radio Press, Ltd.
Publishers of Authoritative Wireless Literature
DEVEREUX COURT, STRAND, W.C.2
Tel.—Central 3763.

Advertisement Managers: { SCHEFF PUBLICITY ORGANIZATION, LTD., 125, Pall Mall, London, S.W.1. *Tel.—Regent* 2440.

Staff Editors:
E. H. CHAPMAN, M.A., D.Sc.
A. D. COWPER, M.Sc.
G. P. KENDALL, B.Sc.
A. L. M. DOUGLAS.
R. W. HALLOWS, M.A.
S. G. RATTEE.

All correspondence relating to contributions is to be addressed to the Editor of "Wireless Weekly."

Editorial



Good Tidings at Last

The Long-awaited Report of the Broadcasting Committee has now been Completed and Delivered to the Postmaster-General.

THE dark clouds which have so long obscured the broadcasting horizon are lifting with increasing rapidity. We have already mentioned in a previous issue that satisfactory indications of an increased public interest were being reflected in a revival of trade in the wireless industry. Whether the improvement was due to "intelligent anticipation" or not, the fact remains that it is now being amply justified.

The Report

As we go to press we receive the invigorating news that the special Broadcasting Committee have completed their investigations, and that their report and recommendations are now in the hands of the Postmaster-General. It is certain that the publication of the report will follow immediately, and, as a matter of fact, it may have appeared before these lines are read.

One important point must not be lost sight of, namely, the duty of the special Committee has been to investigate and to submit a report with their recommendatons. The responsibility with regard to the final decisions and the putting into force of such amended regulations as may be deemed necessary, rests with the Postmaster-General, who will no doubt act with promptitude. The B.B.C. will probably oppose the report, but we hope they will remember that by holding out too long in the past they contributed in no small measure to the slump which is only now beginning to pass.

The New Licence

Our readers will be glad to learn that all the old difficulties in the way of obtaining a receiving licence—the formalities to be complied with, the technical qualifications—are to go by the board, if the report is acted upon. For all receiving purposes there will be but one type of licence, which is to be easily obtainable, without fuss and formality, by all who desire to use wireless receiving apparatus of any description. The licence fee will, in all cases, be 10s. per annum.

These modifications to the existing licensing conditions will, without doubt, have a very stimulating effect throughout the country, and as soon as full details are available, popular interest in wireless, and particularly in broadcasting, will increase enormously.

The B.B.C. Stamp

With regard to the financial arrangements in connection with broadcasting, which, of course, have been at the bottom of all the trouble, the Committee recommend that the use of the B.B.C. stamp, upon either completed sets or components, shall be forthwith discontinued. It will be remembered, of course, that this stamp upon apparatus indicated that the suppliers, members of the British Broadcasting Company, were contributing a proportion of the selling price of the apparatus towards the expenses of broadcasting. Obviously the high costs involved must be met somehow, and it is recommended that the British Broadcasting Company's revenue shall be derived entirely from the licence fees paid by users of the apparatus.

* * * *

And so broadcasting is to come into its own again. And this time we do not expect any sudden, unstable "boom"—a mere flash in the pan so to speak—but a steady though rapid development until, in this coming winter, will be witnessed a greatly increased popularity for broadcasting, and prosperous activity in the wireless industry.

AN EXTREMELY SELECTIVE DUAL CIRCUIT

By A. D. COWPER, M.Sc., Staff Editor.

An interesting circuit which should prove valuable to coast-dwellers and others whose interference problems are serious.

MANY and bitter are the complaints of interference experienced by listeners-in to broadcasting, particularly by those living on certain sections of the coast, where ill-tuned 600 metre ship spark stations, as well as some 300 metre commercial stations, render successful reception at times almost impossible. Even with loosely-coupled primary circuits, and tuned high-frequency amplifying circuits, the mush of powerful near-by sparks comes in, to drown the distant telephony.

The many who suffer from this trouble may be interested in the possibilities of an extremely selective dual-amplification circuit, involving the "rejector" principle which has been developed on a most elaborate scale in commercial radio receiving stations for the elimination of interference, where the margin of difference of wavelength is very small, and the problem of interference an all-important one.

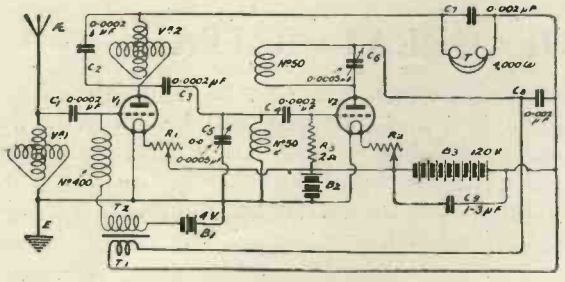


Fig. 1.—The new circuit.

The circuit, which is shown in the diagram, has some points of resemblance to that worked out in characteristic manner by the makers of the Marconiphone in their two-valve dual receiver; but with the tuned anode reactance-capacity high-frequency coupling, and low-resistance tuning units, undamped, for great selectivity.

It is a two-stage dual circuit; giving, like the S.T.75 circuit, one stage of high-frequency amplification; detection by the second valve; and one stage of audio-frequency amplification by the first valve again.

The principal feature is the tuned rejector-circuit put across the grid-connection of the second valve and local earth, on which reacts the tuned anode coil of the latter valve. The inductances of these two oscillating circuits should be of the same value—Nos. 50 duo-lateral coils are suitable for broadcasting, or corresponding values of other coils—and are carefully tuned each by a .0005 μF variable condenser, and very loosely coupled for reaction purposes.

Both aerial-circuit and first plate-circuit variometers should be of low resistance for satisfactory reception: the author used a Bowyer-Lowe (wound with No. 20) and large Igranic variometer respectively. These could be replaced, if the necessary variable condensers are at hand, by a No. 35 and No. 50 coil with parallel condenser. The radio-frequency choke, which was a No. 400 duo-lateral coil, can be replaced by any low-capacity coil of large number of turns, *e.g.*, a single layer solenoid inductance with slider.

The tuning is naturally extremely sharp and critical, and a buzzer wave-meter is almost a necessity for searching purposes, as the four tuned circuits must be controlled simultaneously, as well as the reaction-coupling. For broadcast reception this is no great drawback, as the circuits can be left set when once the station has been tuned in. It will be seen that the reaction is applied at a permissible point.

A high plate-voltage is almost a necessity;

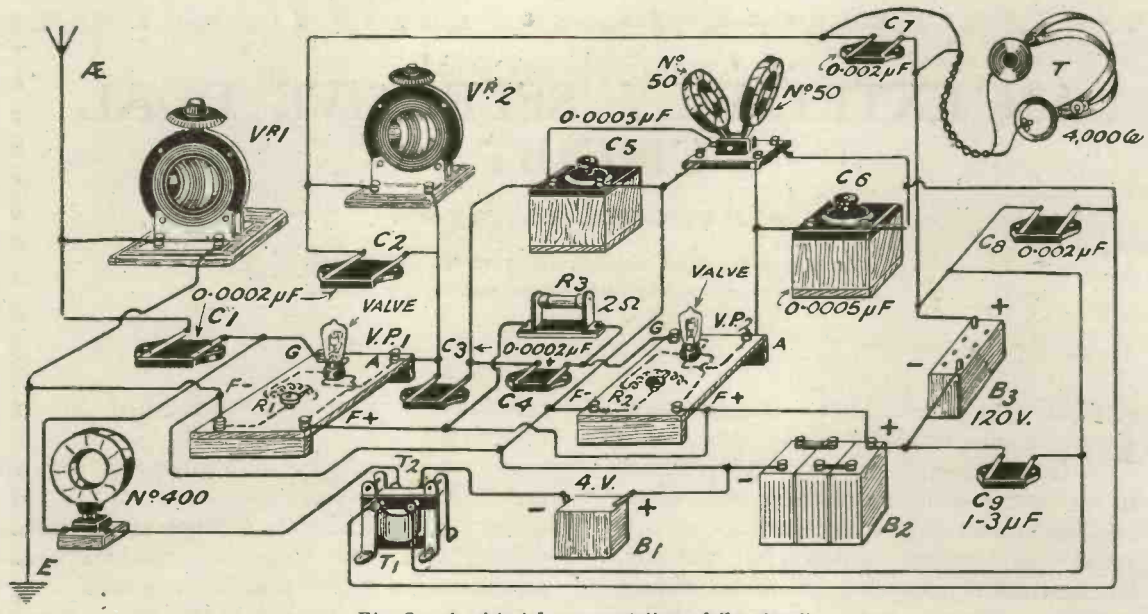


Fig. 2.—A pictorial representation of the circuit.

the minus four volts permanent grid-bias (one flash-lamp battery) is appropriate for this, and is essential to prevent the first valve from acting as a detector-valve and rectifying unwanted signals.

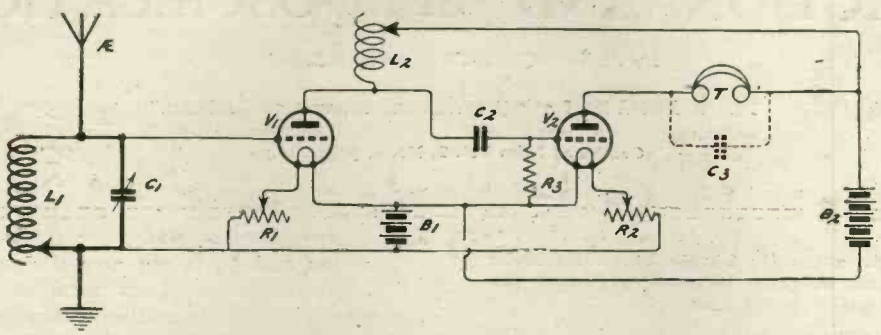
The results obtained by careful tuning with this circuit are striking. Local broadcasting comes in at a distance of twelve miles with extremely good loud-speaker strength, and is very pure and clear, with a completely silent back-ground. Then the local station can be tuned out, and Manchester, for instance, enjoyed at good strength in the telephones in North London whilst 2LO is at full blast, without any loose-coupling in the aerial circuit, and with a difference of only 16 metres in wavelength.

Such results are frequently claimed, but are generally not easy to attain with a comparatively simple two-valve circuit and with a few minutes tuning only. The arrangement of the apparatus is shown pictorially in Fig. 2.

THE RADIO SOCIETY OF GREAT BRITAIN

THE next session of the Radio Society of Great Britain opens on September 26th. Lectures will be held on the fourth Wednesday of each month, at the Institution of Electrical Engineers, at 6 p.m., the season continuing until next June. At the informal meetings which will also be held, discussion is invited and smoking will be allowed. In all probability Transatlantic tests will take place this year, and the Society will shortly be making the necessary arrangements for co-operation with U.S. amateurs.

"WIRELESS WEEKLY" CIRCUITS—No. 20



COMPONENTS REQUIRED

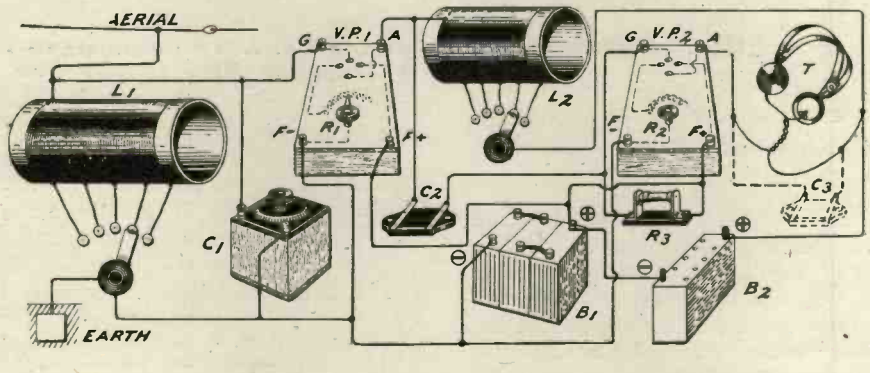
L_1, L_2 } Variable inductances.
C_1: A variable condenser of 0.0005 μF or 0.001 μF capacity.
C_2: Grid condenser of 0.0003 μF capacity.
R_3: Gridleak of 2 megohms resistance.
T: High-resistance telephone receivers.
C_3: Optional condenser of 0.002 μF capacity.

GENERAL NOTES

This is a reactance-capacity coupled receiver. The inductance L_2 is not tuned by a condenser, but is preferably tapped. The loudest signals will be obtained on a certain adjustment of the inductance. Below this value the signals will disappear, but above it weaker but quite loud signals will continue to be received. The arrangement is not selective; tuning is very simple. A slider, instead of a tapped inductance, gives much better results in the anode circuit of the valve. A variometer, if sufficiently large, could also be used.

VALUES OF COMPONENTS

The inductance L_1 may consist of 60 turns of No. 26 gauge wire on a 3in. cardboard tube. Tappings are taken at the 20th, 30th, 40th, 50th and 60th turns. The inductance L_2 may consist of 130 turns wound on a cardboard tube 3½in. in diameter. Tappings may be taken at the 50th, 70th, 90th, 110th and 130th turns.



PRACTICAL WIRELESS NOTES—No. 2

HIGH-TENSION BATTERIES

by reason of the long service which they will give if properly treated, are by no means an expensive item nowadays. Batteries containing the smallest type of cell should not be used with a receiving set employing more than two valves. For sets employing four or five valves, the battery should consist of the largest type of cells available, in order to be able to supply the current required without unduly shortening the life of the battery.

High-tension batteries should be kept in a cool, dry place. Warmth is distinctly injurious, as, although the cells are termed "dry," they really contain moisture, and are quite useless when they actually become dry. Wax-covered batteries should be examined carefully from time to time, and if any signs of a green discoloration are observed (due to corrosion occurring at the top of one or more of the cells), the wax should be removed and the defective cell either taken out altogether or short circuited.

Batteries provided with plugs and sockets are very convenient, enabling varying voltages to be obtained from a common battery. For instance, with a 100-volt battery, 60 volts may be used for the high-frequency valve, about 40 volts for a rather soft rectifying valve, and the full 100 volts for the low-frequency amplifying valve.

In an emergency a run down high-tension battery may be given a temporary new lease of life by "charging" it from D.C. lighting mains, through a single metal filament lamp, exactly as a very small capacity accumulator, for about an hour.

REACTION AND SELF-OSCILLATION

By JOHN SCOTT-TAGGART, F.Inst.P.

This is Part XVIII of "Questions and Answers on the Valve."

(Continued from Vol. 2, No. 6, page 238.)

Draw and explain a simple Single Valve Receiver in which a Crystal Detector is used to Detect the Oscillations, Reaction being used.

Such a circuit is shown in Fig. 1. It will be seen that the tuned anode circuit $L_2 C_2$ has connected across it the detector D and the high-resistance telephone receivers T. When the inductance L_2 is separated from L_1, the

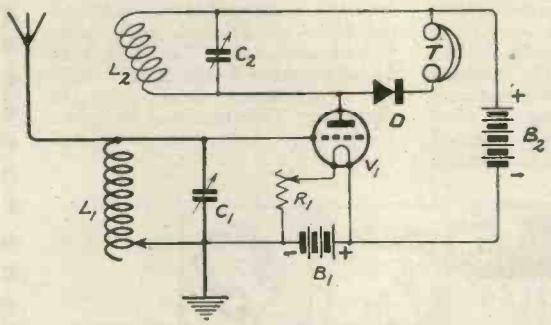


Fig. 1.—A simple valve-crystal receiver with reaction.

circuit is a simple high-frequency amplifier in which a crystal detector is used to rectify the high-frequency oscillations flowing in the tuned anode circuit $L_2 C_2$. If, however, we couple the inductance L_2 to the inductance L_1 in a suitable direction, some of the high-frequency energy from L_2 will be induced into L_1 and will strengthen the existing oscillations there. These strengthened oscillations will now be amplified by the valve and will appear in the circuit $L_2 C_2$. These strengthened oscillations are detected by the crystal detector and telephones, and by the use of reaction in this way very strong signals may be obtained.

How may a Three-electrode Valve be used as a Detector and also for obtaining a Reaction Effect.

Fig. 2 shows a simple single valve circuit in which the valve acts as a detector, an inductance L_2 in the anode circuit being coupled to the inductance L_1 in the grid circuit.

It will be seen in this circuit that the reaction coil L_2 is not now shunted by a variable condenser. It is usual to shunt the reaction coil by a variable condenser and to tune it to the incoming wavelength if some form of detector is connected across the anode circuit, but when the reaction coil is used simply for strengthening the oscillations in the grid circuit, it is customary to use an aperiodic reaction coil which works perfectly well. This reaction coil, by inducing some of the amplified oscillations back into the grid circuit, strengthens the oscillations existing in that circuit, thus resulting in louder signals. The grid condenser and leak act in the usual manner, the oscillations in the grid circuit being thereby rectified by the valve.

