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Popular Wireless

and Wireless Review

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SCIENTIFIC ADVISER: SIR OLIVER LODGE, F.R.S., D.SC.

March 1st, 1924.



Activity in the Birmingham Station's Studio.
The "effects" dept. at work.

FEATURES IN THIS ISSUE.

A Compact Variable Condenser.
 A Simple Crystal Set.
 About that Aerial.
 Series-Parallel Switching.

Hints on Using Dull Emitters.
 Some Radio Reflections.
 Home-made Plugs and Jacks.
 Music and the "Middlebrow."

The Construction of a Two-Valve Receiver (conclusion).

Sparta LOUD SPEAKER

An Explanation.

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POPULAR WIRELESS

AND WIRELESS REVIEW.

March 1st, 1924.] THE RADIO WEEKLY WITH THE LARGEST CIRCULATION. [Every Friday, Price 3d.

Technical Editor:
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TOPICAL NOTES AND NEWS.

Penny-in-the-Slot Radio.

THE latest idea in wireless is the "Radio Slot Machine," which has recently made its appearance in America. The receiver is equipped with a special apparatus, which gives advance information as to wireless entertainment, and posts a warning twenty seconds before another coin is required.

* * *

A Coincidence.

A CURIOUS coincidence happened at a children's party recently given by the well-known author, Gordon S. Maxwell. The children were playing musical chairs to wireless music when "Kathleen," his niece, fell down, and Uncle Jeff's voice was heard through the loud speaker: "Hard luck, Kathleen!"

* * *

2 L O Full Church Service.

IT is contemplated that 2 L O will broadcast their own Sunday services in the near future. Mr. Martin Shaw, the well-known Master of Music of St. Martin's-in-the-Fields, has received an "overture" in this connection from the B.B.C. I understand that the services will be similar to ordinary church services.

* * *

The Collection.

IF this is to be the case, you must not be surprised if during the service a man knocks at the door and announces that the "sidesman has called for the collection."

* * *

5 W A's New Studio.

CARDIFF is to have a new studio. The B.B.C. has acquired No. 39, Park Place, opposite the National Museum, and will erect a first-class broadcasting studio in the garden, which extends for some distance back. The studio will be four times the size of the present Castle Street studio, and will be equal to any in the country.

* * *

"Ariel."

MANY readers and listeners are of the opinion that "Ariel" of the B.B.C. is the same as "Ariel" of "P.W." and "Daily Mail." Let me assure you that this is not the case. There is no connection between the two personalities. As a matter of fact, "Ariel" of "P.W." was "alive" before broadcasting was anything more than a speculative possibility in this country.

* * *

The Most Popular Item.

PROBABLY the most popular item of recent broadcasting programmes has been the comic opera, "The Dogs of Devon." I am told that over 3,500 letters

were received, all giving praise for the splendid performance. As a result of this, a "repeat" performance is to be given early in March. More letters have been received in connection with this opera than any other performance yet broadcast.

* * *

Did You Hear This?

ONE of the bishops who broadcast recently from 2 L O ended his sermon, "I hope we shall all meet in Heaven—I don't think." This sounds terrible, and must have shocked those who heard it, but it happened to be the fault of the announcer, who failed to switch off before the Bishop had time to say in an aside to the announcer, "I don't think I



Miss Violet Vanbrugh and her daughter, Miss Prudence, listen to a broadcast concert whilst travelling in a motor car.

was too long." I should like to hear from readers who have noticed further amusing instances of this kind.

* * *

Miss Alma Taylor.

I CALLED on Miss Alma Taylor the other day at the Scala Theatre, where the British film, "Comin' Thro' the Rye," is being shown. She was listening to the evening broadcasting when I entered her dressing-room. "I really enjoy this broadcasting," she said. "It is very interesting, and I made this crystal-valve set myself and put it into an old desk which my mother gave me when I was a little girl." Miss Taylor had certainly constructed a very fine set—one that would make many amateurs turn green with envy.

The Wireless "Detective" Van.

I LEARN that the "detective" van used for tracking "oscillators" recently was placed in commission by Mr. Woodham (5 O B) and was used in conjunction with Mr. P. Coursey, Secretary of the Radio Society of Great Britain, and 2 K T, not 2 O M, as was stated in our issue of February 9th.

* * *

A Pocket "Joke."

SOMETIME ago I made mention of a pocket wireless set which was supposed to serve the purpose of carrying out a joke on one's friends. I still see hawkers selling this so-called "joke," which is really quite a swindle. I happened to be in a crowd the other day, watching a hawker selling this "wireless set," and noticed two little boys putting their money together to buy one. It was not long before the little boys realised the "joke," which to them, was nothing more than a disappointment. I am glad to say, however, that a kind old gentleman gave them a few coppers to cover the loss.

* * *

Indians at 2 L C.

THE visit of the Red Indians to the London Broadcasting Station, which with considerable difficulty I had successfully arranged, was one of the chief features in 2 L O's programme recently. I took five of the Red Indian chiefs to 2 L O's studio in a taxi-cab, and, after much persuasion, managed to convince them that broadcasting was quite a harmless affair. Chief Yellow Horse and Chief Lone Bear were particularly interested, although I do not think even they could understand exactly what took place when, with their companions, they rattled out their war-cries into the microphone! I introduced them to the Uncles, and then to the children who were listening-in.

* * *

The "Arapahoes."

I HAD an interesting conversation with "Goes in The Lodge," an old chief, who speaks English fairly well. He told me that his tribe, called the "Arapahoes," named him "Goes in the Lodge" because he once went into a lodge or hut to capture a white man, which he successfully did. It is interesting to note that these Red Indians in years gone by were on the war-path gathering scalps and only the other day they broadcast to children!

* * *

Proposed 25 kw. Station.

THE erection of a new station, nearly seventeen times the power of 2 L O, is being contemplated by the B.B.C. I am told that the station will be erected on

(Continued on page 2.)

NOTES AND NEWS.

(Continued from page 1.)

the outskirts of London, perhaps at Cricklewood. The wave-length will be 1,600 metres, and little interference is expected. The idea of the giant station is to reach areas at present inadequately served by 2 L O, and it is predicted that crystal reception up to 100 miles, single valve reception up to 200 miles, will be possible. Before anything can be done in the matter, the Government will have to be satisfied that such a station will not interfere with official services. In any case, a great amount of preliminary work will have to be done before the scheme can be set into operation, possibly at the Marconi Chelmsford station.

"Wired" Wireless Broadcasting.

A FRIEND of mine in America writes that an enterprising electric lighting company has inaugurated a service of broadcasting over their electric lighting supply mains, and entertain their subscribers with regular concerts for a small sum monthly. The transmission is carried out by the same method as wireless broadcasting, the transmitting apparatus being connected through a condenser to the lighting mains. The company supply the receiving apparatus, which is simply plugged into the ordinary electric lamp socket. The idea is not altogether new as regards the apparatus; for we have on the market an appliance which is fitted to an ordinary lamp socket, which utilises the wires as an aerial. The former part of the idea is impossible in this country, on account of the P.M.G. and the B.B.C. agreement, but there is no reason why the electric light companies should not rent out wireless apparatus similarly to the way they loan electric radiators and metres. The whole system is of the "wired wireless" type, concerning which Major-General Squier is an accepted authority.

A Radio Joker.

LISTENERS in Texas, U.S.A., were surprised to hear "2 L O" transmit a "choral service" from "Westminster Cathedral" recently, and letters came pouring in to the B.B.C. offices stating what the writers had heard. The B.B.C. are nonplussed. The only explanation that can be given is that some enthusiast in Texas broadcast gramophone records, and gave the call letters 2 L O. The joker, however, had forgotten the difference in time, as he transmitted at 3.30 a.m. Greenwich mean time when 2 L O was sleeping the sleep of the just!

Illegal Transmissions.

I AM told that there is an amateur in the Sheffield district who has been transmitting gramophone records on a wave-length of 4,000 metres, and stating that

the call sign of his station is 5 D N. As no gramophone records or music have been transmitted from Mr. Halcombe's station, who is the real owner of 5 D N, I am inclined to think that the transmitter is fraudently using other people's call letters, and working on an illegal wave-length.

5 W A's Concerts.

QUITE a few Welsh readers have written of their intention of allowing their licences to lapse unless 5 W A improves its vocal and instrumental programmes. It appears to me, that although Welsh people are well-known for their many difficulties, the station director at 5 W A has successfully coped with his national accomplishments. Others complain that the orchestra is too thin to attempt certain classical items. Perhaps it would be better—and I think Cardiff listeners will agree—that 2 L O should relay more performances to Cardiff. Frequently one hears 2 L O state that a concert will be broadcast simultaneously except to 5 W A. Why?



"Ariel" introduces some famous Red Indians to the Uncles of 2 L O and listeners. Readers will readily recognise Uncles Arthur, Rex and Caractacus.

S. B. Work.

SPEAKING of simultaneous broadcasting, I am told that the B.B.C. will shortly be reducing the number of simultaneous broadcast items because of the unsatisfactory relay transmissions.

Cheap Enough.

I WAS surprised to read in the provincial papers a suggestion that "licences should be reduced to 5s. and 7s. 6d. respectively now that so many enthusiasts have taken them out. A wireless amateur is able to make a set for 2s. 6d. and has to pay 15s. for a licence." The writer of the paragraph forgets that the most pleasant part of the business is the broadcast concert, and he is receiving 365 concerts a year for 15s!

The 2 Z Y Fund.

IT was a great pleasure to meet Mr. Dan Godfrey of 2 Z Y leaving 2 L O's studio the other day, after having assisted during the Children's Hour. In conversation he told me that the "2 Z Y

Children's Hour Fund" was a great success. "Uncle George and I," he said, "have received hundreds of letters from the Booth Hall Infirmary, expressing thanks for the wireless set bought for them out of money subscribed to the 2 Z Y Fund. The nurses tell me that many of the children are better than before."

A St. David's Day Programme.

TODAY'S programme, February 29th, contains the usual talk by Mr. Atkinson, the B.B.C.'s film critic, whose gentle sarcasm and subtle wit many thousands of listeners-in have learnt to appreciate. Mr. Kenneth Ellis is down again to sing, and he is rapidly making a name for himself among listeners-in as a very popular artiste. The rest of to-night's programme contains nothing further of particular or outstanding interest. Tomorrow, Saturday, March 1st, the St. David's Day programme from Cardiff will be simultaneously broadcast, and an item which all listeners will appreciate will be given by Captain P. P. Eckersley, on "Forecasted Technical Improvements."

Girl Scientists.

I FEEL that there will be some jealousy shortly, now that young girls have taken up wireless. I have seen quite a number of sets made by girls of fourteen and sixteen, which are even better than many sets that I have seen made by boys of the same age. I have been asked to lecture to the Roedean School, Brighton, on wireless, as the girls have taken such a keen interest in this new science.

Premier to Broadcast.

READERS will be interested to learn that Mr. John Drinkwater, the famous poet and playwright, will broadcast a selection of his poems from the London station on March 6th. Another item of interest, which will take place on March 8th, is the broadcasting of "Carmen," Acts II. and III., from the Old Vic., at 8.25 p.m. The Prime Minister, Mr. Ramsay Macdonald, is also to broadcast via 2 L O on Friday, March 14th, on the occasion of the annual St. David's Day banquet, to be held at the City Hall, Cardiff.

The Prince at Mill Hill.

A FEW days ago the Prince of Wales visited Mill Hill School to open a new science section. In the course of his visit, he had a long talk with C. W. Goyder, the young 18-year-old schoolboy who recently obtained such wonderful results in communicating with amateurs in America. The Prince gave hearty encouragement to this branch of science, and congratulated the headmaster on his policy in allowing the older boys to do research work. The Prince also remarked that he had been recently presented with a portable wireless set—he did not, however, say whether he favoured a loud speaker or telephones.

HINTS ON USING DULL-EMITTER VALVES.

By R. H. WATSON.

An article that should receive the careful attention of all who intend to use, or are using these useful components.