Why, in Fig. 2, is a Condenser C3 shunted across the Telephone Receiver, and What is its Usual Capacity?

The object of the condenser C_3 is to act as a by-path for the high-frequency currents in the anode circuit of the valve. The value of the condenser is usually 0.002 μF (microfarad). The oscillations in the anode circuit of the valve would find it difficult to pass through the telephone receivers T, although, if

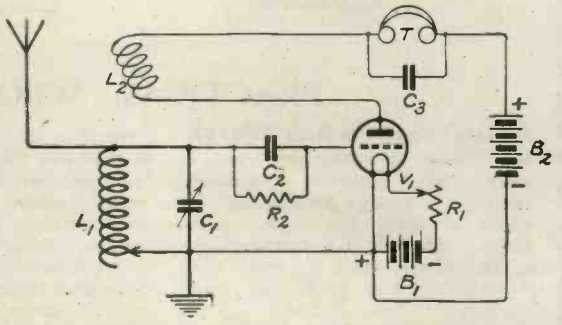


Fig. 2.—A single valve reaction circuit.

these are provided with parallel telephone cords, the condenser C_3 may frequently be omitted. It is, however, usually desirable to insert this by-path condenser

What Restrictions are there Regarding the Use of Reaction?

The Postmaster-General forbids the use of reaction on an inductance associated with the aerial circuit of a receiver. In other words, he forbids the use of reaction in such a way that interference with neighbours may be caused by tightening the reaction excessively. There are methods of applying the reaction in such a way that, even if the valve oscillates, the radiation of waves from the receiving aerial is negligible. Such circuits are permitted by the Postmaster-General to be used, but arrangements similar to those shown in Figs. 1 and 2 are strictly forbidden. These regulations only apply to the reception of British broadcasting, and do not apply to the reception of other signals on wavelengths outside the broadcasting band of wavelengths or when broadcasting is not taking place.

Draw a Two-Valve Circuit in which the First Valve is a Detector using Reaction, and the Second Valve acts as a Low-frequency Amplifier.

Such a circuit is shown in Fig. 3. The reaction coil L_2 is coupled to the inductance L_1 in such a way as to produce reaction. The rectified low-frequency currents are passed through the primary T_1 of the step-up inter-valve transformer $T_1 T_2$, and are applied by the secondary T_2 to the grid of the second valve, which acts as a low-frequency amplifier, the telephone receivers being connected in the anode circuit of that valve. This circuit may not, of course, be used for the reception of British broadcasting.

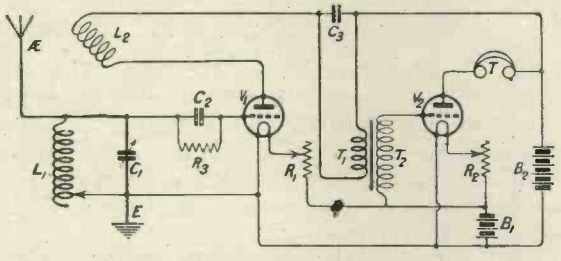


Fig. 3.—The addition of low-frequency amplification to the circuit of fig. 2.

Draw a Two-Valve Receiver in which the first Valve is Used as a High-frequency Amplifier and the Second as a Detector, Permissible Reaction being Used.

Such a circuit is given in Fig. 4 and is generally known as the ST34 circuit. This circuit was first published by the writer and has achieved very great popularity.

In the anode circuit of the valve is an inductance L_2 and a variable condenser C_2. When this tuned anode circuit is tuned to the wavelength of the incoming signals, the latter are greatly amplified, and the oscillations in $L_2 C_2$ are applied to the grid of the second valve. In the anode circuit of this valve is

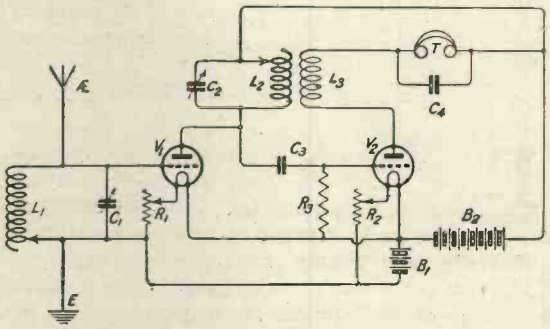


Fig. 4.—A circuit employing the approved type of reaction.

a reaction coil L_3, coupled to the inductance L_2 in such a way as to increase the strength of the oscillations in $L_2 C_2$. The telephones T, shunted by a by-path condenser C_4, are included in the anode circuit of the second valve. This circuit, using reaction, is permitted by the Postmaster-General for the reception of British broadcasting.

What is meant by Self-oscillation of a Valve Receiver?

When reaction is used in a wireless receiver and the coupling between the reaction coil and the grid coil is too tight, the valve commences to generate oscillations of its own accord. These oscillations are like alternating currents, but are of high frequency. Whenever too much energy is transferred from the output circuit of an amplifier to the input circuit, the amplifier will tend to generate continuous oscillations.

A mechanical analogy is the ordinary steam engine. The output side of the steam engine —namely, the crankshaft—is connected to the input side, which is the slide-valve. A commonly used analogy is the pendulum which may be kept swinging by giving it taps at suitable intervals. The ordinary clock is a form of oscillator in which energy is given to the pendulum by means of a main spring, this energy being released at the right moment by the escapement, the timing of which is accomplished by the pendulum itself.

A full explanation of self-oscillation is given in the writer's book, "Wireless Valves Simply Explained."

DULL-EMITTER VALVE FILAMENTS

By Dr. J. H. T. ROBERTS.

In view of the increasing popularity of dull-emitter valves the following information regarding them will be found of interest.

THE filament of a wireless valve which supplies the electronic carriers for the valve current may be made of any sufficiently conducting substance which can be suitably worked into the form of a filament or strip and which will give a reasonably long life in use. The requirements for a valve filament are, in fact, very similar to those for the filament of an incandescent electric lamp, and for the latter purpose a variety of refractory metals and other substances have at various times been tried.

In addition to the ordinary manipulative and service requirements, however, the valve filament must also possess in a pronounced degree the property of thermionic emissivity. It is well known that the thermionic emission from a substance is usually extremely small until a temperature in the neighbourhood of perhaps 600 or 700 degs. Centigrade is reached; this temperature corresponds to a very dull red heat. As the temperature is raised beyond this point, however, the thermionic emission begins to increase considerably, and when the temperature reaches a bright red heat, the emission increases very rapidly until, at a temperature between 1,200 and 2,000 degs., the emission is millions of times as great as it was at the very dull red heat. With most filaments this range, namely, in the neighbourhood of 2,000 degs. Centigrade, is the normal working temperature.

Now the maintenance of the filament at so high a temperature is disadvantageous in a number of ways. In the first place it means that the heating current is greater than it would be for a lower temperature, with the result that the demand upon the heating battery is correspondingly greater. In the second place the life of the filament is considerably shorter when the temperature is very high, and a drop in the normal working temperature even of one or two hundred degrees may increase the normal life of the filament several times over.

In view of the disadvantages of filaments requiring to be raised to a very high temperature, it was natural that efforts should be made to produce a filament which would give the necessary thermionic emission at a much lower temperature. Many years ago Wehnelt found that if a spot of sealing wax were placed upon a platinum strip and the latter raised to incandescence so that the spot of sealing wax was ignited, the strip where the ash was left had a very much greater power of emitting slow-speed electrons.

The explanation of this Wehnelt cathode, as it is sometimes called, is that the sealing wax contains certain rare earth oxides which are left behind when the shellac of the sealing wax is ignited. Oxides of the rare earths, as well as certain other substances, will give a comparatively large electronic emission at a given temperature. Although the wireless valve was probably not thought of at the time Wehnelt made this observation, it seems very clear that the Wehnelt cathode was the forerunner of the present-day dull emitter filament.

When efforts were concentrated on the production of a dull emitting filament, it was natural that they should be devoted in the first place to the development of what were in reality various kinds of Wehnelt cathode. Such filaments are nowadays known as "coated" filaments, and are very extensively used in valves employed in America for the amplification of line-telephony. These coated filaments, however, have certain disadvantages peculiar to themselves.

Now we have seen that up to this point two different kinds of filament have been employed, namely, the filament of a pure metal and the same coated with rare earth oxides. The actual thermionic emission from a filament or from any substance depends upon the temperature, area, and the other conditions, and also upon the nature of the substance itself. Some substances at a given temperature will give a very much greater emission than others. In addition to the two kinds of filament mentioned above, there has now appeared a third kind of filament which, in a sense, is a cross between the other two. This filament, of which the thoriated tungsten filament is an example, is for practical purposes a pure metal filament, and yet in operation it has the properties of a coated filament.

It is curious to note that although the thoriated tungsten filament has now been produced and used with great success, and although it appears to be the best solution yet found to the problem of a low temperature emitter, it was discovered by accident and not as a result of the search which was going on in that direction. The history of the thoriated tungsten filament, in fact, is interesting as a good example of the application of an accidental observation to a useful purpose.

During the manufacture of the extremely fine filaments which are used for electric incandescent lamps, it was found that tungsten which was fired in a Battersea crucible derived certain impurities in the process, and these were presumed to come from the crucible. So far from these impurities being a disadvantage, it was discovered that if they were carefully avoided the resulting tungsten filament was not nearly so tough and generally robust. Consequently, investigations were made with a view to ascertaining the nature and cause of the impurities, and whether the definite admixture of any particular ingredient would produce still better results in the way of tensile strength and lasting properties in the filament.

Without going into further details of these investigations, it was found that the admixture of thoria (which is an oxide of the metal thorium and enters into the composition of incandescent gas mantles) in the proportion of 1 or 1½ per cent. in the tungsten, had a pronounced effect in increasing its tensile strength and other manipulative and lasting qualities. It was for this reason, and for this reason only, that thoria was mixed with the tungsten, and the thoriated tungsten filament was produced primarily for use in electric lamps.

It was later found that at comparatively low temperatures, in the region of 600 or 700 degrees Centigrade, the thermionic emission from a thoriated tungsten filament was thousands of times greater than that from a pure tungsten filament, so much so that the emission from a thoriated tungsten filament at a dull red heat was actually equal to the emission from a pure tungsten filament at a brilliant white heat. The current from such a tungsten filament at 1,250 degs. Centigrade has been measured and found to be about 150,000 times greater than from ordinary tungsten. These figures, however, must not be misunderstood, as statements which have recently appeared in the press have been in some ways rather misleading.

It might be thought that if the emission from a thoriated filament is, say, 100,000 times as great as that from an ordinary filament, then the former, at a working temperature of 2,000 degs. C., would give 100,000 times the current of the latter; that is, other things being equal, a valve with a thoriated filament would carry 100,000 times the current of a valve with an ordinary filament. If such were the case the use of the thoriated filament would be very much more wonderful than it already is. But unfortunately this is not the case, and it must be observed that the enormous superiority in the thermionic emissivity of thoriated tungsten is only available at comparatively low temperatures, so that the advantage lies rather in the saving of heating current than in the increase of thermionic output.

The practical reason why the enormously greater emissivity cannot be taken advantage of at higher temperatures is that if a thoriated filament be raised to too high a temperature, the thorium on the surface of the filament evaporates off, leaving only pure tungsten.

The action of the thoriated filament was at first imperfectly understood. Thorium is a metal which for a given temperature has a very large thermionic emissivity. The increased emission from a thoriated filament is due to the presence of thorium on the surface of the filament. When a thoriated filament is heated to a temperature of about 2,500 deg. Centigrade, some of the thorium oxide seems to diffuse throughout the tungsten and reach the surface. If the filament is kept at this temperature, this surface thorium will evaporate, as already mentioned. If, however, after raising to a temperature sufficiently high to convert some of the thoria into thorium the temperature of the filament be then lowered to, say, 1,800 deg. Centigrade, the thorium is still able to diffuse gradually through the tungsten and yet the surface layers of thorium are not evaporated particularly rapidly.

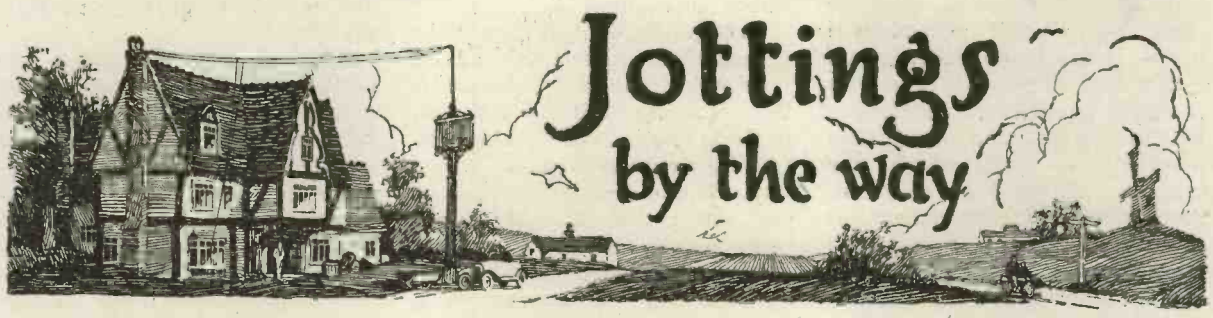
The action of a thoriated filament thus depends upon the gradual diffusion of metallic thorium from the body of the tungsten to the surface. It requires a comparatively high temperature to convert the thoria into thorium, but if this high temperature is maintained the thorium continually evaporates; the thorium leaves the surface, and therefore no useful effect is obtained. If, however, after the filament has been subjected to the temperature necessary to convert some of the thoria into thorium the temperature be then lowered, the thorium will still be able to diffuse gradually to the surface, where it will remain for a sufficient time to give to the filament the special thermionic emissive properties which we have been discussing.

The thickness of the thorium coating which forms on the surface of the tungsten filament is exceedingly small; it has been calculated that it does not exceed in thickness the diameter of a single atom—that is, about one-hundred millionth of a centimetre.

This coating is very susceptible to attack from various causes. It is for one thing very liable to oxidise and return again to thoria. Hence it is necessary to enclose it in an extremely high vacuum, and it is particularly important to exclude any traces of water vapour or other gases which would yield oxygen. One simple method of removing traces of water vapour is to include in the vessel metallic magnesium, with which the water vapour combines more readily than with the thorium.

It has already been mentioned that care should be taken to avoid heating the thoriated filament to too high a temperature; it is best to operate such a filament in the region of about 1,600 deg. Centigrade, as at this temperature the thorium can diffuse through the metal and so replace that which is destroyed at the surface by the effect of residual gas in the tube;

(*Continued on page* 277.)



What the Wild Waves Do

THE weird complaints about the terrible effects caused in all kinds of ways by the "broadcasting of Hertzian waves" and things of that kind still continue. Gentlemen who are brought before the beak on the morning after the night before attribute their temporarily eccentric conduct to the baleful influence of wireless, declaring that they have never been quite the same since broadcasting started, and that they are now liable to periods of what they describe as "queerness." Others aver that they cannot think because of the signals and the music that are incessantly pinging and ringing in their poor brains. Yet a third class unhesitatingly ascribes all the vagaries of the weather to the same cause. It does not seem to occur to these people that, though the great public heard of wireless only about a year ago, it was nearly as much used before broadcasting as it is now. Exhalations, to quote Shakespeare, whizzed through the air or rather the ether then; but as few people had receiving sets and were able to hear them, nothing much was thought about the matter. But when broadcasting, which is, after all, but a tiny drop in the ocean of radio, came in and everyone's talk was of wireless, then the cranks got their innings. Quite the best effort was that of a certain lady who wrote to the papers that birds flying *in line with* a certain aerial's transmissions had been seen to drop dead! That is directional wireless with a vengeance.

The Enthusiastic Journalist

A good deal of this nonsense is due to writers in popular papers who get far out of their depth in their efforts to be topical or sensational, without any knowledge of the subject upon which their pens are engaged. And such wild ideas once started are extremely difficult to eradicate from the minds of a certain type. You have only to go to Hyde Park on a Sunday afternoon to discover the amazing causes to which people of presumably average intelligence will attach themselves with the utmost fervour. The progress of science in the past has been hampered to an almost incredible extent by prevalence of similar wild ideas.

Uncanny!

Mankind is conservative to the marrow. Any new idea is apt to get our backs up. I have a friend who, though a well-educated man and an amateur astronomer of some note, absolutely refuses to listen to a wireless reception because he thinks that the whole thing is uncanny! Yet this same man will use the land telephone a dozen times a day without its occurring to him that it is really a far more astounding feat to confine a current to a wire than to send it far and wide through the ether. Can you wonder that belief in witchcraft was so widespread during the Middle Ages, when any inventor was looked upon as being at all events on speaking terms with the Evil One? Truly we are a weird and wonderful race!

Eyesores

A well-designed aerial properly erected by no means detracts from the appearance of either house or garden. There is always something graceful in the appearance of a tall, tapering mast capped by a seemly truck, and the slender wires with their long curving sweep are good to look upon. But when men put up such horrors as masts that don't stand straight, but seem to reel drunkenly, and wires that either sag forlornly or are stretched so tightly that they look as if they may break at any moment, then the eye is offended. If the thing is so badly put up that the wires are of unequal lengths and the spreaders twist themselves to weird angles instead of lying comfortably horizontal, it becomes a veritable eyesore. The difference in cost between a good-looking aerial and one that proclaims in every line its insufferable ugliness is a matter of shillings. This is surely a case where one should blow the expense and make a good job of things.

Difficulties across the Herring Pond

Our friends in America are becoming seriously perturbed over the congestion that is obtaining over there on the broadcasting band of wavelengths. The number of stations that regularly transmit news, weather reports, games reports, and musical programmes runs to something like 700. Most of them work on 360 or 400 metres, though some are now using 485 metres. Those of us who

tear our hair after vain afforts to separate two of our own stations working on wavelengths 30 metres apart can realise the troubles of the Yank, using a fairly powerful set, with possibly half a dozen 360 metre transmissions all coming in one on top of the other. No known tuning device will pick out one if all are fairly strong. The salvation of America from a wireless point of view seems to lie in the fact that in any big town it is quite unnecessary to use anything more than a crystal, to which you may add note magnifiers if you wish to work a loud-speaker. If sets with high-frequency amplification were as common there as they are here, the welkin would be rent with one long howl, for you are allowed in the States to couple your reaction coil, or " tickler " as they picturesquely term it, directly to the A.T.I. An agitation is afoot for the adoption of some such system as our own, whereby each station is given its own wavelength and a fairly wide band is allotted for broadcasting purposes.

Can you Pick Out One?

The trouble with telephony is that you cannot tune the transmissions very sharply. At 50 miles or more it may be necessary to tune receiving sets fairly critically, but within a shorter radius you can pick up the strains of any broadcasting station over quite a wide band. On my set 2LO, 30 miles away, is just audible from 320 to nearly 400 metres with the switch in the stand-by position. Birmingham, 85 miles distant, covers a band of roughly 30 metres. With the secondary in use and the coupling as loose as possible, these limits are very much reduced. Still, it takes one all one's time to bring in stations on intermediate waves. I have known a cornet solo from Manchester provide an entirely unwanted *obbligato* to a song from Newcastle. Thank goodness they are not all on the same wavelength here!

A Warning

The warning given some time ago against bogus Post Office inspectors who may call and ask to be allowed to examine receiving or transmitting gear has apparently been forgotten by a good many people, and I hear that a few little tragedies have been enacted recently in some places. A friend has just told me how he has been bitten.

Whilst he was away for the day a man called at his house and demanded to be shown his wireless gear. As he looked respectable and spoke with authority the lady of the house turned him loose in the wireless den. When her lord and master returned his lamentations filled the air, for 'phones, condensers, and many valuable gadgets had been borne off in the official-looking black bag carried by the " inspector."

If you are wise, you will warn your household against these gentry. The genuine inspector carries credentials with him, and if the owner is away he will prefer to make another call at a time when he is sure to be in.

Exit the Earth

Another man had an equally sad experience. Wishing to make his earth as good as it could possibly be, he buried a large copper plate. A few nights later he got only the weakest signals when he switched on. On going to investigate he found signs of spade work: the beautiful copper plate had been dug up and removed by miscreants. I used to envy that copper plate, but now I can smile for I don't think that anyone will bother to disinter the ancient scullery zinc bath that lies buried beneath my aerial.

WIRELESS WAYFARER.

DULL-EMITTER VALVE FILAMENTS

(Continued from page 275).

at this temperature also the evaporation is comparatively small. Owing to the lower operating temperature, the life of a thoriated filament is greatly enhanced, and in some cases filaments have been run for considerably over 5,000 hours.

A great advantage of the thoriated filament, particularly for amateurs'-receiving valves, is the fact that the filament can be ignited by means of a two-volt dry battery instead of a six-volt accumulator which is required for an ordinary filament. Whereas an ordinary tungsten filament may take a current of 0·75 ampere at, say, 4 volts, that is 3 watts, a dull-emitter filament will require only about 0·4 ampere at 1·8 volts, that is, about $\frac{3}{4}$ of a watt. Another advantage which is claimed for these valves is their silent working and freedom from crackling and valve noises. Although this advantage has certainly been obtained by a considerable number of users, it appears that the freedom from crackling noises depends to a large extent upon the manufacture of the filament itself, and it has, in fact, actually been urged by some investigators that so far from being particularly silent, a thoriated or coated filament is particularly noisy. It may probably be taken, however, that the present-day thoriated tungsten filament, especially as employed in the construction of receiving valves and when operated in the region of the specified temperature, is exceptionally free from noises.

DESIGNING SIMPLE CRYSTAL RECEIVERS

By E. REDPATH, Assistant Editor.

The following article—the third of a series—deals with methods of tapping inductances and the construction of a variometer tuner.

(Continued from Vol. 2, No. 6, page 242.)

FOR the reception of short waves (of the order of 200 metres), a variable condenser may be introduced as shown at C_2 in Fig. 9. This condenser must be of fairly large capacity, 0.0005 μF at least, so that the better plan in order to provide for all contingencies is to employ a variable condenser having a maximum capacity of 0.0005 μF, together with a "series-parallel" switch, arranged as shown in Fig. 10. With the switch in the upper position the condenser is in parallel across the active turns of the inductance, and the capacity in use should be kept as small as possible. With the switch in the lower position the condenser is in series on the aerial side of the inductance, and the

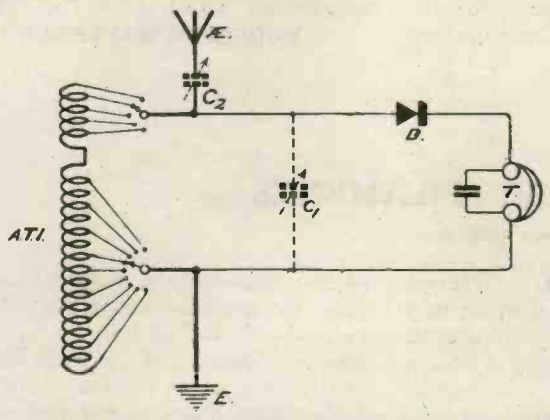


Fig. 9.—The circuit arrangement when a tapped inductance is used.

capacity should be varied from maximum to about half that value.

Methods of Tapping the Coil

There are several methods of making actual connection to the various points on the coil. It is sufficient if, during the winding of the coil, loops about 6 or 8in. long are left at each point, the wire being tightly twisted three or four times and the winding continued. Subsequently the insulation may be removed

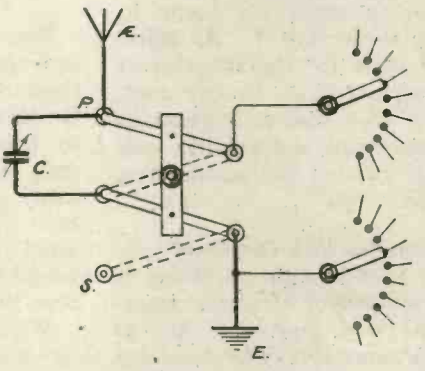


Fig. 10.—Switch to enable one condenser to be used in series or parallel.

from the end of the loop and connection made to the appropriate contact stud, either by means of a nut and washer or by soldering. This simple method is illustrated in Fig. 11, but it has the disadvantage that any current in the coil has to traverse all the preceding "loops."

A better method consists in making, at each selected tapping point, quite a small loop by passing the wire round a lead pencil and twisting the latter three or four times. Subsequently the insulation is to be removed from part of the loop and the end of a single insulated wire is to be soldered to it. Fig. 12 illustrates this method.

Either of the two foregoing methods, however, will prove very awkward in the case of the sub-multiple tappings referred to in connection with Fig. 8, and a much more satis-

factory method of making the single-turn tapping is as follows:—

Secure the end of the wire by threading through two holes in the cardboard tube as usual, and commence winding, inserting beneath the wire as each full turn is completed a small piece of mica about 1-64in. thick. Only

variation being at the rate of one complete turn, is not absolutely continuous, although for all practical purposes it may be considered so.

With a tapped coil having only one tuning switch, the tappings being arranged in groups of 10 or 20 turns, for instance, a parallel

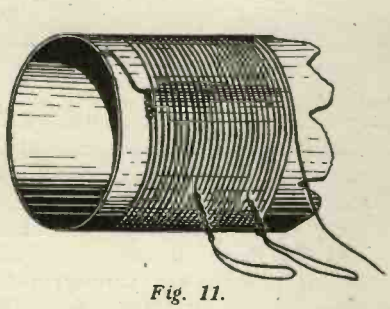


Fig. 11.

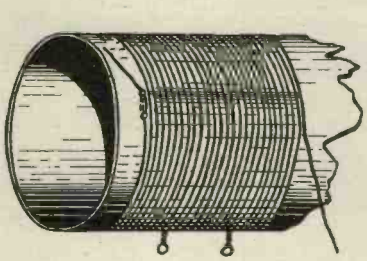


Fig. 12.

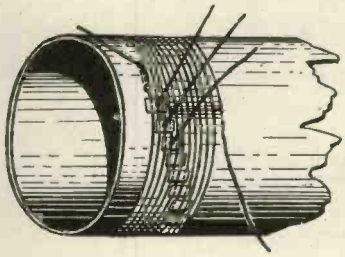


Fig. 13.

Illustrating various methods of tapping inductance coils.

that particular turn of wire from which a tapping is to be made should pass over each piece, the successive pieces of mica being arranged in a spiral around the coil.

The ten-turn tapping may be treated similarly if desired, and when the coil is completed the insulation is to be removed from the wire just above each piece of mica, and the end of an insulated connecting wire is to be soldered thereto. Fig. 13 illustrates the method, three tappings being completed, and if the work is done carefully, the result is a very workmanlike and efficient job.

Variometer Tuning

The main essential of a good tuner is that the wavelength of the aerial circuit shall be variable continuously and smoothly over the

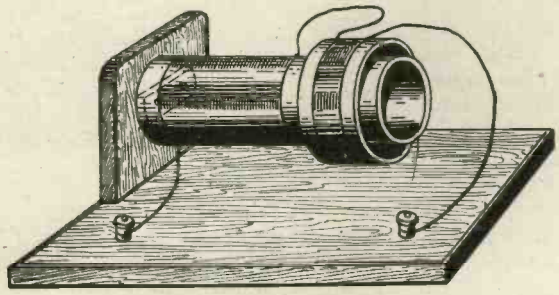


Fig. 14.—An easily constructed but efficient variometer.

range of wavelengths for which it is designed. In the case of an inductance coil provided with a slider or tapped upon the multiple and sub-multiple system already described, the variable condenser becomes necessary, although undesirable for reasons of efficiency, simplicity and economy.

Fig. 14 illustrates a very simple yet effective variometer tuner. It consists of two cardboard tubes, one 2½in. in diameter by 6in. long, and the other 3in. in diameter by 2in. long. The smaller diameter tube is to be wound with 40 turns and the larger tube with 30 turns of No. 24 S.W.G. double-cotton-covered copper wire.

No tappings are required, but the ends of both coils should be left sufficiently long so that, when connected up as shown in Fig. 14, the larger coil may be removed from the

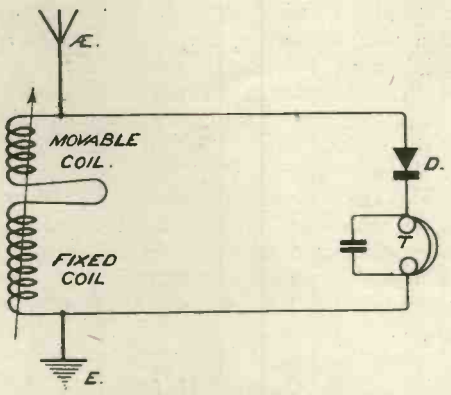


Fig. 15.—Circuit diagram of receiver with variometer.

smaller one, reversed and replaced upon it with the winding in the opposite direction.

With both windings connected in series as

(Continued on page 296.)

News of the Week

ARRANGEMENTS are now well advanced for the first Scottish National Radio Exhibition, to be held at St. Andrews Hall from September 3rd to 8th. The organisers, The Radio and General Publicity Co., expect that there will be about 40 stands, at which all the latest developments in radio science will be exhibited. Comprehensive arrangements are being made to enable visitors to hear concerts broadcast from Glasgow and other stations.

◇ ◇ ◇

We are informed by the Wandsworth Borough Council that there is no truth in the rumour that they have terminated tenancies of persons who have installed wireless apparatus in the Council's houses.

◇ ◇ ◇

A correspondent sends us a cutting from a Scottish newspaper referring to the previously reported episode of the striking by lightning of a tree supporting a wireless aerial near Perth. It now appears that the tree alone suffered, and that no damage was done to the aerial, which does not seem to have carried any of the discharge. The episode seems a remarkable confirmation of the contention of many who should know, that wireless aerials are not a danger in time of thunderstorms.

◇ ◇ ◇

It is being suggested that the newly discovered element Hafnium may be of use in the manufacture of dull-emitter valves, and one of the Dutch firms of valve manufacturers is now investigating its possibilities. It may be remembered that this new element was discovered by a Danish professor who won the Nobel Prize last year and that it occurs in certain minerals in Norway and Greenland.

◇ ◇ ◇

The Danish Island of Bornholm, which has previously had no telephone or telegraph communication with the rest of Denmark, has just been connected with Copenhagen by a combination of wireless and wired telephone systems. It is now possible to make telephone calls through the mainland exchanges. It is claimed that true duplex working is obtained by the system which has been adopted, that is, that there is no need to switch over from send to receive during a conversation, the parties simply conversing in the ordinary manner of the line telephone.

◇ ◇ ◇

For the purpose of this service a new Lorenz-Poulsen transmitting station has been provided near Lyngby at the Copenhagen end. The receiving station is installed in the Island of Amager, to the south-east of the Danish capital, using a loop aerial on the top of a 90ft. mast. At the Bornholm end another Lorenz-Poulsen transmitter has been erected at Hammeren in the northern angle of the island, and the receiver is placed near Ronne Harbour, on the western coast. Further details of the service of these stations are given in the September number of *Modern Wireless*.

◇ ◇ ◇

It is learned from Montreal that an agreement has been entered into between the Canadian General Electric Co., the Northern Electric Co., the Canadian Westinghouse Co., the International Western Electric Co., and the Bell Telephone Co., of Canada, whereby the respective patents of each concern may be used by any party to the agreement. The Marconi Co. have also obtained the use of patents for wireless purposes of the Bell Co., for telephone communication, while the manufacturing companies, including Marconi, can use them for purposes of manufacture and sale.

◇ ◇ ◇

There has been a good deal of discussion and comment upon the delay which occurred in the report of the safety of the passengers of the "Princess Ena," which went ashore near St. Malo recently. It will be remembered that nearly a day elapsed before any definite information reached London as to the fate of the 219 passengers on board, although a series of short messages the evening before suggested that there might have been serious loss of life. The explanation of the delay appears to be that once the "Princess Ena" was in port, she could not, of course, employ her wireless apparatus. It is being suggested that the International regulations should be amended to permit of this being done in cases of grave emergency of this sort.

◇ ◇ ◇

We learn from the *Electrical Review* that the Japanese Marine Products Bureau are considering the possibility of installing wireless telephone outfits on the larger size fishing boats which have their base at Nagasaki, to enable them to communicate with shore when in difficulties, and to report the catch to their owners.

There is quite a number of fishing boats on which such equipment might be installed, and although they frequently go distances from shore too great for direct communication, it will probably be possible to organise a system of relays.

◇ ◇ ◇

The new high power station erected by the Japanese Missui Company at Peking is completed, and has opened communication with Bordeaux. It is estimated to have cost considerably over half a million sterling.

◇ ◇ ◇

According to the reports from the seaside resorts it does not seem as if there were nearly as many wireless concerts as one would have expected. Of course no one wishes wireless to displace any instrumental performance. But it usually happens that there is a huge crowd on the pier or the esplanade in the vicinity of the band performances, and the rest of the holiday makers who cannot get to that particular spot have to do without. There is no reason why there should not be several wireless concerts going on at different parts of a resort to serve those who do not wish to trudge up to the pier or wherever the real performance is taking place

◇ ◇ ◇

The *Ost Express* says that the Minister of Communications, according to reports in the Lithuanian press, is negotiating with the Marconi Company regarding the erection of a big wireless station in Lithuania.