SO popular has the dull-emitter valve become that it seems likely to supersede others whose brightly glowing filaments require anything up to an ampere of current to bring them to their proper working temperature. Dull emitters have been for some time in use in the Navy and they have been adopted by several recent exploring expeditions, owing to the smallness of their current requirements. The amateur is confronted by so large an array of low temperature valves of different design that he may have some difficulty in making a choice. It may help him a little if I make a brief mention of the various types that are now available.

The Three Types.

Dull emitters can be divided into three classes: those whose current consumption is not much less than is the case with the old type of valve, though the voltage needed is low; those in which the current consumption has been reduced to something very small whilst the voltage remains comparatively high; and, lastly, those in which both voltage and current have been brought down to very small values.

To the first class we may assign most of the earlier dull emitters designed in this country. These are such valves as the M. O. DER (1.8 volts, 4 amp.), the Mullard L.F. ORA (1.8 volts, 2 to 4 amp.), and the Ediswan ARDE (1.5 to 1.8 volts, .25 amp.). None of these is really suitable for working off dry cells. All are excellent performers, and, owing to their comparatively stout filaments, they are very long lived. I had one set of DER's in constant use for eight months, and though they have now been replaced for general work by valves which take less current, they are still as good as ever.

To the second class we may assign the M. O. DEV and DEQ (3 volts, .18 amp.); the M. O. DE3, the B. T. H. B5, the

their high price has prevented them from being very widely used by amateurs.

They are first-rate valves of very low capacity, giving results comparable with those of their high temperature counterparts the well known V24 and QX. Carefully used they will last for a very long time. It was a set of these which replaced the DER's mentioned previously, and they

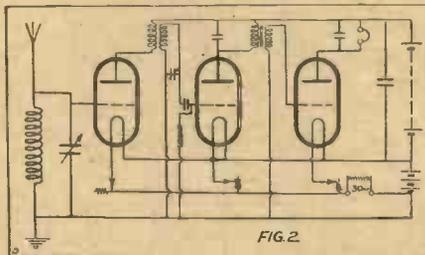
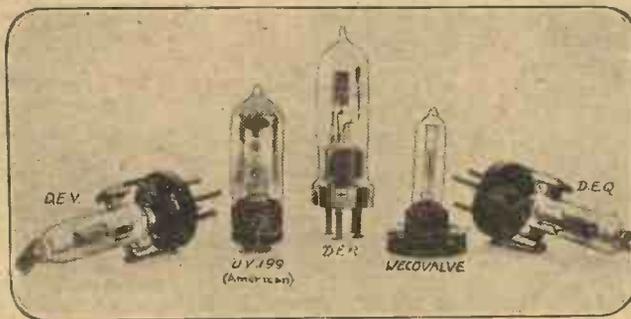


FIG. 2

have now been in use for seven months without any changes becoming necessary. The four valves of more recent design are all obtainable at 30s. apiece. There appears



A group of typical dull-emitter valves.

to be little to choose between them, and if used with care they will do everything that the amateur requires. In the last class we have up to the present two valves only: the "Wecovalve" and the Cossor "Wuncell," both of which are within the capacity of a single dry cell of ordinary size. These are both well made, robust little valves, very pleasant to work with.

Restoring Dull Emitters.

The soundest hint that can be given for using dull emitters in general is not to overdo the voltages. This applies to both plate and filament circuits. Dull emitting filaments are of two kinds. The first, which is the more common, consists of fine tungsten wire with which is blended a small proportion of thoria, a rare earth, used also for making incandescent gas mantles. On the surface of the filament is a very thin layer of thoria, whose presence enormously increases the electron emission. Should too great a voltage be applied the thoria may become volatilised, in which case it will be driven off from the tungsten, and the valve will cease to function as a dull emitter.

It can be brought back to something like its normal efficiency by the rather risky process known as "flashing." To do this one connects one of the filament pins to the positive pole of the high-tension battery, fixing to the other a piece of flex, whose free end is brought for the briefest possible instant into contact with the negative pole. This has the effect of bringing more thoria to the surface of the tungsten. The second kind of filament is made from either platinum or tungsten, with a coating of some lime compound. Excessive voltages here have the effect of breaking up the coating, though the qualities of the valve may be to some extent restored if the filament is left glowing for a time with the high tension battery switched off.

Voltage Control.

Should the plate be overdone the life of the filament is likely to be a short one. If an old valve is broken up and its filament removed and measured with a micrometer, it will be found that its diameter is considerably less than it was when new, particularly at the negative end, where the emission of electrons is at its greatest. By increasing the anode voltage we throw a very great strain upon the filament since we increase the electronic emission, and there comes a time when the fine wire is so battered that it gives way.

Never use a filament voltage greater than that recommended by the makers, and be sure that there is sufficient resistance in the circuit to cut down the electromotive force of your battery. Three dry cells, when new, will have a voltage if wired in series of from 4.5 to 4.8. The ordinary 5-ohm rheostat is of no use whatever for bringing this down to meet the requirements of 3-volt filaments and an auxiliary resistance with a maximum value of at least 30 ohms should be provided. Fig. 1 shows how it can be inserted into the circuit.

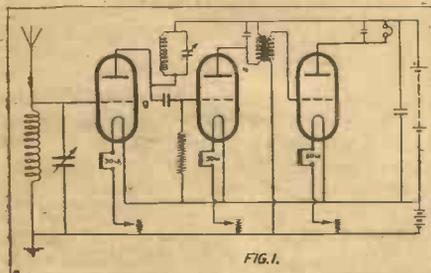


FIG. 1

Ediswan AR.06 and the Mullard D. F. ORA (all 2.5 to 3 volts, .06 amp.). The first pair mentioned are by no means new valves since they have been on the market for considerably more than a year, though

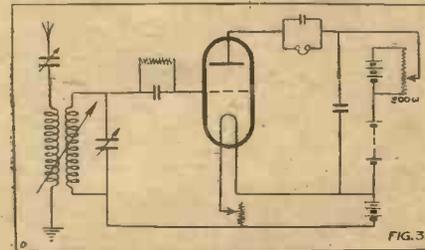


FIG. 3

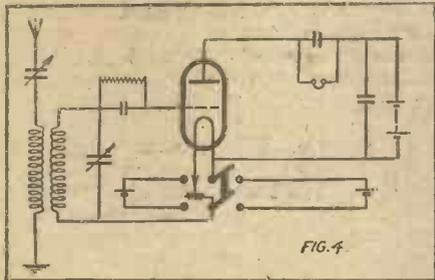
It will be seen that a resistance is provided for each valve. It would, of course, be possible to use an extra resistance for the three, as shown in Fig. 2, but if this is done it will be found that any movement of one valve's rheostat effects also the

(Continued on page 4.)

HINTS ON USING DULL-EMITTER VALVES.

(Continued from page 3.)

other two. Dim one valve a little and the other two brighten; increase its brilliance and the others become duller. Such an



arrangement therefore makes it extremely difficult to adjust the set properly. The next point to notice is that the plate voltage of many of these valves is extremely critical when they are used as rectifiers. With the Wecovalve, for instance, one requires something rather better than the three-volt steps provided by the ordinary high tension battery.

A finer adjustment may be obtained in one of two ways: either a battery of the round cells used for torches may be made up and tapped at every 1½ volts, or, better still, a potentiometer may be used, as shown in Fig. 3, across the three cells at the positive end of the high-tension unit.

Action of Dry Cells.

To obtain the best from dry cells it is essential to treat them carefully. None of them will stand a long continuous discharge. When current is being taken from a dry cell bubbles of hydrogen gas form upon the positive carbon element, setting up an increasingly high internal resistance which leads of course to a drop in the voltage.

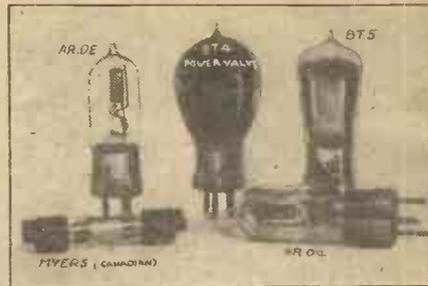
This polarisation, as it is called, is counteracted to a great extent by the depolariser of manganese dioxide, which gives up one of its oxygen atoms to each part of hydrogen atoms, thus dissolving the bubbles and forming water which goes to keep the cell damp. If, however, the cell is worked with a fairly heavy load for a long time the

depolariser is unable to do its proper work and the cell will be injured. It is thus necessary to rest dry batteries as much as possible. Fig. 4 shows a way in which this may be done, the double-pole change-over switch enabling either of the cells to be used whilst the other is resting.

L.T. Accumulators.

With Wecovalves and others which have a fairly high current consumption (for dull emitters, that is), it is best not to attempt to work two or more in parallel from one cell no matter how large it may be. Nor is it advisable to use such a circuit as that shown in Fig. 5, where three cells in parallel are called upon to work three valves. It is better to use a separate cell for each valve, as shown in Fig. 6.

If accumulators are used for heating low temperature valves the result is delightful, for one's low-tension battery lasts an immense time with one charge. It must, however, be remembered that the plates of any accumulator, unless it is a very special kind, suffer if the battery is not charged up every three months or so.



Another group of typical dull-emitter valves.

temperature rises to the working point. Matters are made much worse if the high tension battery is connected up when switching on is done. In this case the full strain of emission to the plate is placed upon the filament suddenly just at its weakest moment. Therefore switch on your filaments gradually through a resistance and do not connect the high-tension supply until they have been glowing for a moment.

You will have no fault to find with the performances or with the life of low temperature valves if you are careful with them. Remember that their filaments are much thinner than those of high temperature valves and handle them with corresponding care. Always mount valves in the set so that their filaments are vertical. If they are horizontal the combined influence of gravity and of static pull from the plate tend to make them sag down on to the grid. Treat your dull emitters considerably and they will serve you well, but handle them carelessly and you will find that they are expensive luxuries.

Filament Control.

As only a small amount of current flows through the dull emitter filaments, it is obvious that a small variation of current will make a large variation in electron emission. Therefore, in order to control this type of valve to the best advantage a filament resistance, capable of vernier adjustment, is necessary, and on no account should the same rheostat be used for several valves.

The rheostat chosen for use should also be perfect in action, as any slight irregularity in current due to poor or unequal contact in the rheostat will be greatly magnified by the valves, and so give a surprising variation in the 'phones, besides causing a considerable amount of unwanted noise.

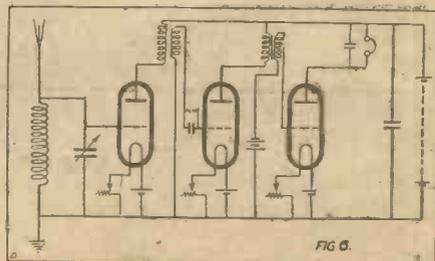
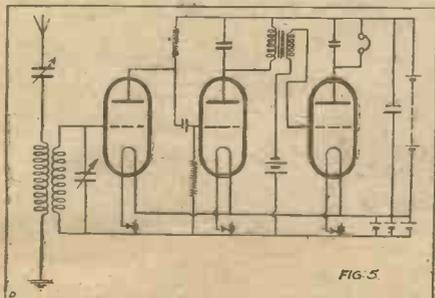


Mr. William Priess, one of the world's leading authorities on dual amplification, testing one of his latest receivers.