◇ ◇ ◇

With reference to the rumours which were current in the daily press recently of the transmissions of waves from Nauen which interfered with the magnetos on motor cars, Dr. A. Meissner, of the Telefunken Co., has stated that "these reports are foolish, utterly stupid and nonsensical."

◇ ◇ ◇

We learn that the United States Bureau of Standards is now inaugurating a service of standard wavelength transmissions at 11 p.m. Eastern time on wavelengths of 300 and 600 metres. It has not yet been announced which stations are to conduct this service.

◇ ◇ ◇

A wireless letter service between Germany and New York has now been arranged by the German Government. This service, such as has been carried on from this country for some time, will be conducted by the Nauen station.

◇ ◇ ◇

We learn that the Town Council of Bournemouth has heard from the B.B.C. that the date of October 9th has been provisionally fixed for the opening of the Bournemouth station, and the Mayor has been invited to attend the ceremony and broadcast a message.

◇ ◇ ◇

It is announced in *The Times* that a radio telephone set is to be installed by the Government of Trinidad at the Port of Spain wireless station to communicate with the stations already established by a British oil company on the Orinoco delta in Venezuela. The development of a complete system of radio telephonic communication throughout the West Indies is in contemplation. This will no doubt necessitate the erection of several complete stations, which will require to be fairly powerful to ensure satisfactory working under all con-

"The Lady Rose," of the Manchester station.

AN EXPERIMENTAL TWO-VALVE SET

By W. R. WISKEN.

Constructional details of a useful receiving set which is easy and economical to build.

THE two-valve set about to be described has given most satisfactory results, and the writer can recommend it for efficiency combined with simplicity of operation.

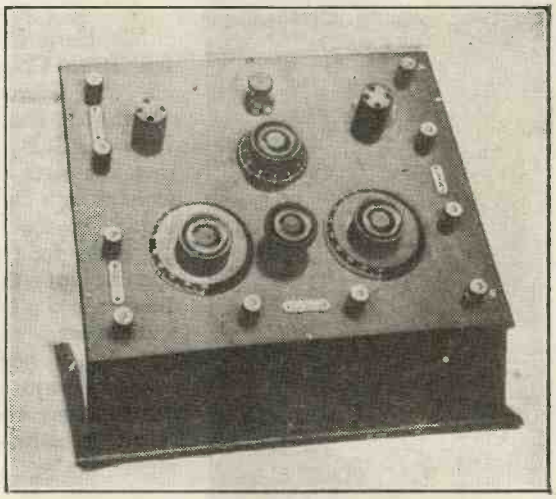


Fig. 1.—The completed receiver.

The accompanying illustrations are sufficiently explanatory to enable experimenters to build a similar set with a minimum of labour and expenditure. The completed receiver is shown in the photograph, Fig. 1. The following is a list of the essential parts and materials required:—

Ebonite panel 12in. by 10in. by $\frac{1}{4}$in. thick, 10 terminals (3BA), 1 filament rheostat, 1 variable condenser 0·0003 μF (or its equivalent in parts), inductance with reaction coil (details to follow), 2 valve holders, 1 fixed condenser, 0·0003 μF, 1 grid leak (Dubilier 2 megohms), 1 H.T. switch, 1 L.F. transformer.

Fig. 2 is a working drawing of the panel showing the necessary holes to be drilled. It is perhaps advisable to add that the ebonite used should be of "A" quality, with a matt surface finish. To obtain this surface, rub evenly in one direction with very fine emery cloth or sandpaper. When all the polish has been removed, rub over the surface with an oily rag. If care has been taken, a matt surface will result.

It is, of course, unnecessary to explain in detail those pieces of apparatus which are secured in position by the mere tightening of a nut; only items where constructional details are necessary will be dealt with.

Details of the inductance will be given first and Figs. 3 and 4 show the type of coil former used. The coils are known as basket coils. The writer recommends these formers to be cut from fibre owing to its rigidity and simplicity of mounting. Three formers are to be cut, one identical with Fig. 3 and two of the type shown in Fig. 4. By referring to Fig. 3 the method of winding these coils will be clearly seen.

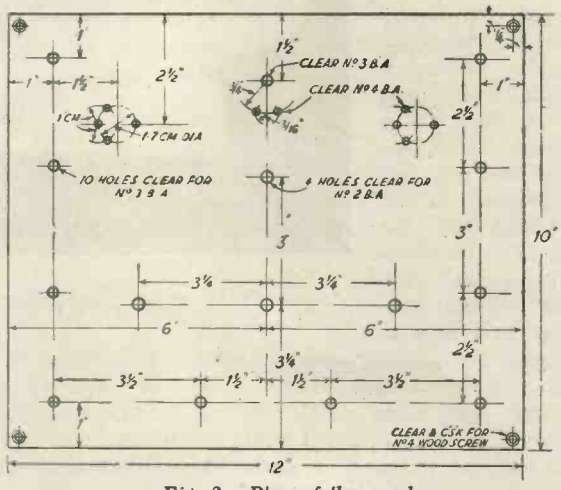


Fig. 2.—Plan of the panel.

Two small holes are drilled, into which No. 24 gauge d.c.c. copper wire is secured and the winding commenced by passing same

under and over alternate segments of the former. This is repeated until 40 turns (20 on either side) have been completed. The finished coil is then given a coat of shellac varnish.

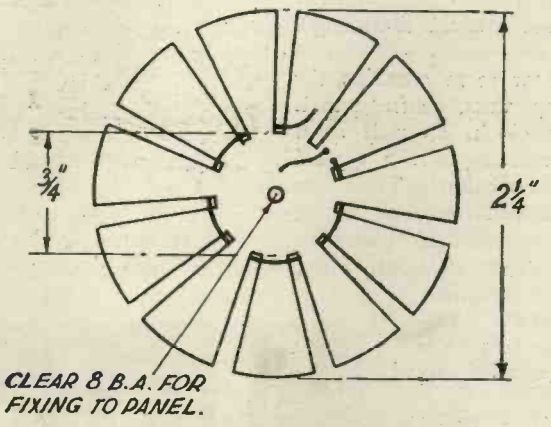


Fig. 3.—Former for the fixed basket coil.

The two ends of the fixed coil can be terminated on two small screws and nuts, fitted in a convenient position on the underside of panel. The two remaining coils may now be wound in a similar manner on formers as shown in Fig. 4, the ends being terminated on two screws and nuts fitted into the two holes as shown. It will be seen exactly how

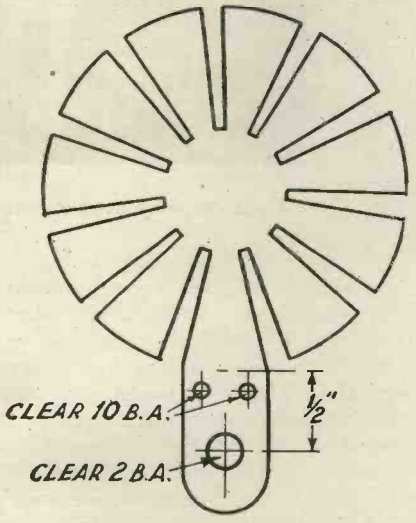


Fig. 4.—Former for the moving coils.

these three coils are mounted by referring to Figs. 5 and 6, which give a plan and section of that part of the panel.

The fixed coil is screwed in position centrally on the underside of panel between the two 2BA clear holes, spaced 3¼in. apart, shown on the left of Fig. 2. The necessary 2BA screwed rod, complete with control knob, is now passed through the clear hole

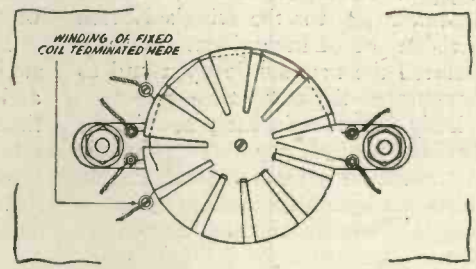


Fig. 5.—Assembly of the reaction coil and variometer.

provided for it on the left-hand side of the panel, and built up as shown in Fig. 6.

The two coils are connected together by joining the two inner windings by means of a short length of flex and, when in circuit, act as a variometer. The third coil, reaction, is

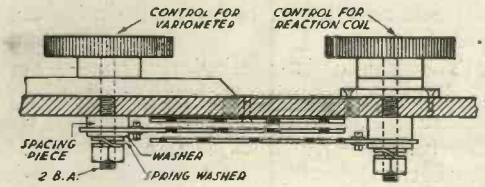


Fig. 6.—Section of variometer and reaction coil.

mounted in a similar manner, the 2BA screwed rod being passed through the clear hole provided, as shown in centre of Fig. 2.

The variable condenser may now be taken into consideration. As the majority of experimenters are sufficiently acquainted with

Fig. 7.—A suggestion for the attachment of the variable condenser to the panel.

the construction of such apparatus, a brief outline only is necessary. Those who are not clear regarding the assembly of variable condensers are referred to an article which appeared in No. 4 of *Modern Wireless*. The

(*Continued on p.* 294.)

THE BIRM STAT

A short account of the op

MONTHS of arduous search for an ideal site for a central broadcasting studio and a month of feverish preparation were brought to a successful climax when at 9 p.m. on August 11th Sir Herbert Austin, M.P. for the King's Norton Division of Birmingham, officially declared the new studio open and so inaugurated the new era.

Duly installed in their new home, the 5IT workers are very optimistic of the station's future fame, and no doubt a formidable attempt is to be made by the Birmingham Station to capture the laurels of British broadcasting.

The new studio is situated on the second floor of a large building abutting on New Street, the city's chief street. Here accommodation has been found to the following extent: An entrance hall, a reception room, a band room, a studio, a room for the modulator panel, and two rooms to be used as offices for the Station Director and for the Assistant Station Director and the Musical Director

The studio is particularly commodious, measuring some 25ft. square It is covered—floor, walls, and ceiling—with thick felt, and an arrangement over the windows enables these latter to be opened between turns, though a forced draught has been provided for ventilation purposes.

The walls and ceiling have been artistically draped in mauve and dove-grey hangings, while four double bracket lights and four centre lights provide the illumination. The chief furnishings are an Æolian grand piano and an orchestral organ, while a stand microphone, immediately in front of a sounding board platform, is used.

Between the modulator room and the studio there is a small window which enables the engineer in charge of the modulator panel to mark the progress of events in the studio.

An ingenious signalling device on the wall of the studio and operated from the modulating room indicates to the studio the requirements of the engineer. A red light above this signal panel gives the warning that the modulating circuit is operating. A number of different coloured lights convey the directions: All correct, come closer, move back, re-arrange, wait, speak.

The modulator room contains the modulating apparatus, control panel, and a master clock, as well as a three-valve receiving set, a crystal set, and a loud-speaker. There are leads from the valve receiver to the director's and assistant director's offices, enabling them to listen. There is also a private telephone connection with the transmitting station at Summer Lane, nearly a mile distant.

The modulator panel consists of a three-valve amplifier, and a control switch enables the right amount of current to be passed to the transmitting station, a volume indicator acting as a check on the output from the studio station.

At Summer Lane Power Works, the property of the Birmingham Corporation, a two-roomed building has been erected for the transmitting plant. Two hundred and ten feet above it, a T-sausage aerial, with a span of 100 feet, is suspended between two high chimney stacks and is said to be the largest broadcasting aerial in the country.

A photograph of the new studio at Birmingham showing seated in

The two rooms of the station are the generator room and the transmission room. In the former are duplicate three-unit motor sets consisting of high- and low-voltage D.C. generators, coupled to a driving motor. The main supply is 400 volts D.C., an automatic starter providing for starting and stopping by means of a press-button control. The driving motor develops 4 h.p. at a speed of 1,750 r.p.m. The high-voltage generator, supplying the plate current to the transmitting valves, is a direct-current shunt wound machine with two commutators designed to deliver continuously 1.25 amps at 1,600 volts pressure.

The low-voltage generator supplies filament current for the valves—28 amps. at 14.5 volts, and excitation current for the high-voltage generator. On the plate current supply is a circuit breaker working with an overload of 25 per cent.

The transmitting panel, in the second room, comprises four 250-watt valves (two oscillators and two

MINGHAM TION

ening of the new studio.

modulators) and a 50-watt valve for amplifying speech input. The oscil-

studio staff. Mr. Percy Edgar, station director, is seen the centre.

lator valves are connected to a closed circuit with variable inductance and capacity, and the energy is transferred to the aerial by inductive coupling.

The change-over was made after the broadcast on the 9th inst., and after a preliminary test on the 10th the new era of broadcasting commenced on the 11th inst. Moreover, it is interesting to note, the change has also been made a dividing line in the matter of broadcast programmes, and several important new principles have been introduced into them.

It has been decided to make each night's programme appeal to a distinctive class of listeners-in, and thus the week will come under the following heads: On Mondays, grand opera—mostly by members of the National Opera Company; Tuesdays, alternately, dance and concert party music; Wednesdays, 7.30 to 8, landline transmissions from Lozell's Picture House, and a programme of choral music by the Broadcast Repertory Company, under the conductorship of the Musical Director, Mr. Joseph Lewis; Thursdays, request music; Fridays, orchestral and classical music by an individual composer; on alternate Saturdays, a military band under the conductorship of Mr. Appleby Matthews.

It is interesting to note that the repertory company is now complete, and that contracts have already been entered into. Moreover, the orchestra has now been permanently increased to fourteen.

The staff of 5IT, now entering upon a new stage of its history, are Mr. Percy Edgar, Station Director; Mr. H. G. Casey, Assistant Station Director; Aunts Elsie and Gladys; Mr. J. A. Cooper, B.Sc., A.M.I.R.E., Senior Maintenance Officer; Mr. S. G. Parsons and Mr. Jinman, Assistant Engineers.

The removal of the studio from Witton, some three and a half miles from the centre of the city, to its present site brings it right into the heart of the Midland metropolis, and affords it first-class opportunity to share in the artistic and musical activities of the city.

The opening ceremony provided another illustration of the fact that broadcasting has brought a commendable brevity into public speeches. Sir Herbert Austin, M.P., introduced by Major J. W. C. Reith, in the fewest words possible, was almost as brief, for, after referring to the inconveniences of the old studio, he alluded to the promise of improvements which the new one gave. Then, as an engineer, he hinted at the possibilities of broadcasting to come, though he did not indicate in what direction, and concluded by performing his official duty—that of declaring the station open.

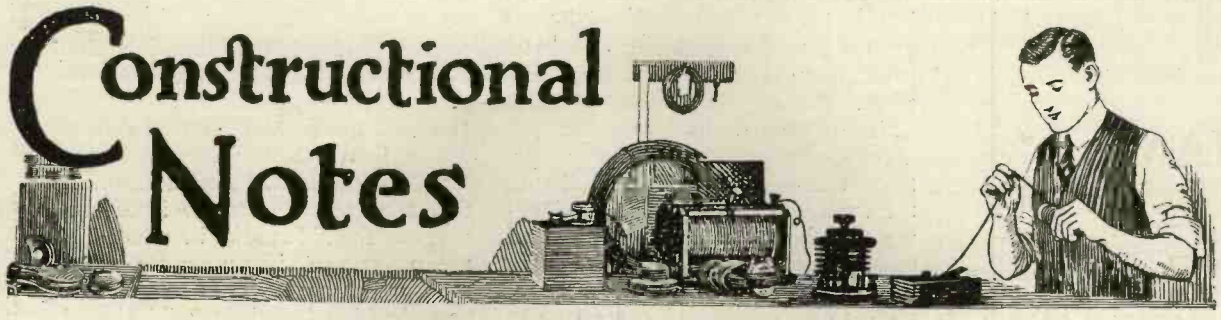
Mr. Arthur Burrows, who was acting as the announcer of the evening, expressed the real note of the moment in adopting Birmingham's motto of "Forward" to the broadcast station. "Forward, 5IT!" he said.

The chief speech of the evening, however, came from Sir William Noble, who expressed the pleasure of the B.B.C. board that a new station for the Midlands was being opened. He declared that they had no reason to be ashamed of their record in the seven months they had been formed. When they began business they had only three stations—one in London, one in Birmingham, and one in Manchester—and all three were temporary stations.

Since then they had opened permanent stations at Newcastle, Cardiff, Glasgow, and Manchester, and now still another in the capital of the Midlands. In addition, they had opened a new studio in London, and hoped to open a new transmitting station in London at an early date. They also had in hand the installation of new stations at Bournemouth and Aberdeen.

They were not resting content, however, with fulfilling the conditions of their agreement with the P.M.G., but they were carrying out experiments with a view to providing relay or sub-stations for several places so that they could give a good broadcasting service to 75% at least of the population of this country without the use of too expensive broadcasting sets.