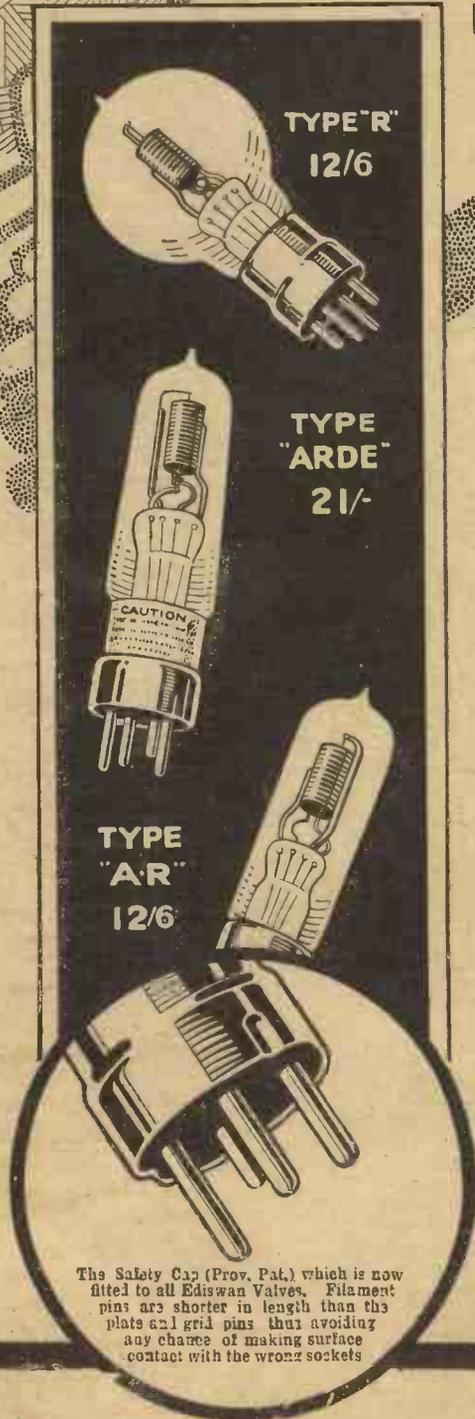
Therefore, even though it appears to be up to its full voltage, it should be sent to the charging station at regular intervals for attention.

Careful Treatment Necessary.

Filament current should not be switched on suddenly; that it to say, it is not advisable to leave the rheostats at their best setting and, when the receiving apparatus is brought into use again, simply to plug-in or switch on the low-tension supply. Curious things, into which there is no space to enter here, take place in an electric circuit which is suddenly brought under full load. The result, however, is that a momentary heavy strain is set up. This is specially undesirable in the case of filaments which are particularly brittle during the brief instant in which their



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The "Ediswan" reputation is your protection

Nothing provides better proof of "Ediswan" superiority than the growing number of letters from satisfied users. Here are more examples showing the wisdom of buying a "valve with a name behind it."

Leicester, February 6th, 1924.

A.R. Valves.
I am able to receive all B.B.C. Stations on my 2-valve Set, H.F. and Det. (home-made). I have now had these 2 valves in constant use since last May, which speaks only too well of their good quality and long life. I consider them superior to any other make on the market.

L. Renals,
Portsmouth.

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January 19th, 1924.

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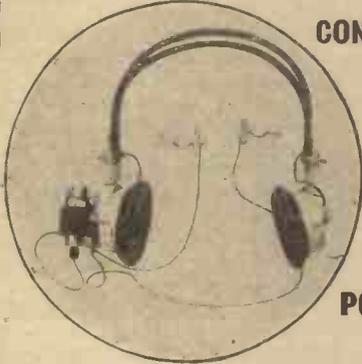


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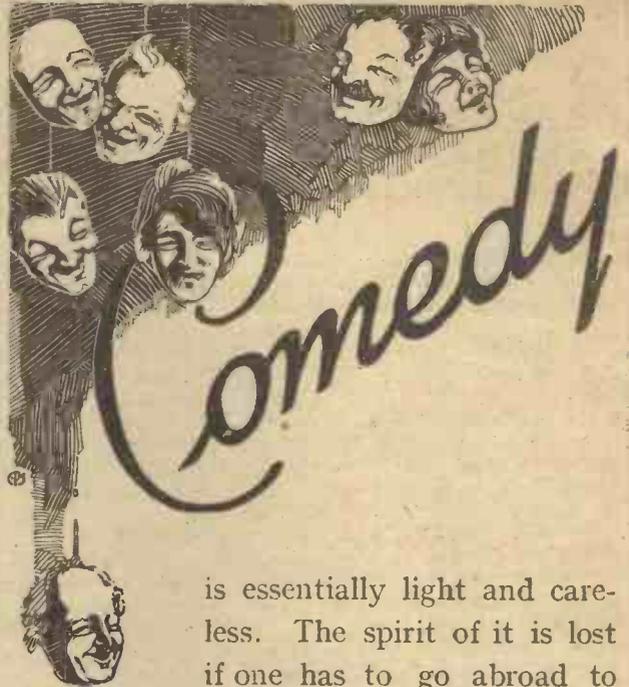
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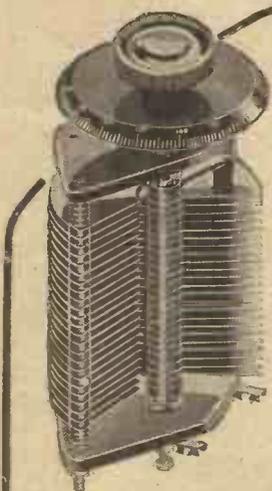
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Mainly About Broadcasting

by The Editor

WHEN we were at school, some of us—possibly a good many of us—were not particularly enthusiastic about that section of the curriculum colloquially known as “stinks.”

Under that curt and pithy head comes chemistry and physics; of the former I have vague memories of mixing H₂SO₄ with nitric acid (I've forgotten the call sign for nitric acid), and various other things, until a test tube containing the mixture frothed and bubbled with fine gusto. And the surreptitious manufacture of chlorine often enlivened the chemistry lecture—but the physics lesson was usually very dull. There is not much fun in playing about with a paper covered with iron filings and a magnet, or even in fiddling with springs in a misguided attempt to understand the “parallelogram of forces” (whatever that may be). But nowadays boys at school must look forward to “stinks” in all its branches.

A Fine Record.

The other day a schoolboy blossomed into fame—for which he has to thank his headmaster's initiative in encouraging modern physics, and his science master's enthusiasm for his work—by creating another radio record.

C. W. Goyder is his name, and he is an eighteen year old student at Mill Hill School, near Hendon. Being keen, he got up early one morning to test out the school transmitting set—and before he had been on watch very long, found himself in touch with Montreal, Nova Scotia, etc.

This is a remarkable achievement, considering that only a one valve 250-watt set was used, and that however good one's transmitter may be, it calls for a good deal of skill to operate a set with such results as obtained by this Mill Hill student.

A Lucky School.

Mill Hill is a lucky school. I am sure the boys do not find “stinks” very dull there, and they must be proud of their science director, Mr. W. H. Brown, whose keen enthusiasm was very apparent before he had spoken half-a-dozen words to me when he paid me a visit some weeks ago.

The radio work carried out at Mill Hill is bound to do a lot of good, and it would not surprise me if some of the school's “old boys” don't distinguish themselves and earn fame in the world as radio research workers.

It is to be hoped other schools will foster the love of science and on the same lines as those so successfully adopted by Mr. Brown.

Many readers of POPULAR WIRELESS write to me from time to time asking for particulars as to how they can become wireless operators. The first thing to do is to select a suitable training college. Twelve months' training should enable a

candidate to sit with success for his examination for the P.M.G.'s certificate.

At the time of writing the total number of British ships licensed to carry wireless gear is, approximately, 3,388, and the approximate surplus of operators over actual requirements was 2,698.

To-day the number of unemployed operators holding the P.M.G.'s 1st class certificate in wireless telegraphy approximates to 1,800.

Operators' Pay.

Wireless operators' pay and conditions of employment are governed by an agreement between employers and the Association of Wireless and Cable Telegraphists, particulars of which may be had from the Association of Wireless and Cable Telegraphists at the undermentioned address.

The commencing salary for a fully qualified marine wireless operator at

employed, one for the grid and the other for the plate circuit. An L 1,250 coil is placed in the aerial-earth circuit. One valve and the usual L.T. & H.T. batteries make up the components.

One unique feature about the Autoplex, when it can be coaxed into satisfactory working order, is that it will work a loud speaker without amplification. But in its present state of development the Autoplex is by no means a finished and reliable circuit. Unless it is very carefully built and very carefully handled it gives poor and highly distorted results. It cannot be denied that, from the experimenter's point of view, it possesses some possibilities, but for general use as a reliable receiver it cannot be recommended.

Interesting Figures.

Readers may be interested to note the latest statistics regarding broadcasting in America.

It is estimated that the American public spent anything from seventy-five to one hundred million dollars on wireless in 1922, and in 1923, at least one hundred and fifty million dollars. This represents, approximately, £33,125,000—a vast sum, even when we make allowance for the huge population of America.

The statement that two million sets are in use in America is regarded as a very low estimate: but by multiplying this figure by the average size of an American family it can be seen that America has a wireless audience of approximately eight millions.

If progress is the same for the next few years, it is more than likely that forty to fifty million people will be making use of

broadcasting in the United States.

The latest figures show that to-day there are four hundred and fifty broadcasting stations in operation in the U.S.A., but out of this number only fifty can be regarded as first-class stations worthy of comparison with, say, 2 L O. The “odd four hundred” consist of local stations without any pedigree worth speaking of, and with no regular time table or permanent claims to public recognition.

The Radio Corporation of America, it is said, have spent about a quarter of a million dollars on the station W J Z alone. This station is situated on the roof of the Æolian Hall in New York City, and costs thousands of dollars a month to run.

Yet, in spite of these somewhat astounding statistics, I think we in Great Britain can say that our radio stations (taking into consideration our population and the comparative short time in which broadcasting has been known in Great Britain) are just as astounding. With over six hundred thousand licensed listeners, and assuming three listeners to every set, we can show a broadcasting audience of at least one million eight hundred thousand.



Master C. W. Goyder operating the transmitting apparatus at Mill Hill School.

present is £7 12s. 6d. per month, while the maximum salary after nine years' service is £18 17s. 6d. per month. In addition, and where applicable, there are small allowances, such as “Foreign and Extended Voyage Allowance,” “Shore Allowance,” “In Charge Allowance,” “Tanker Allowance,” etc. Further information may be had at any time free of charge from the Association of Wireless and Cable Telegraphists, Lennox House, Norfolk Street, Strand, London, W.C.2.

The “Autoplex.”

Some time ago POPULAR WIRELESS drew attention to the Autoplex circuit, which originated in America, and was boomed in many sections of the technical press. The technical staff of “P.W.” tested this circuit thoroughly, but came to the conclusion that it was not a circuit to recommend to readers of this journal.

Within the last few weeks several queries have been received with regard to the Autoplex from readers who appear sufficiently interested to contemplate its construction.

The Autoplex is really a super-regenerative set. Two standard variometers are

MUSIC AND THE "MIDDLEBROW."

By F. G. LIDSTONE.

Our contributor replies to Mr. Percy Scholes' article on "Music for All," and contends that fifty per cent of listeners-in are "middlebrows." The Editor will be pleased to receive the concise opinions of his readers for publication in "Popular Wireless."

IN an article entitled "Music for All," published in POPULAR WIRELESS a week or two ago, the B.B.C. Music Critic, Mr. Percy Scholes, set forth his opinion of the musical tastes of the broadcast listener.

Several of his statements—such as the one that there will always be a diversity of musical tastes—go without contradiction. It is evident that what Mr. Scholes doesn't know about music certainly is not worth knowing. But if I, a humble broadcast listener, may say so, Mr. Scholes has yet something to learn about the tastes of the people who listen to the broadcasting programmes.

Types of Listeners.

In the first place, he bases all his arguments in favour of highbrow music on the assumption that listeners are divided into two distinct classes—the highbrow and the lowbrow. This is wrong. There is another and greater class of listener—the middlebrow. I venture to suggest that if it were possible to take a census of broadcast listeners on the question of musical taste, it would be found to work out something like this:

Highbrows	25 per cent
Lowbrows	25 "
Middlebrows	50 "

A highbrow, as I interpret the word, is a person who refuses to recognise as music any composition that can be understood and appreciated without mental effort. The lowbrow is one who regards with scorn anything more edifying than "Yes, we have—," etc., and songs which centre around mummies, grannies, and intentions to return without delay to the place of one's birth.

Need for Variation.