Constructional Notes



Conducted by R. W. HALLOWS, M.A., Staff Editor.

A GOOD CRYSTAL HOLDER.

THE ordinary type of crystal cup with one or three gripping screws is anything but satisfactory, one of its many weak points being its awkwardness. Also the screws sometimes break the crystal, and to get a grip of any kind is often very difficult. An efficient crystal holder may easily be made from strip brass. The two types shown herewith both have the advantage of simplicity of construction, quick adjustment at any point, and easy manipulation. Fig. 1 shows the type which is easiest to construct.

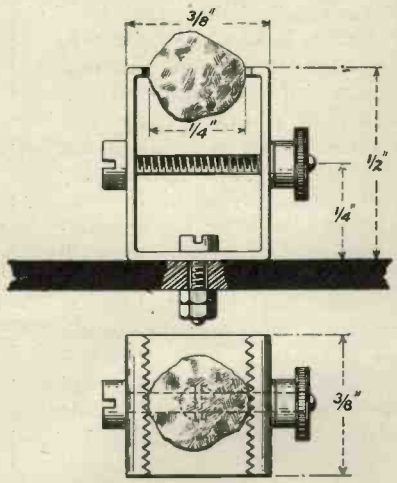


Fig. 1.—Elevation and plan of crystal holder.

A piece of springy brass is cut about 1½in. long by ⅜in. wide. Each end is jagged like a saw edge to give a good grip on the crystal (see Fig. 1). Two holes are punched $\frac{5}{16}$in. from each end, and one in the centre. A 6B.A. screw is passed through the centre hole and also through the ebonite panel in the manner shown. The brass strip is then bent over, and a 6B.A. screw is passed through the other two holes. An adjusting nut is then screwed on. Fig. 2 is made in a similar way with the exception of the spring, which resembles a common tie-clip spring. To adjust the crystal, pressure is brought to bear on the projecting arm, when the jaws will open to permit of the crystal being placed in position; when the pressure is removed the crystal is held firm.

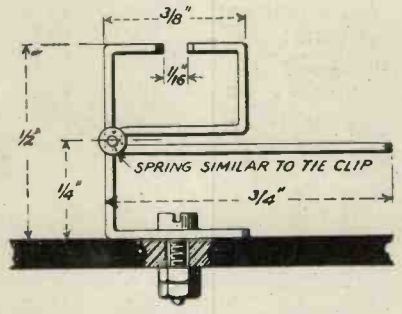


Fig. 2.—A spring-grip type of holder.

Modifications of this idea will no doubt occur to readers, and it is an easy matter to adapt an actual tie-clip to form a serviceable crystal holder.

H. B.

A NOVEL AERIAL MAST.

AN aerial mast that is light, inexpensive and strong can be made in a novel way from inch-thick deal planks. They are nailed (or, better, screwed) together in the way shown in Fig. 3 to form a box from 25ft. to 30ft. long.

The principle is much the same as that of the split cane fishing-rod. If you lay a 1in. plank flat across two trestles, a very slight pressure applied to a point near its middle will cause it to give a little, and if the pressure be increased it will bend more and more until it breaks. But fix the same plank with one *edge* uppermost, and it will withstand an enormous strain before it gives.

If a mast is constructed on the box principle, it will be seen that from whatever direction a strain may be applied it will always be directly across the edges, or very nearly so, of two of the side members. Hence if the mast is securely put together, it shows little or no tendency to buckle, provided that it is stayed, as all masts should be.

The planks used should be of good deal, 6ft. long and 3in. wide. To make a 30ft. mast, 20 of them are needed. Obviously, we must break the joints just as bricklayers do when building a wall. We therefore begin in the way shown in Fig. 4. Plank No.

1 is fastened to plank No. 2, so that there is an overlap of 1ft. 6in. at either end. Fig. 5 shows the first section completed. No. 3 is secured to No. 2, and No. 4 to No. 3 with the same overlaps.

We can now continue from either end of this first section until the desired length is reached. We then fill the gaps with short pieces to make the ends even. The best mounting for the mast is a step, consisting of a box from 3ft. to 4ft. long and with an inside measurement of 4in. by 4in. made in the same way from planks 5in. wide and sunk in the ground.

The top of the mast requires a truck to keep moisture from getting into the grain of the wood. This may be a 6in. circle cut from an inch-thick plank of hard wood. Both truck and mast should be given two good coats of solignum, or some similar preservative before erection.

Fig. 6 shows how eyes for stays and pulley may be fitted. Five plates shaped as shown are cut from stout sheet metal. Four, for the stays, are secured by means of a pair of ½in. bolts passed right through the mast from face to face. The fifth, which is intended to support the pulley, may be attached either by a lashing of wire or by another bolt.

R. W. H.

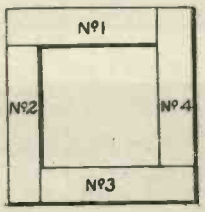


Fig. 3.

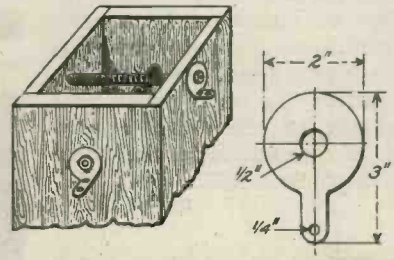
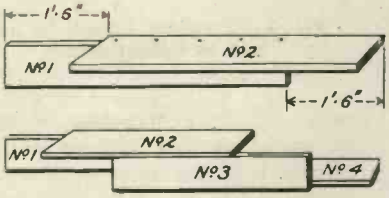


Fig. 6.



Figs. 4 and 5.

Fig. 3.—A section through the mast.

Figs. 4 and 5.—Method of jointing the planks.

Fig. 6.—Fittings for guy ropes.

A NOVEL AERIAL MAST.

A RACK FOR COILS.

THE time when coils are most likely to suffer damage is when they are lying about. Things are inadvertently placed on top of them, or they are knocked off on to the floor, which treatment is not calculated to improve them.

The best way of keeping them, and, incidentally, of prolonging their useful life, is to make a rack for them, which can be done quite easily.

From almost any electrical shop can be obtained a switch block, measuring 9in. by 6in., made of polished hard wood. Draw a line 1½in. from either edge and make five equally spaced marks along it, the first and last being 1in. from the ends. Drill a $\frac{3}{16}$in. hole at each mark. The plugs of de Forest coils will fit tightly into these holes, and the rack will hold ten coils, any one of which can be picked out without disturbing the others.

R. W. H.

HINTS ON WOOD PLANING.

WHEN using rough wood for the construction of wireless cabinets it is necessary, in order to obtain a finished appearance, to employ, firstly, the use of a plane, and finally a sandpaper block.

A metal handplane is best for work of this nature. The most important point to remember when planing surface areas is to work the plane in the same direction as the grain formation of the wood. If the plane is used at right angles to the direction in which the grain runs, the result will be a series of deep ridges.

If the plane is used in the direction of the grain, but running into or opposite the direction of the growth, the plane will immediately bite deeply into the wood and kick up a series of splinters, which will also choke the clearance space between the blade and the plane box. The direction of the formation of the grain can be detected by the practised eye, but the amateur should easily overcome the difficulty by making a few trial strokes on the edge of the wood.

For the final operation of sandpapering, a large, flat piece of cork should be procured round which is wrapped some medium sandpaper. The work is finished off by giving a final rub with some very fine sandpaper, remembering always to work in the direction of the grain. A useful device to assist in the operation of planing is the bench hook. This consists of a plain hardwood base to which a wooden stop is firmly screwed at one end. The hook is then clamped to the work-bench, and the wood to be planed is rested against the stop while the operation is in progress. This does away with the necessity of clamping the actual work to the bench, giving a free action to the plane over the whole surface.

H. B.

FILLING HOLES IN EBONITE.

IT happens occasionally when one is drilling a panel that one or more holes are made not quite in the right places. Sometimes they are so far out that there is room to make others correctly placed. In this case the problem of filling them up is a simple one, for the object of our "botching" is merely to hide them as far as possible from view and to prevent their spoiling the appearance of the panel.

The simplest way of filling them is to use black sealing-wax of good quality. A small quantity of the wax is dropped into the hole and pressed firmly in with a wet finger. Any surplus is then scraped away carefully with a knife. When the surface of the panel is finished up with knife powder and oil or turpentine the plugging will hardly be visible. It will certainly not be so noticeable as to strike the eye unless one is actually looking for it.

Another method which is still more effective is to make use of short lengths of ebonite rod. These are rubbed down until they are a driving fit for the unwanted holes. They are then warmed until they are soft and pressed in. A touch with a warm soldering iron above and below the panel will fix them securely in position.

Neither of these methods, however, is of any use if the hole originally made is so little out of its proper place that there is no room to drill another clear of it. The same problem frequently arises when we wish to make use of an old piece of ebonite which already contains holes for making up a new piece of apparatus. It will usually be found that the holes already there are just where they are not wanted.

If lengths of $\frac{3}{8}$ in., $\frac{1}{4}$ in. and $\frac{1}{8}$ in. ebonite rod are kept in the scrap box the difficulty is one that can be got over quite easily. Tap the existing holes and cut off pieces of rod $\frac{1}{4}$ in. longer than the panel is thick. Put threads on to them with a die and make a hacksaw cut in the end of each so as to turn it into an ebonite grub screw. The plug can now be turned in with a screw-driver. When it is home trim off both ends roughly, then use the warm soldering iron as before. If the plugs are made a tight fit for the threads, as they should be, there will now be no difficulty about drilling fresh holes close to the original ones.

Cracks in ebonite may be healed by running a warm soldering iron along them—it must be just hot enough to make the material flow. Even if a small piece has broken off altogether it can often be joined on again in the same way The writer effected by this means an entirely successful repair of a condenser of the Dubilier type, one of whose lugs had been broken off by a fall.

R. W. H.

CAT-WHISKER WHEELS.

A USEFUL experimental gadget to adapt to crystal detectors is a cat-whisker wheel, which enables the experimenter to quickly adjust one of a selection of four or more different whiskers. The simple construction of the wheel is shown in Fig. 7 The four cat-whiskers selected can be platinum, gold, magnesium, and silver. Platinum gives the best result when used in conjunction with iron pyrites. Magnesium gives remarkably good results on almost any crystal. Silver wire should be of a fine gauge, as this material is not very springy; this also applies to the gold wire. Many silver and gold wires now sold are thick and quite useless. Any combination of wires, of course, may be used to suit the experimenter's tastes. A series of the wheels may be kept in stock, as they can be readily adjusted in the type of detector shown in Fig. 8. A wooden centre post is fixed as shown. A brass strip arm is bent from one piece, and pivoted centrally both sides. A 2B.A. rod is placed at one end to clear the arm on the inside. Halfway between the wooden post and the wheel a small rivet is placed in the arm. The spring is fixed to this rivet at one end, the other end of the spring being fixed under the head of a small screw in the base. By tightening the adjusting nut, the cat-whisker is lifted from the cup, and, of course, *vice versa*. The wheel is fixed into the detector arm by means of the 6B.A. screw which acts also as a bearing, and is adjusted to the desired position by tightening up the end nut.

H. B.

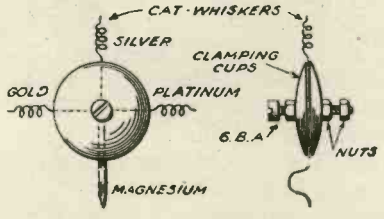


Fig. 7.—Details of a wheel to hold four contact wires.

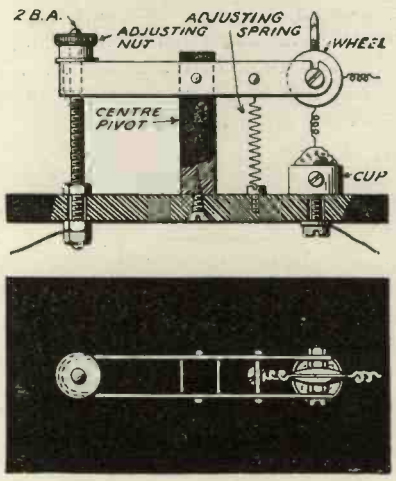
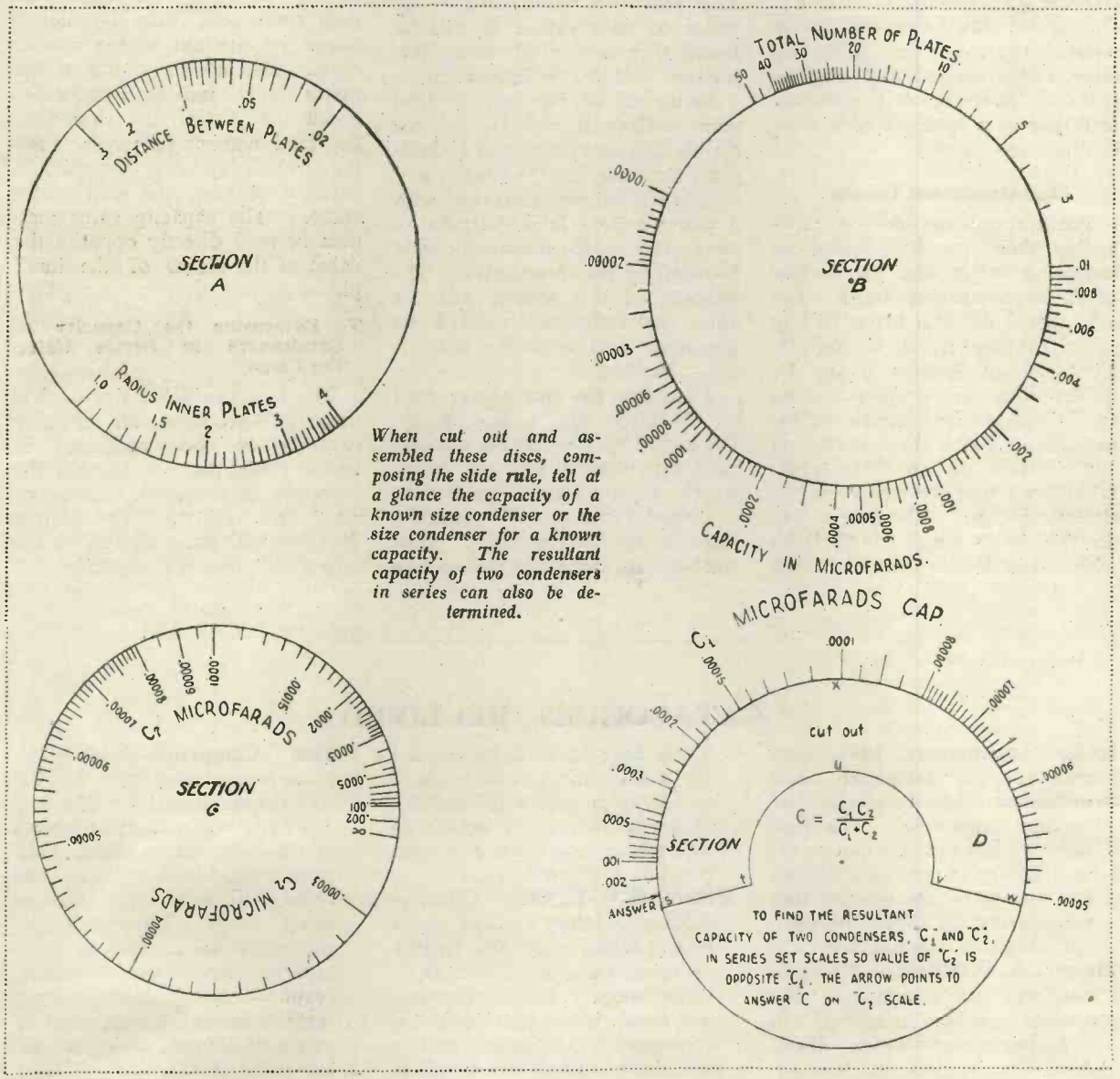


Fig. 8.—A detector suitable for use with the rotating wheel.

ANOTHER PRACTICAL RADIO SLIDE RULE

The following complete article gives constructional details for making a very useful slide rule to be used in calculating condenser capacity.

THIS easily constructed radio slide-rule will indicate the capacity of a variable condenser of the semi-circular plate type with air dielectric, and on the reverse side of the computer other scales give the solution of the problem of two condensers in series. When two condensers are connected in series the resulting capacity is always less than that of either condenser, the exact value being ordinarily determined by means of the formula appearing at the centre of the scale of section



When cut out and assembled these discs, composing the slide rule, tell at a glance the capacity of a known size condenser or the size condenser for a known capacity. The resultant capacity of two condensers in series can also be determined.