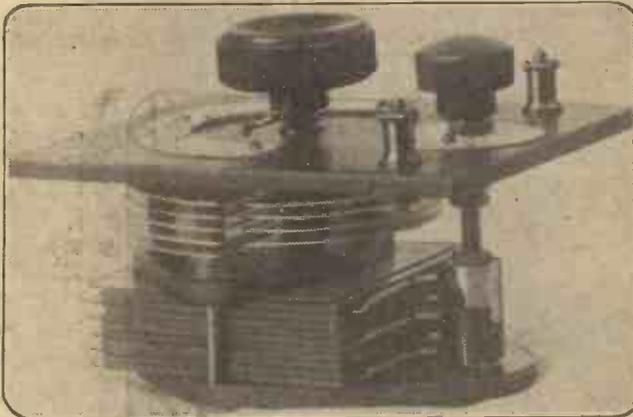
The middlebrow's taste in music is broad. He will listen to Mozart or Beethoven with enjoyment. Puccini will give him pleasure; he likes a song or two about "roses" and "you"; the Rachmaninoff "Prelude" thrills him; an hour with the Savoy Dance Bands will not be at all out of place, and he likes to hear items rendered by good orchestras or military bands.

Give him a whole evening of jazz, mummies, cabin-doors, and "going backs" and he will protest. Confine an evening's entertainment to chamber music, and he will not like it. Broadcast a programme that includes something from each class of music, and he will be more than satisfied.

He is not highly educated, nor is he by any means ignorant. He is sufficiently broad-minded to appreciate any class of music providing it is good in its way.

The "Highbrows."

I have estimated the percentage of highbrow listeners at 25 per cent. Some will agree with me on that figure, but some will not. I do not suggest that only a quarter of the music lovers in this country are highbrows. I refer to broadcast listeners only. My contention is that the majority of people who really do appreciate "heavy"



The compact variable condenser, clearly showing the fixed condensers with the cylindrical switching device.

music (as distinct from those who pretend they do to show their "superiority") do not possess wireless sets, but look elsewhere to have their tastes satisfied.

I have in mind a particular family, all the members of which really enjoy this type of music. They will sit engrossed through a three-hour Bach recital. At home they have a cabinet gramophone and a big library of records, but they refuse to instal a wireless set. Asked why, their reply will be, "Because everybody has one." With the gramophone, things are different. They can play whatever records they like just when the fancy takes. With wireless, they would have to take what is given them, and the thought that the same entertainment is being sent out for the benefit of hundreds of thousands of other people of all classes doesn't please them. All highbrows are not snobs. But many are.

Increase of "Middlebrows."

As Mr. Scholes remarks, the coming of broadcasting was the most important event in the history of music. And where would listening-in be if music did not exist? Broadcasting is going to do a wonderful lot for music. And music is going to do a great deal for broadcasting.

But I do not agree that listening-in will eventually make all lowbrows into highbrows. Rather will it make them into

middlebrows. The ranks of the latter class will also be swelled by the inclusion of a number of former highbrows. (I can almost hear the gasps of amazement at that statement!) But a moment's consideration will make my meaning plain. Listening to the better-class music will incline the taste of the lowbrow towards that of the middlebrow. And, similarly, listening to the lighter kind of music will help the highbrow to appreciate that even jazz is music—and entertaining music, at that.

The Ideal Programme.

Even Mr. Scholes himself is something of a middlebrow—for did he not reveal the fact to us that he liked to listen to the Savoy Dance Bands before retiring to bed! And between you and me most highbrows are middlebrows at heart.

After all there will be, as Mr. Scholes said, adversity of tastes in music and a totally highbrow or lowbrow programme will never be popular. It is always impossible to please everybody, but the nearest approach to that happy state of affairs in music is to be obtained by providing a middlebrow programme with occasional high or low brow items.

A COMPACT VARIABLE CONDENSER.

THE capacity of a variable condenser can be increased by adding in parallel fixed condensers of suitable capacities, and a combination of a fixed and a variable condenser of equal capacities can be successfully used to get any capacity, provided its value does not exceed the total capacity of both condensers.

Novel Switching Device.

The above principle gives rise to this variable condenser, which consists of a moving blade condenser of about .0001 mfd. capacity and five fixed condensers of nearly the same capacity. The variable part has four moving blades of standard size, separated by $\frac{3}{32}$ in. washers, thus giving a capacity of about .0001 mfd., the fixed condensers being simply rectangular pieces of brass foil, of suitable size, and separated by ebonite sheets $\frac{1}{4}$ in. thick. A cylindrical brass piece of a suitable shape mounted on an ebonite cylinder, clearly shown in the photograph, automatically makes contact with the springs soldered to the fixed condensers. A pointer attached to the cylinder moves on a circular scale marked 1, 2, 3, 4, 5, 0, and denotes the number of condensers in parallel with the variable part.

Vernier Adjustment.

For capacities up to .0001 mfd. the variable condenser is only used, while for greater capacities the required number of fixed condensers can be put in parallel with it, and the finer adjustment is made by turning the moving blades. The whole arrangement forms a compact variable condenser that can easily be fitted in a cabinet $2\frac{1}{2}$ in. deep, $3\frac{1}{2}$ in. wide and 4 in. long and the fact that the real variable part has a low capacity of .0001 mfd. makes the whole apparatus capable of fine adjustments.

The photograph shown on this page is nearly full size.



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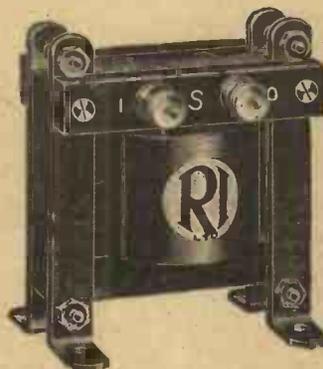


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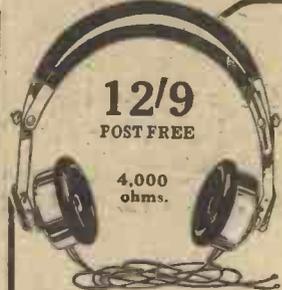
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It is proposed to describe the construction of a thoroughly reliable and inexpensive valve panel which will accommodate from one to four valves. In designing the instrument the writer has made an effort to combine compactness with simplicity and cheapness, and thus it is with every confidence that the idea is presented as a proposition likely to interest any reader of this journal who prefers to make his own experimental apparatus.

The Materials Required.

The general arrangement of the device will be easily understood by referring to the accompanying photographs. It will be seen that "Wirelesstat" vernier rheostats are employed, but any other suitable type of rheostat may be used, if desired.

As pointed out above, compactness was one of the most important considerations in the design of the instrument, and on account of this the present type of rheostat was selected as being most suitable.

The following materials and parts will be required: A 1/4-in. matted ebonite panel,

The vertical lines are then drawn by means of the T-square and set-square, and, commencing from the outside line on the left, they are spaced as indicated. At the points where these lines cut the longitudinal centre line, four circles of 2 1/2 in. diameter are drawn, and by using the 45 degree set-square the positions of the holes for the terminals are quickly found, these being marked off at the points where the lines cut the periphery of the circles.

A valve is then placed in position on the template, and with the two filament pins directly on the centre longitudinal line, an impression is taken, the holes

arrangement the base of the cabinet was removed and replaced, after making the necessary connections.

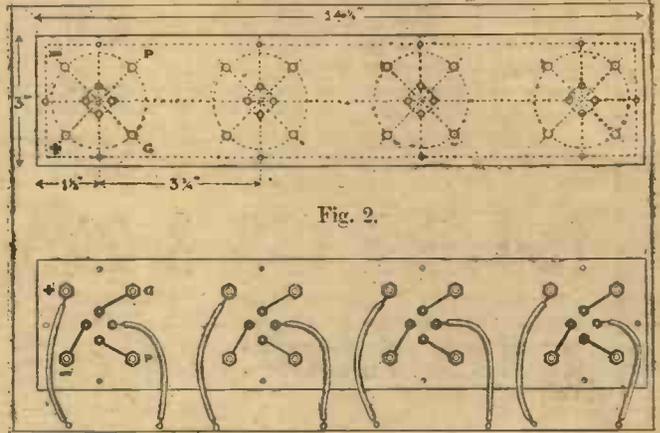


Fig. 2.

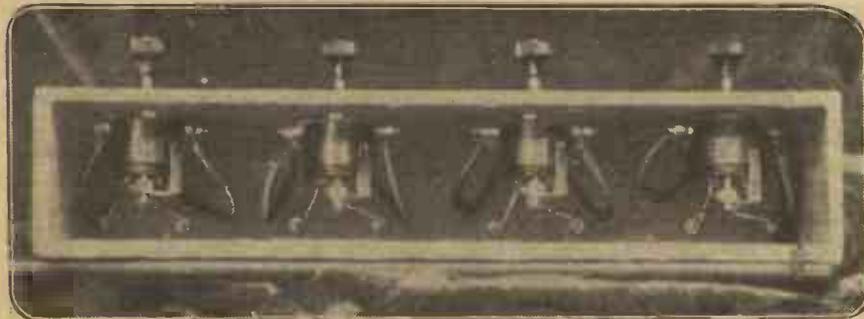
The wires which connect the grid, plate, and L.T. negative sockets to their respective terminals are not insulated, these being kept flat against the under-side of the panel.

Trying Out Circuits.

It will be seen that one to four valves may be used as desired by simply linking up the filament terminals of one valve to the corresponding filament terminals of the next valve, and thus the serious experimenter is able to connect up a new circuit with the greatest ease and confidence.

Other components such as coils, condensers, transformers, etc. taking their usual places with external connections.

This piece of apparatus will always prove very useful as it is a permanent method of mounting valves with their required rheostats so that they can be connected up in any circuit when required, without the trouble of having to arrange valve holders and filament resistances, and the consequent loss of time.



Showing the internal arrangement of components in the experimental panel.

14 1/2 in. by 3 in., a wooden cabinet 14 1/2 in. by 3 in. by 4 1/2 in. deep, four good rheostats, four valve holders, sixteen terminals, and the necessary connecting wire.

The method of marking off the panel is shown in Fig. 2. It is best to first make an accurate paper template, temporarily attach this to the ebonite by means of some thick paste, and mark off all holes with a sharp-pointed bradawl.

To make the template proceed as follows: Attach the paper firmly to the drawing-board, and, using the T-square, draw the five horizontal lines in the longitudinal direction, commencing with the centre line, which is exactly 1 1/2 in. from the outside lines.

Marking Out Positions.

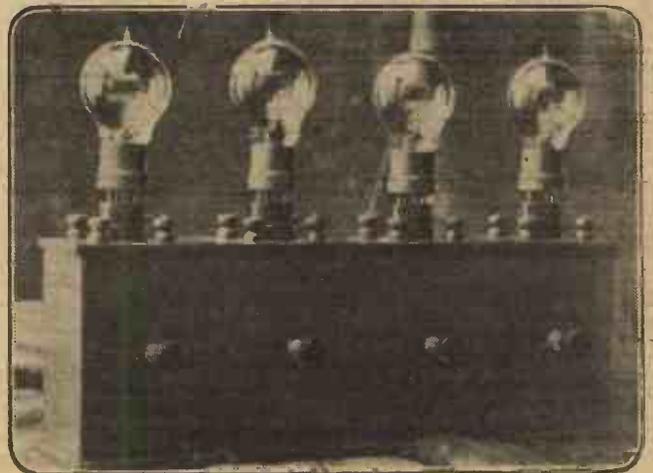
The exact position for the lines for the screw holes will be determined by the thickness of the wood used in making the cabinet, and the best way to ascertain this is to find half the thickness of the walls of the cabinet, by means of the instruments indicated in Fig. 3, and then carefully run the instruments round the edges of the panel or template.

then being marked off with the bradawl.

Assuming Fig. 2 to also represent a view of the top of the panel (with plate sockets nearest the top line), the holes for the terminals are marked "positive," "negative," "plate," and "grid," as shown on the left.

Fig. 1 shows a view of the back of the panel where the wiring is clearly indicated. The rheostats, which are fitted to the front of the cabinet as shown in the photographs, are connected in series with the positive L.T. line, the long insulated leads shown being connected up to their respective rheostats after mounting the panel to the top of the cabinet.