D. This slide rule gives the answer to this formula directly.

In cases where three condensers are in series, it is best to determine the effective capacity of two of them in series and then determine the resultant capacity when the third condenser is connected in series with an imaginary condenser having a capacity equal to the series capacity of the first two.

The scales have ranges greater than those required for ordinary radio frequency circuits. If, however, it is desired to use the chart for series condenser problems, for other ranges, the three scales C_1, C_2, and C may be multiplied by 0.001, 0.01, 10, or 100, or by any other factor desired and used as before. The only rule necessary to follow is to multiply each scale by the same factor.

Constructional Details

Procure two smooth flat cards having their smaller dimensions somewhat larger than the largest of the accompanying scales. For convenience the four scales will be called Sections A, B, C, and D. First cut out Sections B and D, in the form of a square, being careful not to trim away any of the numbers. Paste these scales on opposite sides of one of the cards, taking care that the centres of the circles coincide. The best way to do this is to punch small holes with a pin in the centre of each section B and D and another hole in the centre of the card. When these three holes are in line, the centres are together. The small dot in the centre of each section indicates where the hole should be punched. After pasting, dry the card under pressure between flat surfaces to prevent warping.

Then paste sections A and C on opposite sides of the other card, getting the centres together in the same way, and dry flat. When dry, carefully trim off the edge around section A outside of the circle, leaving no margin. This leaves a round disc with scales on each side. It will be found that section C is a little smaller, but this is intentional.

Returning to the square card with sections B and D, cut out the circular slot on section D indicated by the letters " s-t-u-v-w-x," cutting right through the card with a sharp knife. It is desirable to cut exactly on the lines and curves bounded by the above letters. The removal of this section will not affect the scales on section B on the other side, since the latter is somewhat larger.

Then lay the rectangular card on the table with section B up. On top of this place the circular card with face A up, and fasten the two together with a small rivet or paper fastener eyelet inserted through the centre holes. The smaller disc should be free to turn about the centre. When this is done the computer is complete. If it is constructed according to these plans, the outer edge of section A should coincide with the inner edge of section B, and the scales of section C will be visible through the slot opposite the scales on section D.

To Determine the Capacity of a Condenser by Means of the Chart

A great many of the condensers available at the present time are rated according to the number of plates rather than by their capacities. The maximum capacity of such condensers may be determined by the aid of the special chart. Measure the radius of the plates (inner) and the distance between the plates, and determine the total number of plates. Set the disc so that the " spacing " value is opposite the total plates value. The capacity value may then be read directly opposite the value of the radius of the inner plates.

To Determine the Capacity of Condensers in Series Using the Chart

The reverse side of this card is used to determine the effective capacity of two condensers in series. Set the disc so that the values of these capacities are opposite each other. The arrow (answer) will point directly to the effective or resultant capacity.

CATALOGUES RECEIVED

Radio Instruments, Ltd., have sent for our inspection their well-illustrated catalogue of wireless apparatus. The products of this firm are almost too well known to need description, but we are of the opinion that no experimenter should be without a copy of this booklet.

Messrs. A. E. Hilton.—This firm has sent us samples of the ebonite bushes described in " Mainly about Valves," *Wireless Weekly*, Vol. 1, No. 13. These have been on the market for some months, and are well turned from good solid ebonite. Wireless enthusiasts would do well to use these where a wooden panel is preferred.

Messrs. G.W.I., Ltd.—This firm supplies a rotary rectifier and a rotary transformer for battery charging from A.C. and D.C. respectively. These machines are made in various sizes for corresponding outputs, and a switchboard can also be supplied.

Formo Company.—The illustrated catalogue of wireless components issued by this firm describes well-made instruments of British manufacture built from machined parts, no pressed work or rolled threads being used. This catalogue should be of interest to every experimenter, one notable feature being a low-frequency transformer entirely screened by means of a metal casing, at the low price of 18s.

Broadcasting News

By OUR SPECIAL CORRESPONDENTS.

LONDON.—There was a plebiscite at 2LO the other day, and hundreds of postcards were received on which were entered the favourite musical items of the senders. By far the largest number of people seem to like a preponderance of orchestral music. That is not surprising to any who have noticed the difference in the size of the crowds which attend the performances of pierrots and of bands or orchestras at the seaside

♔ ♔ ♔

The relay tests from 2LO and the other stations were a great success, but as they have already had a wide publicity there is no need to refer to them further. One interesting fact has not been noted hitherto, and that was that the Sheffield experiments were picked up in Penzance which is a very gratifying circumstance. Also the programme which was relayed from London *via* Manchester was picked up on crystal sets twelve miles round Sheffield. In making their calculations as to the numbers who might listen-in on crystal sets to relay stations, the B.B.C. were only calculating on a radius of four miles, but if the radius is to be ten miles or twelve it stands to reason that a very much larger number will be roped in

♔ ♔ ♔

It is to be hoped that more sacred compositions will be played on the organ at the Sunday afternoon concerts. Many of the composers were Catholics and wrote their masterpieces for the Church. Take, for instance, Mendelssohn's "Lauda Sion," Haydn's "Imperial Mass," Weber's Mass, Rossini's incomparable "Stabat Mater," Gounod's "Gallia," and so on, all masterpieces, because they were labours of love and not operas or the like written for "bread and butter."

♔ ♔ ♔

This has been a week of real music, for have we not revelled in such perennial delights as excerpts from "La Sonnambula," by Bellini, "Les Cloches de Corneville," by Planquette, "Il Trovatore," by Verdi, Reminiscences of Offenbach, to say nothing of those delightful Three Dances from "Nell Gwynn," by German, and one or two ever new Waldteufel waltzes.

By the by, the writer cannot recall hearing any of Donizetti's compositions from 2LO. Is he "banned by the band"?

Forthcoming Events

AUGUST.

29th (WED.).—7.15 p.m., Mr. Archibald Haddon, Dramatic critic. 9 p.m., Prof. Ireland. 10 p.m., Sir George Davies, J.P., "Preserved Food."

30th (THURS.).—7.15 p.m., Mr. Percy Scholes, "Robert E. Lee."

31st (FRI.).—7.15 p.m., "Seen on the Screen," by G. A. Atkinson, the B.B.C. film critic. 9 p.m., Mr. Cecil Hallett, "British Museum."

SEPTEMBER.

3rd (MON.).—7.15 p.m., Mr. John Strachey, "Books." 9 p.m., General Bruce on Everest.

4th (TUES.).—7.15 p.m., Rev. W. Hodson-Smith. 9 p.m., Lt.-Col. W. W. Clemesia, C.T.E., M.H.

5th (WED.).—7.15 p.m., Mr. Archibald Haddon. 9 p.m., Sir Joseph G. Brookbank, "Port of London."

BIRMINGHAM.—Mr. Percy Edgar spoke the simple truth when he characterised the first performance of the Station Repertoire Company as "one of the great nights." The programme of old English part songs which the choir, under Mr. Joseph Lewis, rendered, was delightful from start to finish, and there must have been few listeners-in who were not charmed by the unusual clearness of the choir's pronunciation. The performance emphasised the success of Mr. Lewis's venture at once, and made it obvious that choral music by wireless, if it is to be wholly successful, involves particular attention to the character of individual voices. In his search for talent, the music director of 5IT has concentrated upon what has been termed the "wireless voice," and the result has been extremely pleasing.

Forthcoming Events

SEPTEMBER.

4th (TUES.).—Mr. Lloyd's Dance Band.

10th (MON.).—Mr. Walter Hyde, tenor, of the British National Opera Co.

11th (TUES.).—The Greys Concert Party.

12th (WED.).—Opera, "Merrie England," by the Station Repertoire Co. and an augmented orchestra.

13th (THURS.). — Miss Beatrice Evelyn, 'cellist.

15th (SAT.).—Station Military Band.

♔ ♔ ♔

CARDIFF.—Mr. Stanton Jeffries visited Cardiff the other day and conducted a complete performance of "Faust" with the leading British National Opera

Company artists as principals. The experiment was a great success, and will be repeated at the other stations. Local choruses have been formed in Manchester and Birmingham, and others will follow. Operatic performances will be a prominent feature of the winter programme.

♔ ♔ ♔

GLASGOW.—Mr. Herbert Carruthers, the Glasgow Station Director, delivered an interesting address to the members of the Glasgow Rotary Club. He described broadcasting as still being in its infancy, but a very healthy child and likely to grow to a ripe old age. Upwards of 50,000 people, he stated, "listened-in" to the Glasgow station each evening.

♔ ♔ ♔

Referring to the early days of the Glasgow station, Mr. Carruthers mentioned that the original orchestra of four performers had been increased to eight, and they now contributed 90 to 100 items to each week's programme.

Forthcoming Events

SEPTEMBER.

2nd (SUN.).—The Whiteinch Primitive Methodist Church Choir, the Rev. John Maughan. Miss Etty Friedlander, violinist.

3rd (MON.).—The Wireless Orchestra's Dance Night. Mr. Jaye Kaye, entertainer, of London. Miss Ella Lorraine, the Scottish prima donna.

4th (TUES.).—Mr. William Birrell, Registrar, of Loughborough College, will talk on "Modern Methods in the Training of an Engineer." The Barrington Male Voice Quartet.

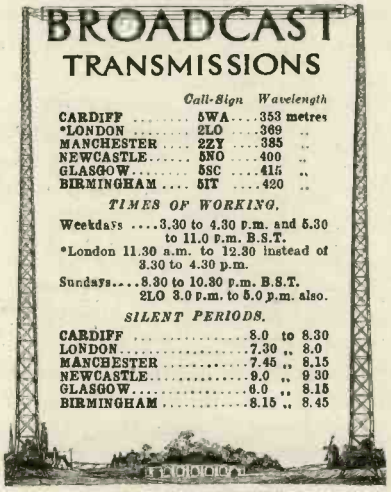
5th (WED.).—Classical night of the "Wireless Orchestra." Mr. Stephen Cosh, of Ayr, and Miss Christina Macfarlane, contralto.

6th (THURS.). — Miss Gladys Palmer, of London, and Mr. John Russell, baritone, will sing. Mr. Lambert C. Flack, flautist.

7th (FRI.).—"The Merchant of Venice," produced by Mr. R. E. Jeffrey, of Glasgow.

8th (SAT.).—The Empire Male Voice Quartet, of Kilmarnock.

MANCHESTER.—On Tuesday, the 14th inst., the first symphony concert was broadcast from the Manchester station. An augmented orchestra, conducted by the station director, Mr. Dan Godfrey, Junr., A.R.A.M., gave a splendid performance of operatic music. The soloists were Miss Beatrice Miranda and Mr. William Anderson, both of the British National Opera Co. The singing was delightful throughout, and the orchestral accompaniment placed the performance on a level, in our opinion, with the operatic transmissions recently heard from the Covent Garden operas.



Listeners-in desiring to join the "Radio Circle" are invited to send in their names to the Manchester station for a radio badge, a supply of which will shortly be available at a very trifling cost.

♔ ♔ ♔

A wireless revue is the latest innovation promised from 2ZY. The title is to be "Hello Listener," and the "revue" is being written by Mr. R. Guy-Reeve, the well-known theatrical writer. Incidentally, Mr. Guy-Reeve is the writer of the amusing adventures of "Algy," which are being broadcast each Saturday evening from Manchester.

Forthcoming Events

AUGUST.

29th (WED.).—Miss Jennie Lord (soprano), Mr. Tom Sherlock (baritone).

30th (THURS.). — Week's music criticism by Percy Scholes; Mr. Joseph Markham (tenor).

31st (FRI.).—Nunn's Grand Dance Orchestra; Mr. Victor Smythe in "Funniosities."

SEPTEMBER.

1st (SAT.).—Radio Military Band; Miss Gladys Hulme (contralto); Mr. Victor Smythe in "Algy on Motor-cycling."

2nd (SUN.).—Mr. Ronald Chamberlain (pianist); Miss Mary Ogden (soprano); Mr. Frank Taylor (baritone).

3rd (MON.).—Madame Oates' Quartet; Miss Agnes Clarke and Mr. Harold Derbyshire.

4th (TUES.).—Mr. James McCafferty (Londonderry, baritone); Miss Gladys Palmer (contralto).

5th (WED.).—2ZY Orchestra; Mr. Jaye Kaye (humorist); Mr. Harold Brown (baritone).

♔ ♔ ♔

NEWCASTLE-UPON-TYNE.—All owners of sets in the neighbourhood of the five other stations had an opportunity of listening-in to Newcastle between 11 o'clock and midnight on August 13th, when a relaying test was carried out. The impromptus delivered to 5NO's microphone were sent by land-line to London and thence similarly to the other stations for wireless transmission. Apropos of the London correspondent's recent remarks regarding the accomplishments of various B.B.C. officials, the test brought out the fact that both the station director and the engineer have considerable vocal ability. Incidentally it was interesting to note how clearly the gurgle of water poured from a carafe came through.

♔ ♔ ♔

SHEFFIELD.—Within a week or a fortnight from the time these notes appear, the Sheffield relay station should be in practical operation. This is the latest forecast of the experts, who have set up a receiving station at Greenhill, and a retransmitting station in Corporation Street. At the latter place the aerial has already been erected between a huge chimney stack and a mast, and all sorts of weird apparatus given a home inside the old Grinding Wheel.

RANDOM TECHNICALITIES

By PERCY W. HARRIS, Assistant Editor.

A few notes relating to ebonite, high-resistance telephones, and other items of general interest to experimenters.

A VERY good way to save yourself the trouble of rubbing the surface of an ebonite panel with emery paper and turpentine to remove the surface skin is to get the panel treated with a sand blast. Many firms must have sand blast apparatus lying idle, and I am sure that if they advertise the fact they would soon do a good trade in treating amateur's panels for them. The surface given by sand blasting is very pleasing, and naturally the treatment removes all of the semi-conducting skin so frequently found on the surface of ebonite.

* * * *

By the way, I think it is high time that the leading ebonite manufacturers sold this substance either ready treated (if it is absolutely essential to make it in a way which leaves a conducting surface) or else with some kind of guarantee that this treatment is not required. As it is if you walk into the average wireless dealer's you must take your chance, unless the man is known to you and you can rely on his purchasing good material. I suggest to the leading firms that they mark every square foot or so with their trade-mark and then advertise the fact that the ebonite so marked is guaranteed of high insulating quality, both internally and on the surface. The marking should be so printed on that it could easily be removed with a damped cloth or a touch of turpentine. I for one would be willing to pay a few pence more a pound, and I know many others who would do the same.

* * * *

New recruits in the wireless art should guard against purchasing too high a resistance in telephones for use with valve sets. High-resistance telephones are, of course, essential when connected directly in the plate circuit of a valve, for low-resistance types can only be used with a telephone transformer. High-resistance 'phones should theoretically be of about the same impedance as the valve with which they are used, but this high figure is not practically obtainable; 2,000-ohm telephones are usually quite satisfactory in the average valve set, but 4,000-ohm resistance 'phones give better results; 8,000 ohms would appear perhaps to be still better, but whilst this may be so from some points of view, the wire with which the 8,000-ohm telephone is wound is so extremely fine that it will very soon burn out—not, as is sometimes thought, from the strength of the signal received, but from the steady plate current passing through the windings. I have heard of several cases where expensive 8,000-ohm telephones have been bought, hoping that improved results would be obtained, and after about three weeks they have been burnt out. If you have such 'phones and they have burnt out in this way I would advise you to send them to the makers and have them rewound for a resistance of 4,000 ohms. The cost of rewinding is not nearly so great as that of a new pair of 'phones. Be careful, however, where you send them to be rewound, and if you cannot get them done by the maker, take them to a reputable dealer and ask his advice.

* * * *

For some reason or other wireless men put up with a good many things which should be remedied forthwith. For example, every one who winds an inductance coil with double-cotton-covered wire takes some precautions to prevent the absorption of moisture and the consequent reduction in efficiency of the coil. If the coil is carefully dried, coated with a thin layer of shellac, and the shellac itself heated and dried, we obtain a coil which is thoroughly waterproof, but the high dielectric value of this shellac increases the self-capacity of the coil very considerably. To give but one example, a coil which tuned to a minimum wavelength of 350 metres had its minimum raised to about 380 with even a light coating of shellac. Paraffin wax, also a waterproofing material and quite effective

from this point of view, has a similarly high dielectric value, and we frequently see warnings that a minimum of shellac or paraffin should be used. These facts are so well realised that it is hardly necessary to point them out. I mention them merely to bring out one of my latest grumbles. Why cannot the wire manufacturers supply us with an insulated wire, ready treated to obviate the necessity of after-treatment with wax or shellac? I am sure we should all be willing to pay a slightly increased price per pound, and a great deal of trouble would be saved when making inductance coils. I commend this idea to all interested.

* * * *

No doubt many readers will be experimenting with long range and long wave reception during the coming winter months. Single-layer inductances for such wavelengths as are used by transatlantic stations are an impossibility for the ordinary man. It is not generally realised that the single layer equivalent of some of the larger honeycomb coils, wound with the same size wire, would be about a foot in diameter and 8 ft. high. Consequently most experimenters turn to the plug-in form of inductance as being both convenient and compact.

Now although the self-capacity of honeycomb, duolateral and other multi-layer coils is comparatively low, it is possible to obtain a still lower self-capacity with very little expense. One of the best—probably *the* best—methods of winding an inductance for such long waves is to make a number of basket coils of reasonably thick wire and fasten them side by side fairly close to one another on an ebonite rod. The self-capacity of such a coil is lower than the best of the plug-in types, whilst the space taken by the whole coil is no greater than quite an ordinary single-layer inductance.

The multiple basket method has the advantage that it is very easy to make tappings. Such a set of coils neatly wound, mounted on an ebonite rod and fitted in a box with an ebonite front, on which is fitted a switch with some means of eliminating the dead-end effects, is one of the most useful things an experimenter can have on his work-table. I hope to give constructional details shortly of such a mounted inductance.

AN EXPERIMENTAL TWO-VALVE SET

(Continued from page 283.)

number of fixed and moving vanes for the capacity of condensers recommended is 10 fixed and 9 moving, together with the necessary screwed rod (2BA), spacing washers, nuts, etc.

Fig. 7 gives a suggestion for the fixing of the rods; an arrangement which avoids disfiguring the front of the panel. A simple and most useful form of high-tension switch, consisting of a short length of 3BA screwed rod with three laminations of phosphor-bronze and control knob, etc., is fitted into the clear hole shown at top centre of panel (Fig. 2). Two studs (4BA) are fitted into the two holes immediately below. The filament rheostat and terminals are fixed in position in the holes provided and the grid leak and fixed condenser fitted in a convenient space.

The whole assembled, the wiring is next to be considered. This is carried out in accordance with Fig. 8, which shows the lay-out of the underside of the panel.

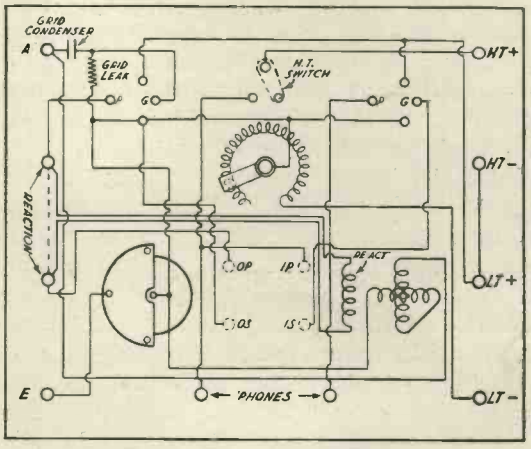


Fig. 8.—The wiring diagram.

THE CONSTRUCTION OF A THREE-CIRCUIT TUNER

By ALAN L. M. DOUGLAS, Staff Editor.

The conclusion of an article describing a useful tuning unit.

THE pins may be turned out of $\frac{5}{16}$in. brass rod if desired, but as it is now possible to purchase both plugs and sockets at a very reasonable price, and as lathe work is necessitated in order to make an accurate job of them, it will be a distinct economy to buy them ready-made. Care should be taken to see that a small screw, about 6 or 8B.A. by $\frac{1}{2}$in., is tapped into the lower end of the plugs and sockets in order that connection may be readily made to the appropriate circuit, and also so that they may be firmly anchored in position in the ebonite blocks.

The centre coil mount is fixed, the outer two being movable. In order to ensure an easy action, the two semi-circular side plates should be assembled on the centre fixed plug, which is held to the former by means of two small B.A. screws on each side as in Fig. 5, and the outer faces of the two plugs carrying the movable coil should be carefully rubbed down with emery cloth until the desired clearance is obtained. These two movable coil mounts should now be attached to the side plates by means of two small studs, which may have ornamental heads as shown in the photograph. These studs should be screwed for a small portion of their length so that they may be firmly secured in the ebonite side pieces, but the portion projecting into the coil mount should be turned smooth.

The most satisfactory method of determining the correct alignment for the position of these studs is to insert an Igranic coil in the centre plug and one into each of the side plugs. If these latter are now so placed that the three coils are touching each other all over, the position for the bearing holes for the studs may be noted and drilled accordingly.

In order to hold the coil mounting itself at an appropriate distance from the face of the panel so as to give sufficient clearance for the coils, three distance pieces consisting of $\frac{1}{4}$in. brass tube with a $\frac{1}{8}$in. bore and each $1\frac{1}{2}$in. in length, will be required. The appearance of one of these may be observed from Fig. 5. They

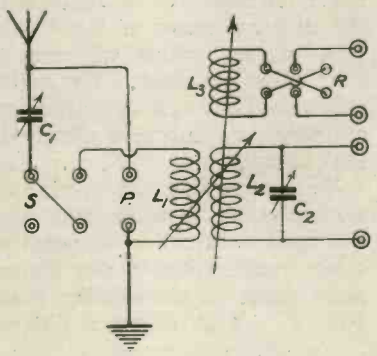


Fig. 6.—Circuit diagram of the tuner.

should be polished and lacquered, and tapped for about $\frac{1}{2}$in. at each end 5-32nds Whitworth. They may be subsequently secured to the coil mounting by means of three short countersunk head Whitworth screws, which should be tightly inserted.

The two handles for controlling the side coil plugs should now be constructed from pieces of $\frac{1}{4}$in. brass rod, screwed oB.A. These might be of any convenient length, but $1\frac{1}{4}$in. has been found to give very easy control without fouling any of the other apparatus on the instrument. Small ebonite handles should be made so as to impart a finished appearance to the device. These rods may be screwed into the centre of the two outside faces of the movable coil plugs at any required angle, but in the writer's case the most useful position was found to be at right angles to the plugs.

The variable air condensers may be next procured and fitted into position, and, of course, it is quite possible for the experimenter to construct these if he wishes for himself. Detailed instructions for building variable condensers from bought component parts were given in "Modern Wireless," No. 4, from which all the required information can be obtained. The aerial circuit tuning condenser should have a capacity of 0·0012 μF, and the secondary circuit condenser a capacity of 0·00075 μF. These will be found to be very suitable values for general experimental work. The method by means of which the secondary circuit condenser is attached to the base of the tuner internally by means of a brass strap surrounding the case, will be observed from Fig. 4, which at the same time makes clear the details of the extension handle. Fig. 4 will show how this is controlled from outside the case.

The next step in the construction of this instrument is the introduction of the switches necessary to place the aerial circuit condenser in series or parallel with the aerial tuning inductance, and to reverse the direction of reaction. In order to provide a neat fitting, the Dewar type of switch was used for the reaction reversing control, as these

may be obtained from dealers in wireless apparatus at a reasonable cost, and are very compact. They should not, however, be used for controlling circuits in which high-frequency current is flowing, as the thickness of the insulation is not sufficient to prevent leaking, and in addition the capacity existing between the large springs of the switch may upset the working of the apparatus. In this instance it is assumed that reaction is taken from the anode circuit of the detector valve. As the aerial condenser switch comes under this category, a double-throw switch with widely spaced arms was employed.

An examination of the photograph will make clear the appearance of this switch, which is of such a nature that it may be very easily constructed by the reader without any special tools. All that is necessary is a strip of springy phosphor-bronze of about No. 18 gauge, ¼in. wide by 14in. long. This will provide ample material for making the two side switch blades, the four contacts, and the two central pivots for the switch arm. The four contacts may be bent up with long-nosed pliers over pieces of brass rod, and if the phosphor-bronze is heated during the bending process, there will be no fear of the metal fracturing. On being slowly cooled in air, it will be found that it retains its natural springiness. Four exactly similar contacts should be made, the precise dimensions of these not being of vital importance, so long as the switch blades fit into them closely.

The two switch blades may be 1¾in. in length, and should be separated by the insulated handle for moving the switch, which can be made from a 1in. piece of ⅜in. diameter ebonite tube. A 6B.A. bolt and nut passed through the centre of this will anchor it to the side members of the switch. After this handle has been screwed up to a sufficient degree of tightness, any remaining portion of the 6B.A. screw may be cut off, and a small dot made on the end of the screw with a centre-punch, which will prevent the nut working loose.

The two small centre brackets which form the pivot for the switch are made in a precisely similar manner to the four contacts, and should be drilled, when finished, with holes suitable for receiving a 6 or 8B.A. screw. The two arms may then be attached to the strip by means of the 6 or 8 B.A. screws, which will require to be about ½in. long. The switch may then be placed in position on the panel, as indicated clearly in the photograph.

To accommodate the reaction reversing switch, a rectangular hole will need to be cut in the panel of a size conforming to the dimensions given in the drilling plan, Fig. 2. This is not a difficult matter, as a number of holes may be drilled in the ebonite with an ordinary twist drill, and, after the centre portion has been removed, the sides can easily be filed square with a flat or half-round file. Care should be taken that the switch fits accurately into this hole, as with the Dewar pattern of switch there is generally not too much metal to spare round the edges for fitting purposes.

This completes the description of the various component parts actually required for the construction of the tuner, and there only remains the wiring up. This should be quite clear from the circuit diagram, Fig. 6, which is self-explanatory. The connections of the reaction reversing switch should be carefully noted. In order that the various components may be identified, referring to Fig. 6, we shall see that C_1 is the aerial circuit condenser, S and P the series-parallel positions of the switch, L_1 the aerial circuit coil, L_2 the closed circuit coil, C_2 the closed circuit condenser, L_3 the reaction coil, and R the reaction reversing switch.

The operation of the tuner in actual practice presents little or no difficulty, and it is merely a question of experience to obtain satisfactory results. With a little patience, very selective working can be obtained, which will be found a great boon in the coastal districts where jamming is bad.

DESIGNING SIMPLE CRYSTAL RECEIVERS

(Continued from page 279.)

shown, and in the same direction, the maximum wavelength will be obtained when the 3in. coil is about the middle of the 2½in. coil. As the 3in. coil is moved towards the outer end of the 2½in. tube, the wavelength will be reduced, and will be at about mid-point of the range of wavelengths when the two coils are entirely separated. Upon reversing the 3in. coil and replacing it upon the 2½in. tube, a further reduction in wavelength will be effected until, when the outer coil is back again at about the middle of the inner coil (the windings now being in opposite directions), the minimum wavelength will be obtained.

Thus, with this very simple piece of apparatus, as illustrated in Fig. 14, and which requires the addition of a crystal detector and telephone receivers, to be connected in series with one another right across the two terminals as shown in Fig. 15, we have an effective receiving set, the tuning of which is continuously variable over the complete range of wavelengths employed by the British broadcasting stations, namely, 353 to 425 metres.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc.

High-frequency Plug-in Transformers

MESSRS. L. McMICHAEL, LTD., have submitted for test three high-frequency transformers, of the medium high-resistance type, tuning by

The plug-in transformer.

a 0.0003 μF condenser over the ranges 300 to 600 metres, 550 to 1,200 metres, and 1,100 to 3,000 metres respectively. These are wound in slots in ebonite barrels, with the customary plug-in connections in the form of four valve pins. They are well-made, highly-finished units; on test they proved to cover the range claimed, and gave good amplification and fairly sharp tuning. They form a convenient and effective H.F. coupling unit.

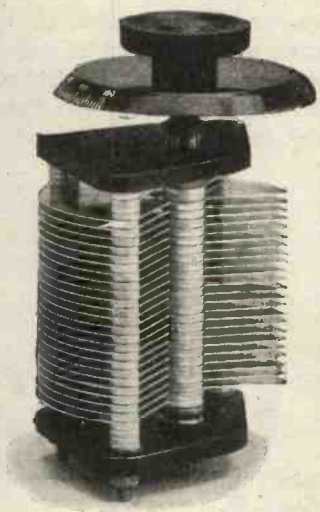
"Talite" Crystal

An addition to the number of types of galena crystal on the market is offered by Messrs. Harding, Holland & Fry, Ltd., in the form of "Talite," which is claimed to be of natural origin, and, as a matter of history, to have been well proven in severe practical use before it became available for wireless amateurs and broadcast reception.

It is of the bright, finely granulated type; the firm who supply it advocate the use of a round knob on the end of a stout copper wire in preference to the usual slender, springy cat's-whisker. On test it was found to be sensitive practically all over, even on the older surfaces of a sample which had been handled; on a newly-fractured surface it was hard to find an insensitive spot at all with a fine wire point. With the large knob supplied in place of a fine cat's-whisker, applied pretty well anywhere with a fairly firm contact, good signals were obtained; but the writer prefers the use of a finer point. With the latter local broadcasting was clearly audible at a dozen miles with the 'phones on the table in a quiet room and with a by no means perfect tuner and a fair aerial. Tested on simultaneous-amplification circuits it gave good results, and stood up well to two high-frequency stages in front of it; every British broadcasting station (including Glasgow) being tuned in, in turn, audible on the loud-speaker, on a two-valve dual circuit.

A Moderate-priced Variable Condenser

Messrs. Jackson Bros. have sent for inspection and trial a 0.0005 μF variable condenser for panel mounting, which has a very simple and convenient one-hole fixing by means of a screw-collar,



The "J.B." condenser.

necessitating only a single $\frac{3}{8}$in. hole in the panel. It is a well-made and finished instrument, with well-designed bearings, free from shake; the electrical connections are sound, so that the condenser is silent in use. A good-quality knob and bevel-scale with clear divisions are provided.

On test, the capacity was found to be just under 0.0005 μF, with a low minimum; it was quite satisfactory in use, and the insulation was excellent.

The condenser represents exceedingly good value for money, and can be adopted for use in receiving sets with every confidence.

Mainly about Valves

Our weekly causerie written by the Editor.

A Note on the ST75 Circuit

REPORTS from all over the country indicate the great effectiveness of the ST75 circuit, and it seems likely that it will become one of the regularly used circuits for the reception of broadcasting. Of course, one of its chief advantages is that it conforms to the Postmaster-General's instructions regarding reaction, this, of course, being applied to the tuned anode circuit.

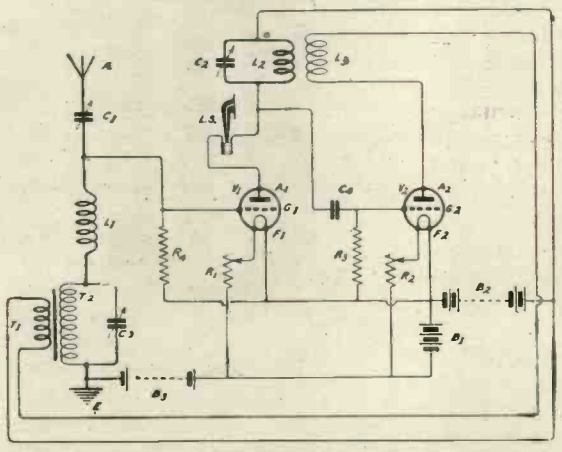
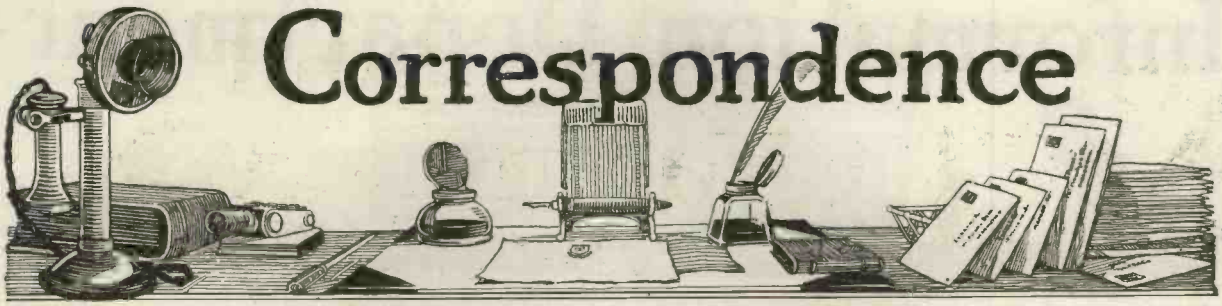


Fig. 1.—The ST75 circuit showing the position of the extra resistance R_4.

I have overcome the technical objections to having the telephones, or transformer, next to the anode of the first valve, while still retaining these pieces of apparatus in their original positions. This original position, of course, is of considerable importance, as the circuit does not then tend to oscillate. The great trouble about dual amplification circuits is that there is always a tendency to complete a chain of low-frequency reaction. For example, the anode circuit of the first valve contains an impedance of some kind, such as telephone receivers, a loud-speaker, or a transformer winding, and the E.M.F.s across this impedance are communicated to the grid of the second valve, which amplifies them, and then they are introduced in some manner into the grid circuit of the first valve, and so the low-frequency reaction chain is established, with a resulting tendency to howl.