It is most convenient to provide hinges on the back of the cabinet, but in the present



A view of the completed panel with valves in position.

ABOUT THAT AERIAL.

Some interesting and useful facts concerning the erection of aerials that should receive the attention of every amateur.

IN spite of the frequent appearance in most wireless journals of articles concerning aerials, a short train journey through the suburbs reveals such a vast number of badly designed and roughly constructed aerials that one is forced to wonder that many of them function at all. Yet in almost every case these could be replaced, at a very small expense, by something far more efficient and more pleasing to look upon. For the wireless public will judge you by your aerial, and your time will certainly not be wasted in putting up something more worthy of the name.

Dimensions and Directions.

Erect your aerial as high above all surroundings as you can. A short, high aerial will give better results than a long, low one under the same conditions. If you are erecting it on a roof, have it as high above the roof as possible—not a few feet above the slates.

If the wires must slope, try and arrange to take your lead-in from the end farthest from the ground. Do not run the wires parallel to any near-by telephone or telegraph wires, or to your neighbour's aerial. Subject to these conditions, arrange it to point as nearly as possible in the direction of the station it is most desired to receive. Results will usually be improved by taking the lead-in from the end nearest the station to be received.

The writer would not recommend the twin aerial for other than experimental purposes, provided a fairly long single wire is practicable, since the extra expense and trouble involved, and the heavier fittings required, are not justified by the almost negligible increase in signal strength obtained. The inverted L type of aerial is almost always used by the amateur, being simple to erect and quite satisfactory for ordinary requirements.

The Wire to Use.

Copper wire is nearly always used nowadays, its chief advantage being good conductivity, and its chief disadvantage a low tensile strength. In view of the latter property the reader may prefer to use hard-drawn copper or phosphor-bronze wire, obtainable at a slightly increased cost. Stranded wire is very suitable, since it possesses a greater surface than the single wire; 7/22 or thereabouts gives very good results.

Enamelled wire is usually stated to be better than bare wire, since the latter is liable to corrosion. It is doubtful whether this corrosion is sufficient to affect results, though the tensile strength of the wire may be decreased. For seaside aerials enamelled or rubber-covered wire would perhaps be preferable.

Large insulators are quite out of place on a receiving aerial. Not only are they unnecessary, but they increase the weight on the supports. For a single wire two, or at the most three, small insulators of the egg, reel or shell type are quite sufficient. If two

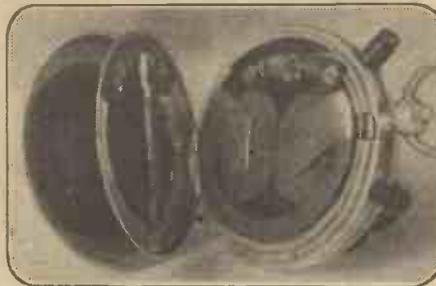
wires are used, one insulator at each end of each wire, and two between the spreader and the support, are all that are necessary.

The Lead-in Wire.

The lead-in is the weak point in many aerials. The best arrangement is to have it in one piece with the aerial, thus doing away with soldered, or, worse still, unsoldered joints, and all the attendant evils. You are allowed to use any aerial the combined length and height above lead-in point of which does not exceed 100 ft.

All that is necessary is to attach one end of your 100 ft. to an insulator, measure from this point the length of your aerial, attach another insulator, and use part or all of the remaining length for your lead-in. The insulator at the lead-in end is best attached by binding the wire to it with tarred string, or something similar.

Although this "no-joint" system is by far the best, if you still intend to indulge in a soldered joint, don't attach your lead-in wire some 5 ft. from the end of your aerial. If you do so you will change it from an



This extremely ingenious receiver enclosed in a watch is the invention of Mr. A. Page, B.Sc., 33, Old Craigie Road, Maryfield, Dundee. The complete set is included, together with earpiece and tuning coil.

TECHNICAL ODDS AND ENDS.

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

Transmission on Two Waves.

A NEW system suitable for telephony or C.W. is described by H. J. Tyzzer in a recent number of "Q.S.T.": it depends upon the use of a doubly-modulated wave. Suppose the primary wave is 300 metres. A continuous modulation is produced on the top of this at another frequency, much lower than the original frequency (say 5,000 metres wave-length). The second is still above audible frequencies, and so is soundless.

Elimination of Jamming.

It is even possible, according to the inventor, for two stations to transmit on the same primary wave (300 metres) without interference, provided they use different superposed modulation-frequencies: say, one at 5,000 metres and the other at 6,000 metres. Information on this subject can be obtained

inverted L-40 a very bad T aerial with the lead-in very far from central. The result will be two natural wave-lengths, and consequently poor results. Yet one very frequently sees aerials arranged in this manner.

Another point which for no apparent reason nearly everybody overlooks is the advantage of keeping the two lead-in wires from a twin aerial separate until they reach the instrument room. Text books frequently advise joining the two wires and having a single lead-in. By the use of two separate lead-in wires, joining at the instrument table, the twin aerial can be used for receiving on the longer wave-lengths, and one wire disconnected for short wave reception. And, still more important, yet another point has been avoided. Finally, keep your lead-in away from any cast-iron pipes or gutters, otherwise energy will be lost in inducing eddy currents in the metal.

Putting Up Masts.

An item of considerable importance in aerial design is, the almost inevitable mast. Do not use flimsy material. A bamboo mast consisting of three or four pieces bound together seldom makes a satisfactory job, and is usually not worth the trouble. A metal mast is probably the best type if properly erected, but these cost money. Old scaffold poles are cheap, and a good sound specimen, if trimmed up and given a few coats of paint, is quite suitable.

The writer obtained an old railway sleeper, sunk one end of this to a depth of 5 ft. into the ground, and bolted a 30 ft. scaffold pole to the protruding end. Railway sleepers are thoroughly impregnated with creosote, and can be relied upon not to rot for a considerable period.

The rope used should be thick enough to withstand a much greater strain than that imposed upon it by the weight of the aerial. It should be free from knots, and long enough to allow of the aerial being lowered to the ground without getting out of reach. Stranded iron wire should be used for stays, galvanised to prevent rusting. For the V's of a twin aerial iron wire is suitable, or provided the aerial is not too heavy, insulated cable of ample section answers the purpose quite well.

by those interested from H. J. Tyzzer, American Radio and Research Corporation, Medford Hillside, Mass., U.S.A.

Detector Valve without Filament.

The quest of the filamentless valve is almost as old as the valve itself. Various principles have been employed or suggested, such as the use of a radio-active substance in place of the heated filament, a high-tension discharge, or even the use of a suitable liquid. A new valve for detecting purposes, which does not employ a filament, has been produced in the laboratories of the Western Electric Co., of America, the invention of a Mr. C. G. Smith, after whom it is known as the S tube. It has two electrodes of carbon, one in the form of a hollow cube or cup, the other a small plate.

(Continued on page 35.)

WIRELESS VALVES



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AN ARTISTIC TWO-VALVE "SUPER."

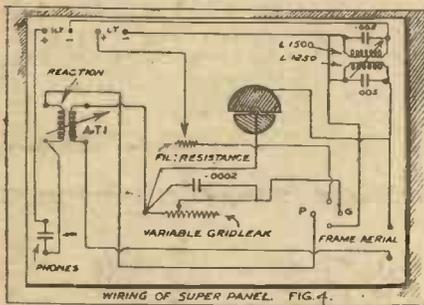
BUILT AND DESCRIBED BY A MEMBER OF THE "P.W." TECHNICAL STAFF.

In this, the third article of the series, the construction of the "super" panel is completed.

THE "super" panel is now ready for wiring, and although it is eminently desirable that every connection should be soldered, it is as well not to carry this out until the panel has been tested, as the wiring, although by no means intricate, is slightly, to say the least of it, "tricky." However, the filament connections can be soldered and for this purpose it is advisable to employ leads of stout tinned copper wire—14 gauge would not be too thick. One does not require to be very careful in respect of the positions of the various leads as long as there is no danger of shorting and the connections are carried to their correct points.

No Screwing Necessary.

The wiring diagram, Fig. 4, shows very clearly how the various points are connected. Twenty gauge tinned copper wire can be



used for the bulk of the wiring. The positions of the various coils are shown in dotted lines, for it is essential that the connections to these points should be correct.

The fixed condensers can be mounted in the manner shown in the photographs, that is, using the actual connecting leads to hold them in position or they can be mounted upon the panel with countersunk screws and nuts. The method shown, however, answers the purpose very well.

For experimental purposes three hard wooden legs, of sufficient length to allow ample clearance of components, were screwed to the panel, as was shown in a photograph. Thus the panel can be tested with complete accessibility to the wiring. More important still, from the author's point of view, it allows a carved box to be used without necessitating screwing. The panel merely drops in and stands securely in position without any form of fastening whatsoever.

Size of Frame Required.

The "super" panel is now complete, and the amateur can please himself whether he encloses it in a sloping desk type case or a box similar to the one shown in the photographs. It can also be tested, and upon the results of this will probably depend the amateur's decision in respect of casing and the construction of the low-frequency panel. If a loud speaker is to be used at some fair distance from the broadcasting station, say 15 to 30 miles, then the second unit will be advisable, although perhaps not essential.

If 'phones only are to be used, then any amplification would be disastrous—to the 'phones.

The best results have been obtained with this "super" by the writer using a Marconi "R" or a "Thorpe K1" valve, with 120 volts on the plate and a six-volt accumulator. A Microstat filament resistance is employed, as is shown in the photographs, and besides being very suitable on account of its compactness, with it, it has been possible to employ a very comprehensive range of valves for comparative purposes, including dull emitters with the one six-volt accumulator. It has been found that while dull emitters will function in the circuit they seem to lack the "punch" of the bright emitters.

The amateur must be warned that even although he may have had experience of "supers" before, he will find the one under consideration a very tough proposition in respect of tuning-in until he becomes acquainted with the peculiarities of the circuit. Results must not be expected immediately the panel is connected up. Also, it will not operate on an outdoor aerial. A two-foot frame aerial with some 8 turns of 24 in. or a 14 in. frame aerial with 12 turns—the full construction of this will be detailed later—will prove most satisfactory. The value of both the coil marked in Fig. 4 as A.T.I. and the reaction, will depend to a great extent upon the size of frame employed, and in any case are well worth experimenting with.

Tuning-in.

In order that amateurs who decide to build but the one unit may be able to proceed to place the receiver into commission, a few words concerning tuning-in will not be out of place. With a frame aerial of 12 turns of 24 gauge wire with 14 in. sides, a reaction of 75 turns either honeycomb or basket and an A.T.I. of 125 turns will be necessary for optimum results, although as a matter of fact these values are by no means critical. At least 120 volts high-tension will be required, and a "hard" valve.

The frame aerial should be pointed edge-on towards the transmitting station, this position being varied slightly subsequently to the other adjustments until loudest signals are obtained. The coil couplings should be opened at about 120 degrees in each case, and the filament resistance turned until by closing the reaction adjustment slightly, the set is observed to oscillate. Ignoring any slight "howling" the variable condenser should be adjusted until the stations

"carrier" is loudly audible. After this very delicate adjustments of the variable grid leak, the variable condenser, and in fact every adjustable unit on the panel must be made until signals are pure and strong. The whistle inherent with the majority of "supers" can almost entirely be cut out by means of the extra adjustment provided in the coupling of the oscillator coils.

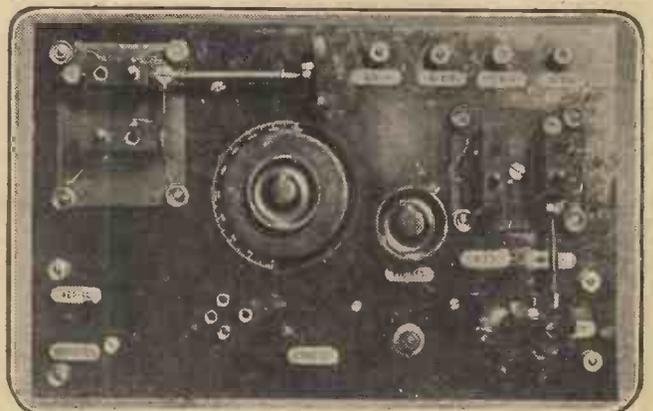
Patience Required.

The effect of hand capacity must be taken into account while the adjustments are being made. The only definite adjustment is that of the primary setting of the variable condenser to find the carrier wave; after this has been accomplished one can almost say that the set is a Yale lock, and the key to let in signals is only obtained by one particular combination of every available adjustment.

One must be prepared for an hour or two's practice in the tuning-in of a new "super," but once a rough idea of the various "settings" is obtained, tuning-in will become easier until eventually it will be possible to accomplish it inside a minute.

Amateurs should not forget to remember that the tuning of "supers" is such a critical business that if the position of the receiver in a room is altered, or if it is transported to another room altogether, or if several persons get close to it, slight readjustments will be essential. Hundreds of amateurs in fact attempt the construction of a "super" and succeed in that respect perfectly, but fail when it comes to the "tuning," and eventually discard or dismantel the instrument as faulty.

Of course, there are always a few modifications that may be necessary in individual



The "super" panel completed showing the disposition of the coil holders.

cases in order to make the receiver function. For instance, if success is not attained after a fair amount of "wangling," the oscillator coils should be changed over. Then a reversal of the leads to the reaction coil might be necessary, or even a reversal of the frame aerial leads.

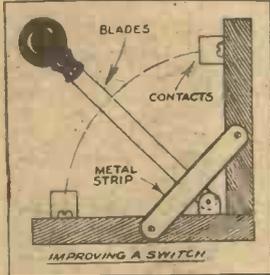
(To be continued)

CONSTRUCTIONAL NOTES.

CONDUCTED BY J. H. T. ROBERTS, D.Sc., F.Inst.P.

Improving a Switch.

PROBABLY you have noticed that it is sometimes very awkward to manipulate a single- or double-pole double-throw switch. This depends upon how it is placed in the set or lay-out and whether it is easily reached. One amateur who had difficulty in this direction altered his double-pole double-throw in the manner shown in the accompanying sketch.



He cut the base-board through and erected one half so that it was vertical. This part was secured in

position by means of two brass strips. The switch blades then required to be moved only half the distance, and the difficulty was overcome. Of course, the switch must be weighted or else secured to the table, otherwise, when putting the arm over to the vertical position, the switch will shift on the table.

Mounting Valves.

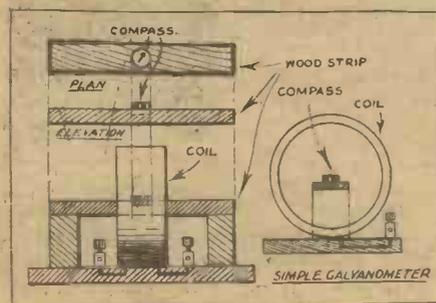
Mechanical vibrations communicated through the table are very difficult to avoid, and in some cases they cause pronounced microphonic noises in the set, owing to the vibrations of the valve-electrodes, and the consequent change of position with relation to one another.

A simple way to avoid this trouble, however, is to mount the valve sockets upon a small base, and then to mount this base again upon two or three heavy rubber bands stretched across suitable wooden frames or supports. This is, in effect, an elastic "sling," and very little of the vibration will be communicated to the valves.

The weight of the rubber bands, and the tension to be applied to them, will need to be found by trial. The length of the free part of rubber band at each end of the valve-base is also important: if this is too short, the cushioning may not be sufficient.

Simple Galvanometer.

We recently gave some notes of how a simple galvanometer could be made by means of a compass-needle and a coil of wire. A drawing is given herewith which

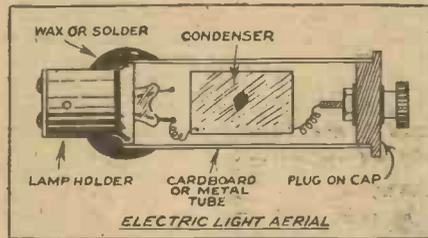


shows how the instrument may be constructed. The coil is mounted in a vertical plane and the compass-needle is fitted into a strip of wood as shown. Two supports are then provided, one on each side of the coil, upon which the wood strip rests. The height of these supports should be such that when the parts are assembled the compass-needle comes about at the centre of the coil.

The coil may consist of a hundred or so turns of, say, No. 30 S.W.G.; but neither the number of turns nor the size of the wire is particularly important. A larger number of turns will give greater sensitivity of the instrument, and will, of course, mean that a smaller size of wire will have to be used. This instrument may be calibrated by placing in series with a standard instrument and marking off the indications of current strength to correspond to those given on the standard instrument. It may also be used for a variety of other purposes, such as testing 'phones, testing polarity, and so on.

Simple Polarity Indicator.

Every wireless experimenter requires at some time or other a polarity indicator.

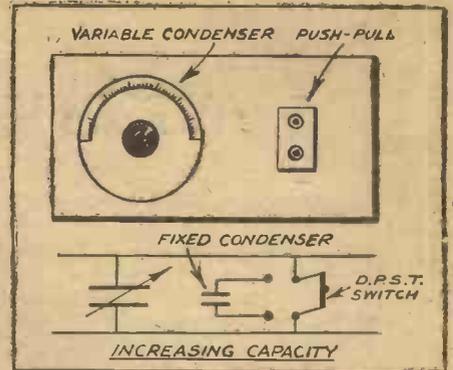


There are various kinds which can be made or bought. Polarity indicating paper, for example, is very convenient for some purposes. A simple indicator, which is easily made, was mentioned in some technical notes recently, and is here repeated with diagram for the benefit of those who wish to make it up.

A glass tube of fairly stout wall and, say, an inch in diameter, is procured and is fitted with good corks or rubber stoppers. Through the latter suitable terminal-screws are bolted. A solution of phenol-phthalcin is contained in the tube (a fair-sized air-bubble being left, to allow of shaking the contents). When the potential-difference is applied at the terminals, the negative will show a red coloration. Afterwards, on shaking the bottle, the coloration will disappear, and the device is ready for use again. The phenol-phthalcin can be obtained from the chemist.

Electric Light Aerial.

This is an interesting and simply-made electric-light adaptor for using the mains as an aerial. The base of a broken electric bulb may be used as a plug for the electric-light socket. A short length of cardboard or metal tubing is then obtained, of such a diameter as to fit on to the lamp base. If it is of cardboard, it can be secured with sealing-wax; and if metal, with solder. It



should preferably be of cardboard, however. The condenser is placed inside the tube, and one terminal connected to one terminal of the lamp base. A metal plug or cap is fitted to the other end of the tube, and the other end of the condenser is connected to this; the terminal on the cap is then connected to the aerial terminal of the set. The device is very simple and cheaply made.

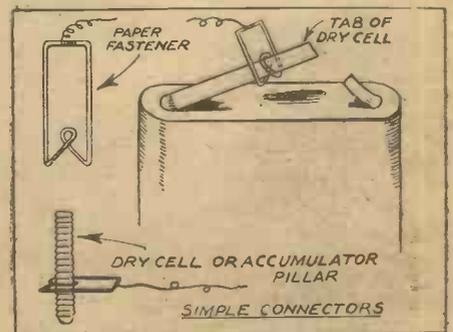
Increasing Variable Condenser Capacity.

It is frequently required to increase the total capacity of a variable condenser and this may, of course, be done by connecting a fixed condenser in parallel with it. In order to permit of the ready introduction of the second condenser the arrangement shown in the accompanying illustration may be employed.

A double-pole single-throw switch is used for connecting the fixed condenser in circuit, and this switch may conveniently be operated by means of a push-pull lever through the front panel. If the maximum capacity of the variable condenser is, say, 0.0005 mfd. and the capacity of the fixed condenser is the same, the maximum capacity of the two in parallel will be 0.001 mfd., and the minimum capacity will be the minimum capacity of the variable. Thus, instead of being variable up to 0.0005, the capacity is now variable up to 0.001, the second condenser being switched in when it is desired to go beyond 0.0005.

Simple Connectors.

The ordinary paper-fasteners form convenient connectors for many purposes in the experimental lay-out, but if you can get hold of a supply of the kind illustrated in the accompanying figure, you will find them much more generally useful. Some of their



many uses are illustrated (a wire being, of course, soldered to one end). They may, for example, be used to connect to the tab

(Continued on page 28.)

Artistes of the Aether

BY 'ARIEL'

Some of the artistes who have given you pleasure while listening-in

TO live in a groove is to lose the best of life, but with the miracle of wireless, there is very little chance of any one becoming a recluse, for if he or she will not go into the outer world, then the world is brought home to them, if only by the loud speaker next door.



Mr. Victor Smythe.

But one thing to be remembered is, that the "delivery" of the world to your hearthstone is the result of the experience of others, and the British Broadcasting Company has, for the most part, been lucky in getting men who have not lived in a groove, and are possessed therefore of both knowledge and experience, which are not always synonymous.

2 Z Y's Versatile Announcer.

The provinces have been especially fortunate in their choice of directors, and Manchester, almost from the opening of its station, has stood forth prominently for its music, its opera, and its general programmes. One of the chief officials here is Mr. Victor Smythe, and if, as they told us at school, "experientia docet," then Mr. Smythe has little more to learn, for apparently he has crammed into his life experience of the mercantile, army, theatrical, commercial, and film professions, while he has been interested in broadcasting since early last year when, in addition to being assistant director, publicity director, and announcer, he created that laughter evoking character, "Algy," who has travelled round the stations, and is usually one of the star turns of the week.

Bournemouth recently came to London for a Sunday afternoon's symphony concert. An augmented orchestra, under Captain Featherstone, carried out an excellent programme, in which contrast was the leading note. The "Ruy Blas" Overture of Mendelssohn, vied with the Grieg Suite, "Sigurd Jorsalfar," the only point of fault

in the latter work being the exceptionally slow tempi, especially in the last movement. Contrast, too, was the outstanding feature between the movements from Beethoven's Trio and the Tchaikowsky Symphony No. 5.



Mr. Samuel Clifford.

Miss Gertrude Newsome chose somewhat hackneyed songs, amongst them being "Down in the Forest," by Landon Ronald (so few singers apparently realise the vast number of other songs by this prolific composer), and "Songs my Mother Taught me" of Dvorák. These, however, were well within her range.

2 L O's Musical "Uncle."

Like most of the provincial stations, Bournemouth has recruited its orchestra from members of a big orchestra, and for the most part, Sir Dan Godfrey's Municipal Orchestra has been its source. Amongst them is the well-known solo 'cellist, Mr. Samuel Clifford. He is a player of fine repute and achievements. After studying in the conservatoires of Amsterdam and Leipzig, he became soloist under the great Nikišch. During the war, he joined up, acting for three years as interpreter and intelligence officer. Then he returned to the Winter Gardens.

At the Bournemouth station he played last week in Grieg's 'cello Sonata, his accompanist being Miss Ethel Rowland, while on Friday he was heard in Boëllmann's



Mr. Ernest Thesiger.

"Variations." Mr. Clifford radios well, because his tone is free from hoarseness, and his gift for expression makes his renderings impressive. He admits a liking for playing before the microphone, and invariably gives a masterly interpretation. It was good last week to hear Mr. Rex Palmer in something more exhilarating than "Stand by for two minutes, please," or wishing many happy returns of the day to Orland Smith, of Peckham. When, also, he joined forces with that clever young pianist, Mr. Maurice Cole, 2 L O was assured of a real treat. Mr. Palmer has a voice of fine tonal range, a marked gift for expression, and a capacity to obtain his effects without effort or strain.

A Broadcast Opera.

While not quite epoch-making, one of the best attempts at wireless drama was "A Mock Trial by Jury," played with its sub-titles, "What we're Coming to," "A Future 'Cause Célèbre," and "Swale v. Prendergast." Purporting to be "tried" April 1st, 1954, all we can say is that if fifty years are likely to make so much difference in matters communal, some of us won't mind much if we are missing.