Owing to the diversity of the transformers on the market, and to variations in telephone receivers and loud-speakers, one can never be absolutely certain with a dual amplification circuit that howling will be obviated. In ST75, by virtue of the position of the loud-speaker, there is no possibility of a chain of low-frequency reaction being set up. If there is howling, it is due to the first valve oscillating at low-frequency, and this must be due either to some capacity coupling in the valve or to a magnetic coupling between the windings. As the capacity coupling is very small, the trouble, if experienced, is probably due to magnetic coupling, and a change in positions of the transformers or a wider separation should stop the oscillation. In any case a reversal of the leads to one of the windings of the transformer should effectively prevent any whistling.

Fig. 1 shows an ST75 in which a resistance R_4 having 100,000 ohms is connected across the grid and the positive terminal of the filament accumulator. This resistance will help to stop the first valve oscillating, either at high or low frequencies. Personally, I have not found this resistance necessary.



Correspondence

THE NEW ORGANISATION

SIR,—As a member of the old Wireless Society of London since 1914, as well as the holder (*pro tem.*) of what is probably the most comprehensive experimental licence in the country, I regret that it should be necessary to enter a protest against the "arbitrary" selection of so-called representatives on the Committee of what is in name only the Radio Society of Great Britain. The reason given that election would take place appears somewhat inadequate, as nobody, whether Radio Society Members in the provinces or affiliated Societies, were ever consulted as to whether they desired any election. We are now bound, in the eyes of the Post Office, by a decision taken by London and affecting to represent the Provinces. If I only speak for one area I feel quite certain that such representation could never be recognised.

In addition to the above, it is necessary to point out that in a Society which affects to represent Great Britain, the proportion of eight London to four Provincial Members in a Committee of twelve is hardly a true proportion of interests; it should be pointed out in this connection that the decision was again made in an entirely arbitrary manner by London.

The extremely great representation of the trade as against other members on the present Committee of the Radio Society of Great Britain is a matter on which considerable comment has been made already, with no apparent result. As no statement has ever been made to account for this preponderance of trade members, others are left to draw their own conclusions.

It is with regret that I have to point out that, whilst a suggestion from the R.S.G.B. that they selected *pro tem.* "might" have been passed, at the same time the present dictation can hardly pass without comment.

I am, etc.,
H. BURBURY.

Wakefield.

NOTE.—We are informed that copies of the above letter have been sent as follows: President, The Radio Society of Great Britain; Chairman, The Radio Society of Great Britain; Treasurer, The Radio Society of Great Britain; Secretary, The Radio Society of Great Britain; President, Halifax Wireless Club and Radio Scientific Society; Secretary, Halifax Wireless Club and Radio Scientific Society; Senior Vice-President, Wakefield and District Wireless Society; Secretary, Wakefield and District Wireless Society; the amateur section of the general Wireless Press, and in particular the official organ of the Radio Society of Great Britain.

5NO

SIR,—With reference to "Would-Be-Helper's" letter about Newcastle's programmes, may I write a few lines in defence of same? I am an experimenter and do not bother much about the B.B.C. concerts, but there is one thing I am quite convinced about, and that is that the one programme that is worth listening to (as a rule) is the one from Newcastle.

I am nearer 5SC than I would wish to be, but the Newcastle programmes come through clearer than any other station, even when employing four valves.

Is "Would-Be-Helper" getting his tuning perfectly, I wonder, as the complaint of announcements not being clear is anything but justified.

The Kiddies' hour alone we consider quite a "Star Turn" up here.

I am, etc.,
A. M. H. F.

Renfrewshire.

IN BUENOS AIRES

SIR,—I have pleasure in enclosing herewith my replies to your enquiries *re Wireless Weekly*, and take this opportunity of congratulating you on the excellence of your publication, which is far and away the best of the many which reach this country—both English and American.

It may interest you to know that in Buenos Aires there have been in daily operation for several months two 500-watt broadcasting stations, in addition to transmission from several theatres, one of which, namely, the Colon Opera House, was, I believe, one of the first theatres in the world to be fitted with a transmitter. The number of amateur receiving sets installed is rapidly increasing, there now being several thousand in use, and the "Radio Club Argentino" alone have some 600 members. From this it will be seen that we are quite up-to-date in wireless matters.

I am, etc.,
E. K. BERRY.

Buenos Aires.

Information Department

F. G. R. C. (WANSTEAD PARK) refers to the circuit diagram shown in Fig. 7, page 89, "MODERN WIRELESS," No. 2, and asks the value of the various components for receiving British broadcasting.

The coil L_1 should be a 35 or 50 "Igranic" coil shunted by the condenser C_1, which should have a value not less than 0·00075 μF. Coil L_2 should have 50 or 75 turns, the condenser C_2 being of 0·00025 μF capacity. Coil L_3 should have 75 turns, and condenser C_4 should be of the same value as C_2. C_3 should be 0·0003 μF, and C_5 0·001 μF. C_6 might have a similar value to C_5, The valve should be hard and the telephones of a resistance not less than 2,000 ohms. The condenser C_7 should have a value of 0·002 μF.

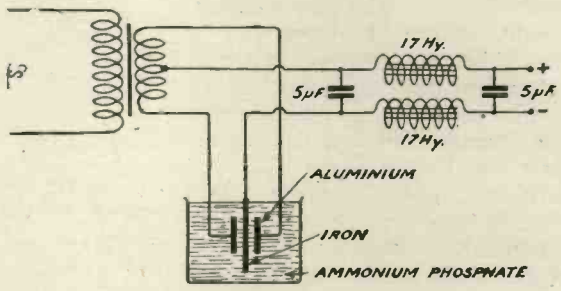
C. H. W. (CROWTHORNE) asks questions about the correct high tension voltage to use when using sets containing different numbers of valves.

The statement that you should readjust the high-tension voltage for each additional valve used is rather misleading, as an increase in the anode current is generally only desirable where additional magnification is required from low-frequency valves. The high-tension battery would therefore be at a value of, say, sixty volts whether the receiver had one valve or six, provided that sixty volts was the correct working pressure for the valves in question.

H. M. (BECKWITH, BIRMINGHAM) refers to the article in No. 4 of "MODERN WIRELESS," entitled "Some Simple Sets Employing Crystal Rectification," and asks in connection with Fig. 6: (1) Would selective tuning be obtained by means of the variometer arrangement shown. (2) For constructional data for these variometers. (3) For suitable valves.

(1) This arrangement of variometers is quite selective and produces great amplification. (2) Full data for the construction of suitable variometers appeared in *Modern Wireless*, No. 2, page 143. (3) Any good make of receiving valve will be suitable for use with this circuit.

C. H. M. (GLOUCESTER) asks for a circuit diagram of a suitable arrangement for deriving his H.T. supply from the alternating current lighting main. He wishes to know the values of the smoothing chokes and condensers.



Rectified A.C. supply for reception.

A suitable method of arranging this apparatus is shown in the accompanying figure. The exact values of the chokes and condensers are not critical, but the latter should have a capacity exceeding 1 μF, and the values we have marked on the diagram will be found to ensure a steady supply.

J. R. (GLASGOW) asks for a suitable value for a telephone condenser.

The exact value of this condenser is not critical, but in general should be either 0·001 μF or 0·002 μF. In some circumstances condensers up to 0·005 μF may be used with advantage.

W. G. B. (SOUTHGATE) refers to circuits showing low-frequency amplifiers, and asks whether it is essential to use a transformer.

Amplification of signals may, of course, be effected by the valve alone, but the results are greatly enhanced if a step-up iron core transformer is used.

R. H. (S.E.1) has an "Igranic" vario-coupler and asks how he can extend the range of this to 4,000 metres.

The range of the tuner can be extended to any desired degree by plugging-in appropriate coils in series with it. A coil having about 350 turns would be necessary in your case.

A. H. H. (LEEDS) asks for the correct times of the various French transmissions of telephony, as he finds the times of working generally given do not correspond with the times at which he hears the stations.

We give herewith the exact times (B.S.T.) of the various French transmissions. The attention of all readers is directed to the following list:—

L'Ecole Superieure (PTT). 450 metres.
7.48, Tuesdays and Thursdays.
3.18, Mondays and Fridays.
2.18, Saturdays.

Lyons. 450 metres.
10.18 a.m., daily.
3.43, weekdays.
6.48, meteorological forecast.

Tours. 2,500 metres.
2.2 p.m., Thursdays, concert.

Radiola. 1,785 metres.
12.33, weekdays. News and concert.
4.52, daily. Financial news and concert.
8.33, daily. News and concert.
1.48, Sundays. Concert.

A. W. T. (KENTISH TOWN) is constructing apparatus described in "WIRELESS WEEKLY," and asks questions about the winding of aerial and anode inductances.

The two coils in question must not be wound on the same tube, as there must be no coupling between them. As regards the question of taking tappings, we do not recommend departures from the instructions given in the article in question. If the valves are to be used in a horizontal position, they should be so arranged that the filaments are vertical.

H. F. (WEMBLEY HILL) has a small loose-coupled inductance, the range of which he wishes to extend by plug-in loading coils. He asks whether this is a feasible proposition.

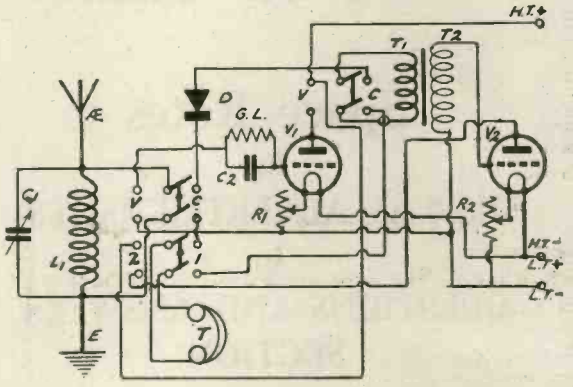
It is possible to extend the range of the tuner by the method you mention, although if too high a range is reached the degree of coupling possible between the circuits will not be sufficient. To cover up to 2,600 metres, you should plug-in coils in series with the primary and secondary. Without knowing the present range of your tuner we cannot advise you as to the size of these coils.

F. T. G. (LONDON, N.W.10) asks: (1) How to find the resistance necessary to charge an accumulator from a direct current lighting main of known voltage at a certain rate. (2) What is the finest wire which could safely be used to wind a low-frequency intervalve transformer coupling valves the anode feed of which is at a pressure of 200 volts? (3) Whether the winding of a solenoid coil for short waves with stranded copper wire would be an improvement.

(1) If the voltage of the supply is known and the charging rate is also known, then the required resistance R equals E over C; where R equals the resistance, E equals the voltage of the supply and C equals the charging rate in amperes. (2) Not finer wire than No. 38 s.w.g. double silk covered should be used for this transformer. (3) On very short waves an increase in efficiency would probably be observed, but this would not be sufficiently great to justify the use of stranded wire.

W. B. (JARROW) wishes to know how to amplify the signals from a crystal receiver.

Suitable circuits for adding note magnifiers to crystal receivers are shown in *Wireless Weekly*, No. 7, also in "Practical Wireless Valve Circuits."



A valve and crystal circuit with alternative switching arrangements.

C. de la C. (BRUSSELS) asks for a circuit diagram showing how by means of suitable switches he may use a crystal or valve detector with or without a note magnifier at will.

We give herewith a circuit diagram showing how the necessary change in connections may be made by means of three double pole double throw switches. Such a circuit arrangement is very useful for experimental work.

A. J. H. (KINGSTON-ON-THAMES) wishes to know of a good crystal receiver circuit for use at a distance of 23 miles from 2ZY.

The compact broadcast receiving set described in *Modern Wireless*, No. 2, will be very suitable for your purpose.

R. A. B. (EAST HAM, E.6) refers to the simple coil winder described in "MODERN WIRELESS," No. 1, and says that he has difficulty in making the wire adopt the correct formation on this machine.

This coil winder will be found very satisfactory if a strip of emery cloth is wound round the former with the rough face outward before winding is begun. After the first layer has been put on, the wire will automatically assume the correct formation.

M. H. W. (BRISTOL) asks for a good two-valve circuit employing one high-frequency valve with reaction, and also for the necessary values of the component parts.

A suitable circuit for your purpose is ST34, "Practical Wireless Valve Circuits" (Radio Press, Ltd.), and the values of the components are as follows:—

L_1—60 turns of 20 s.w.g. double cotton covered wire on a 3in. former.
L_2—80 turns of 26 s.w.g. double cotton covered wire on a 3in. former.
L_3—35 turns of 28 s.w.g. double cotton covered wire on a 3½in. former.
C_1—0·0005 μF.
C_2—0·0005 μF.
C_3—0·0003 μF.
C_4—0·002 μF.
R_1 and R_2—6 ohms.
R_3—2 megohms.
B_1—6 volts.
B_2—60 to 100 volts, depending on the valves in use.

T. G. W. (WIMBLEDON PARK) experiences trouble with his note magnifier due to the presence of a 50 cycle A.C. lighting main.

We suggest you use high-frequency amplification and remove the low-frequency transformers if possible. You will then not be troubled to the same extent. If, however, you still wish to employ note magnification, we suggest you use the frame aerial, which is generally very effective in eliminating interference from this source.

B. R. (BRADFORD) asks how many turns of wire would be required on a 3in. former to make primary, secondary and tuned anode coils for the British broadcasting range of wavelengths, for PCGG, and for the Eiffel Tower transmissions.

The following numbers of turns may be used:—

For British broadcasting.—Primary, 50 turns; secondary, 70 turns; tuned anode, 70 turns.
For PCGG.—Primary, 100 turns; secondary, 150 turns; tuned anode, 150 turns.
For the Eiffel Tower.—Primary, 200 turns; secondary, 250 turns; tuned anode, 250 turns.

Radio Press Books give him all the information he needs

Complete List

	Price.	Post Free
1. Wireless for All .... John Scott-Taggart, F.Inst.P.	-/6	-/7½
2. Simplified Wireless.. John Scott-Taggart, F.Inst.P.	1/-	1/1½
3. How to Make Your Broadcast Receiver . John Scott-Taggart, F.Inst.P.	1/6	1/7½
4. How to Erect Your Wireless Aerial .... B. Mittell, A.M.I.E.E.	1/-	1/1½
5. The Construction of Wireless Receiving Apparatus ..... P. D. Tyers.	1/6	1/7½
7. How to Make a "Unit" Wireless Receiver ..... E. Redpath.	2/6	2/8
9. Wireless Valves Simply Explained .. John Scott-Taggart. F.Inst.P.	2/6	2/8
10. Practical Wireless Valve Circuits..... John Scott-Taggart, F.Inst.P.	2/6	2/8
11. Wireless Licences and How to Obtain Them ..... E. Redpath.	1/-	1/1½
Elementary Text-book on Wireless Vacuum Tubes ..... John Scott-Taggart, F.Inst.P.		10/- (Post free)

¶ Those printed in heavy type have been published recently.

HOW many turns for a Coil to reach the Paris Wavelength—the type of circuit to operate a Loud Speaker using only an indoor Aerial —Crystal or Valve rectification in a multi-valve Set? These are a few of the questions which confront the amateur constructor.

Some will find out the correct answers by expensive experiment—others, more wisely, will benefit by the experience of those who have trodden the thorny paths of Radio before them.

The concentrated experience of some of the best known Wireless engineers and experimenters is available for all readers of Radio Press Books. You cannot do better than purchase the complete Library—one Book at a time. Each Book covers a different phase of Wireless and none overlap. Get one or two to-day and keep them by you for ready reference—they are sure to save their cost many times over. From all Booksellers.

RADIO PRESS LTD.,
Devereux Court, STRAND, W.C.2.

Radio Press Books
—a complete Wireless Library

Gilbert Ad.

Printed for the Proprietors. RADIO PRESS, LTD., Devereux Court, Strand, W.C.2, by THE CORNWALL PRESS, LTD., Paris Garden, Stamford Street, London, S.E.1. Published on Wednesday of each week at 3, Bolt Court, Fleet Street, London, E.C.4. Address for Subscriptions and Editorial communications:—Devereux Court, Strand London, W.C.2. Advertisement Managers:—THE SCHEFF PUBLICITY ORGANISATION, LTD., 125, Pall Mall, London, S.W.1. Registered as a newspaper and for transmission by Canadian Magazine Post. Subscription rates:—32/6 per annum, 16/3 for six months, post free. Sole Agents for Australasia:—GORDON & GOTCH (Australasia), LTD. For Canada:—IMPERIAL NEWS LTD. For South Africa:—CENTRAL NEWS AGENCY, LTD.