The parts were admirably taken, chief honours perhaps, falling to Norman V. Norman, P. P. Eckersley, our very own

engineer-in-chief, and Mr. Ernest Thesiger, the well-known actor. Considering his past experience, perhaps this is not surprising, for few can show greater versatility. Making his debut with Sir George Alexander, Mr. Thesiger has played under most of the big actor-managers, including Sir Charles Hawtreay and Sir Beerbohm Tree.

Probably of all the four sections of Wagner's "Ring" cycle, the "Valkyries," the second opera, is the favourite with most opera lovers. To begin with, there is the great love scene of the first act, with its Spring song, and the capture of the Wanderer's sword, "Nothing." Lastly comes the judgment of Brunnhilde, the disobeying daughter of the gods, doomed to lose immortality and await in sleep the coming of the hero Siegfried. Broadcast on Friday last, this opera roused the Covent Garden audience to a pitch of tumultuous excitement as is rarely witnessed. The interpretation was exceptional, and it radioed better than many of the other operas this season.

Noted Australian Artistes.

With such a cast, it is not difficult to realise also the reason for its success. All the artistes are stars of the operatic world, and most of them have also sung before the microphone this year. Walter Hyde was Siegmund, Robert Parker, Wotan, and Norman Allin, Hunding, while on the feminine side were Miss Florence Austral as Brunnhilde, and Agnes Nicholls, C.B.E., as Sieglinde.

Miss Austral is, as her name denotes, an Australian singer, possessed of a voice of rare beauty and exceptional power.

In opera she has made the part of Brunnhilde particularly her own, and her rendering is always one of the most poignant in the work. She has sung in nearly every other operatic rôle, and on the concert platform she is one of the most appreciated singers in London.

Strangely enough Miss Agnes Nicholls was the first English vocalist to play Brunnhilde throughout the whole "Ring" cycle when first produced. Few singers also have had more all-round experience.



Miss Florence Austral.



Miss Agnes Nicholls, C.B.E.

SOME RADIO REFLECTIONS.

By C. G. GIBBONS.

Some interesting notes on various wireless matters that only go to emphasise the tremendous strides made in that science during the last few years.

THAT'S the worst of wireless—you simply must see a new gadget through. It was 1 a.m., and the clock seemed to chime the hour with undue emphasis; the fire had flickered out, despairing of further attention; the draught which I had successfully diverted with the aid of several mats found new zest through a fresh aperture.

I pulled a switch—it was the great moment. Would this new "reflex" circuit do all that was claimed for it? Ah! a voice, audible but distorted! "Ding, dong!" Bother the clock! "Got him!"

"U.S.A." Calling.

A tense feeling gripped me, exhilaration beat the thermometer and set me a-tingling—the "voice" was speaking phrases rich in Americanisms, dominant with the real nasal twang. And then: "Well, old man, that concludes our test for the present. Hope you like my 'Yankee Doodle' stuff; I was quoting from an American magazine—good test of modulation. 2—over!"

That's the worst of wireless, it's so prolific of the unexpected. Time was when the reception of transatlantic broadcasting meant the elevation of the successful operator to a dizzy pinnacle of fame; the columns of the daily Press were adorned with eulogies of his performance; his photograph, taken amidst the scenes of his triumph, showed him in battle array, grim of visage, and not in the least perturbed by the sudden notoriety.

The local radio society, anxious to render due homage to one so worthy, fêted him, dined him, praised him, and promptly spoiled their "hero's" digestion by putting upon him the onus of an "after dinner" detailed technical résumé of the great event. Such is fame!

Experts Dumbfounded.

America! Nothing short of four valves could achieve it! Thus spake the experts. To feel tolerably confident, the use of five valves was advocated, and to warrant a preliminary optimism the employment of as many more as it was possible to beg or borrow.

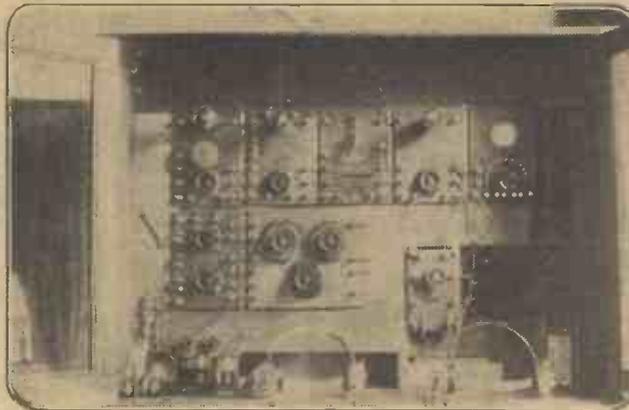
Theory being one thing and practice another, the fabric of the universe was not materially shaken when Mr. Phil Ament, an impartial and assiduous manipulator of a one-valve reaction receiver, sent a postcard to the Press announcing his reception of five American broadcasting stations. Did our leading radio engineers suspect a "secret process."

That is not known, but the temerity of this achievement had lessened the prerogative of the multi-valve expert. The wise ones shook their heads—and put down a barrage of explanation involving the

"heavy-side layer," and other considerations which have a determining influence on the R 5 or R 6 strength of signals.

A Common Occurrence.

But the one-valve and two-valve enthusiast, seeking the new Mecca, was not discouraged. Staunch hearts! From many sources, where "heavyside layer" was probably associated with a road macadam, came glowing reports of the reception of U.S.A. broadcasting. I chanced upon one of these twentieth century "Columbuses" whilst making a train journey to the North. Conversation was prompted by our mutual interest in copies of "P.W." "Seen the new list of people who've heard America?"



A neat unit receiver made by Mr. K. F. Simmonds, 69, Exeter Road, Cricklewood, N.W. 2.

I ventured. "Yes, everybody's doing it." "Have you managed it?" I asked. "Heard two stations a week ago"—this with a chuckle. "Thought it was an English amateur till I heard the 'call-sign.' Didn't expect to get anything when I commenced to tinker about—had an inclination to try my luck, that's all." "Big set?" I queried. "No, just a two-valve receiver, quite an ordinary affair."

Newspaper placards, with their blatant messages, have a certain incisiveness which unfailingly catches the eye. "America on a crystal set." This, viewed from a 'bus-top, was sufficient to disturb my ruminations on the current political situation. "Well," thought I, "these things will happen, even in the most orthodox of radio circles. We've heard of the man in Jersey who 'picked up' Aberdeen on 'zincite-bornite,' and the gentleman who uses his bicycle as a frame aerial. You can't stay evolution."

Seventeen Valves.

I bought a paper, speculating as to which piece of household furniture would be an added inducement for someone to purchase my three-valve outfit. There it was again, "America on a crystal set" in glaring headline. What was this? "B.B.C.

attempt to relay American broadcasting. An opportunity for owners of crystal sets." My further study of the details regarding the "17-valve, North Downs, 3.30 a.m. relay test" was terminated abruptly.

Something descended on my shoulder—it felt like a hand—with convincing force. Turning in self-defence, having retrieved my hat from an undignified position on the bridge of my nose, I was greeted with a cheery face adorned with an expansive smile. Two voices, simultaneous in surprised greeting, a hand-clasp of a long-lost brother variety, and an old friendship, made in a "wireless" atmosphere, was again resumed. We commenced a mutual catechism, accounting for an interim of five years.

Five Years Back.

"Did I remember the old 'dug-out' and its facetious notice-board at the top of the stairway?" Did I not! Never likely to forget our old "Marconi House." How we used to literally boil in the humid air, and how, when "traffic" was slack, we indulged in "unofficial" naps, relying on the first buzz of Morse in the 'phones to waken us! "D'you know what became of that chap at Corps H.Q. whose pet slogan was 'Send slowly'?" "D'you ever think of that night when we were bringing up accumulators, and got mixed up with a ration party?" Think of it? Well, some things do leave an impression. At the junction of

some communication-trenches the two parties had met, the one with re-charged accumulators, the other with the requirements of the "inner man." The rain was torrential, duckboard as slippery as a greasy pole, and nerves and tempers a trifle taut. Each party, having to take the same path (spare the name!) on the last lap, claimed preference to "go ahead."

And then in front and to the right of us came a deafening roar and a blinding flash. A shell—and a heavy one, eliminating beyond question the "right of way."

The Philosopher.

Irrepressible, even at a moment when mud, men, rations, and accumulators were one confused heap, there came, from 'neath the debris, a faint voice, philosophic in adversity. "Well, it's settled the argument, anyway." "So we're both still interested in wireless, eh?" It was two minutes before my train left, and two hours "yarning" in a quiet corner of the buffet had left much still unsaid. "Yes; and now that you're in London I'll look you up." "Do," said my friend. "And, by the way, did I mention that I've just got my transmitter licensed?" "Transmitting, are you!" said I, half-way through the barrier. "Then expect me to-morrow night."

THE CONSTRUCTION OF A TWO-VALVE RECEIVER.

By J. LAURENCE PRITCHARD.

(Technical Editor of Harmsworth's "Wireless Encyclopedia.")

This is the second and concluding article describing the construction of an efficient two-valve set with which it is possible to receive all the B.B.C. stations.

HAVING made the reaction coil arm, the next step is to mount it on the panel by drilling a hole near the top left-hand corner, as shown in Fig. 8, placing the screwed part through the hole and securing

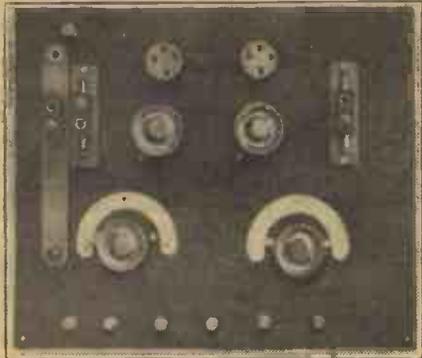


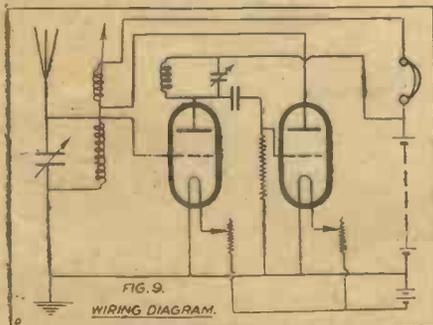
Fig. 8. Showing the layout of the panel.

it with the lock nut, which should be screwed up tight to the underside of the panel. A plain washer is placed over the projecting part of the screw on the upper side of the panel, the arm put in place, and then the spring washer followed by the remaining nut. The arm should then be capable of easy movement, but without detrimental shake.

Fixing the Coil Holders.

Place the arm parallel to the side of the panel in the position shown in Fig. 8, and secure the aerial coil holder to the top of the panel with a couple of brass screws. Arrange the position on the holder so that it comes exactly opposite the holder on the moving arm, as shown in Fig. 8, taking care to place the socket of one holder opposite the pin of the other holder. Secure the remaining holder to the other end of the panel, test the movement of all the knobs and see that there are no loose parts anywhere.

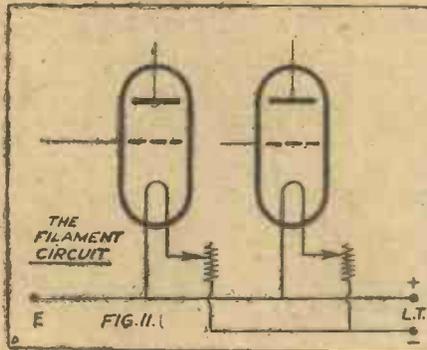
The two condensers should be so placed that the moving plates are in the same relative position on each, and the pointers set to correspond. Fix the dials or scales to the panel, and do the same for the filament rheostats, and the set is ready for wiring.



The theoretical wiring diagram is given in Fig. 9, and those familiar with such diagrams will be able to wire the set from it without any difficulty. But the amateur wiring a valve set for the first time will do well to take the work step by step, and wire the components in a methodical manner.

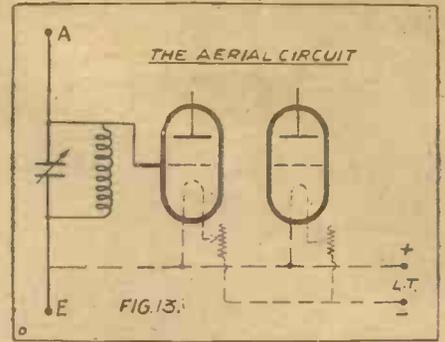
The L. T. Circuit.

The filament circuit may be commenced, and this is shown in place in Fig. 10, wired on the actual set, while Fig. 11 shows the portion of the theoretical circuit corresponding to it. All the connections may be effected by forming a loop or eye on the end of the wire after baring the insulation, and slipping it under one of the lock nuts on the part where it is to be attached. The important point is to tighten the nut well home



on to the wire to ensure a good contact. Alternatively, the connections may be made by soldering.

The illustration, Fig. 10, shows the exact whereabouts of all the wires in the filament circuit. This part of the circuit can now be connected to the low tension battery, the valves placed in the holders, and the current switched on, when the filaments should light up correctly. Any defects in this part of the circuit can therefore be detected at the commencement, and remedied if necessary. The wiring can be carried out throughout with good quality indiarubber-covered bell wire, as this obviates any chance of a short circuit in any part of the battery circuits.



The next step is to complete the aerial circuit, and this is shown by the white wires in Fig. 12, which illustrates the whereabouts of all the wires on the set, the filament circuit wires being shown by dotted lines. The same method is followed in Fig. 13, showing the corresponding portion of the theoretical circuit. In this case the

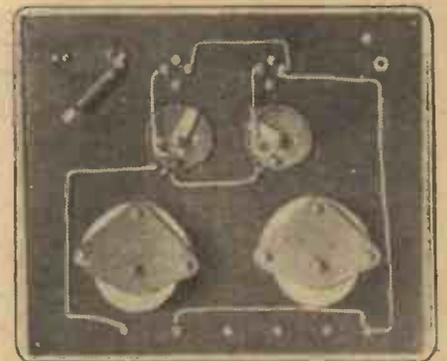


Fig. 10. The L. T. connections of the set.

aerial wire is taken through the panel by drilling small holes by the side of the holder and passing the wires through from beneath and connecting them to the terminals on the holder.

Testing the Connections.

When this part of the circuit is wired, the connections may be tested with a single dry battery, and the telephones or a test lamp, to make sure they are correct. It is best to test each portion of the circuits separately,

(Continued on page 20.)

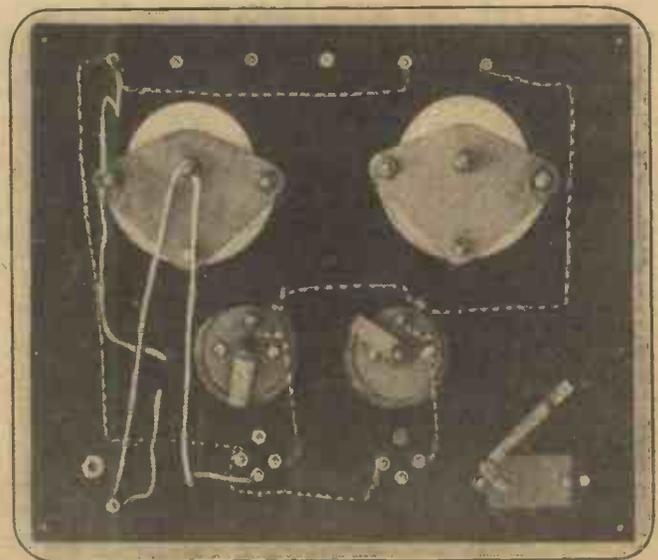
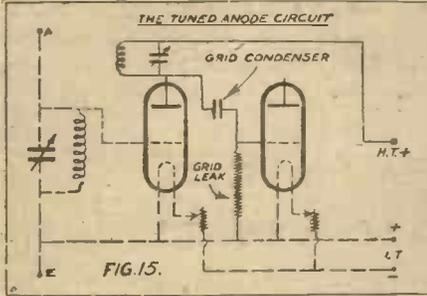


Fig. 12. The aerial circuit. The white wires show the aerial circuit on the actual panel. The dotted wires are the filament wires.

THE CONSTRUCTION OF A TWO-VALVE RECEIVER.

(Continued from page 19.)

as then any faults are speedily discovered, and when the work is ultimately completed, there is every chance that an immediate



response will result when the set is tuned to a broadcast station.

The tuned anode circuit is the next to wire up, and this is shown in Fig. 14, where the wires forming this part of the circuit are shown in white and the other wires dotted. The portion of the theoretical circuit is shown in Fig. 15 in solid lines, and the other parts of the circuit in dotted lines. This only leaves the reaction circuit to wire up.

Final Details.

The feature of this part of the work is the passing of the wires through the hole in the pivot, as shown in Fig. 16, by first connecting two wires to the holder and drawing them through the hole as there shown. A small piece of empire cloth, or other insulating material, should be wound round the wires and worked into the hole to prevent chafing the wires when the arm is moved. The wires should be left a trifle slack on the underside of the panel to permit a little movement. The remaining connections are then made as shown by the white wires in

Fig. 17, corresponding to the black lines on the portion of the theoretical circuit in Fig. 18.

After testing all the circuits, the panel may be screwed to the top of the case, which should previously have been stained and polished. The result will appear as shown in Fig. 19, except for the necessary coils, valves, and batteries.

These can be any reputable make. The coils used in this set are ordinary Burndept concert coils, the best values for which will have to be found by experiment. As a start, try No. 2½ in the aerial coil holder, a No. 4 in the tuned anode coil holder, and a No. 2 in the reaction coil holder on the moving arm. The set works well on M.O. or Ora valves



Fig. 16. Connecting up the reaction coil. with 4 volts low-tension current.

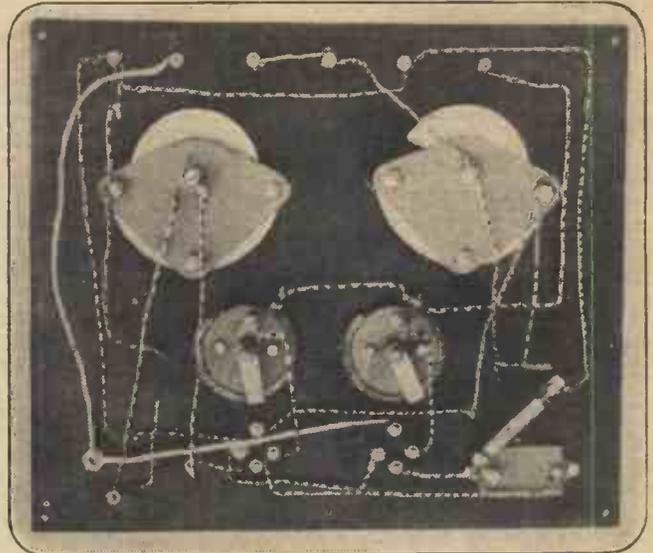


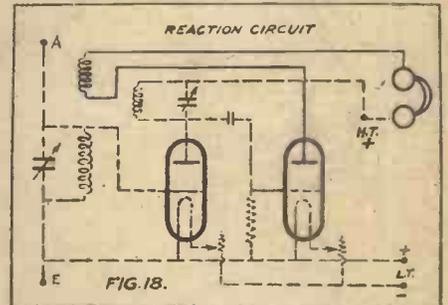
Fig. 17. Reaction circuit. The final connections are shown in white. The connections already made by dotted line.

bright emitter valves are used, and rotate the two condenser knobs slowly and simultaneously until a signal is heard.

This may be only a spark signal, but it will suffice, as by a little individual movement of the tuned anode condenser, the signal will increase or diminish in strength, the best positions soon being discovered by trial. The process of searching is continued until a faint whistle denotes a carrier wave, which is then tuned by individual movement of the condenser knobs until speech or music is heard.

All B.B.C. Stations.

Critical adjustment of the condensers and the filament rheostats, especially the high-



frequency valve, will bring in the signals loud and clear. On an ordinary aerial, if the set is well tuned, it is possible to receive all the broadcasting stations, but this will need very critical tuning, and the use of the reaction coil to bring in the distant stations.

The high-tension battery should be of 66 volts capacity, and be tapped at the points that give the loudest signals. As a trial, commence with 45 volts and increase or diminish it according to the results obtained. Telephones should be good quality and of high resistance, at least 2,000 ohms.

When the set has been connected to the aerial and earth, and everything is in readiness, place the moving arm with the reaction coil about 25 degrees from the aerial coil, turn the filament rheostats until the filaments burn brightly, if

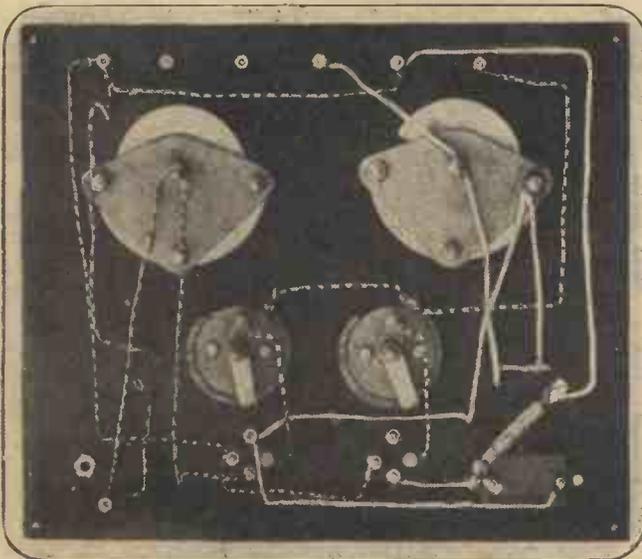


Fig. 14. The tuned anode circuit. The tuned anode circuit wires are shown in white on the back of the panel, and the other wires dotted.

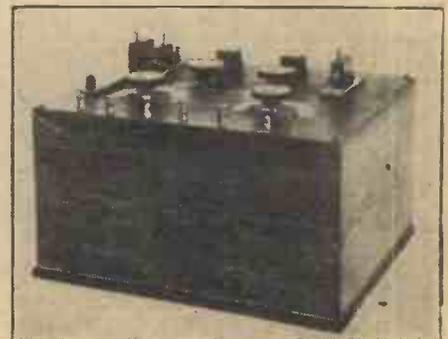


Fig. 19. The completed receiver.



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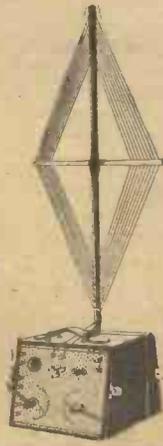
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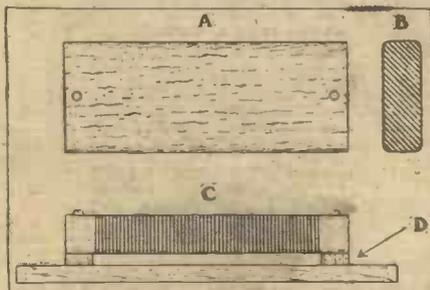
A Section Devoted to the Interests of the Younger Constructor.

A SIMPLE CRYSTAL RECEIVER.

READERS who are fortunate enough to reside within a fifteen miles radius of a broadcasting station will find this simple crystal receiver quite satisfactory, providing it is properly constructed, that the aerial and earth system is as efficient as possible, and that telephones of 4,000 ohms resistance are used. The former for the coil consists of a piece of dry hardwood A, which is about $\frac{3}{4}$ in. in thickness and 6 in. long by 3 in. wide. The four longitudinal edges are rounded off by means of a file or rasp, as shown in the cross sectional elevation at B, and two holes are drilled in the approximate position shown at A, these being provided to accommodate fairly long wood screws. It is then smoothed up with a piece of glass-paper, given two coats of shellac varnish, and wound with No. 24 enamelled copper wire.

Winding the Coil

The wire is wound on very tightly before the last coat of shellac varnish has thoroughly set, and the turns are kept as close together as possible. The two ends of the winding are temporarily anchored in the two screw holes, and the whole winding is then given a coat of shellac varnish. The completed coil is then mounted on the baseboard as shown at C, two small wooden distance pieces D being provided to keep the winding clear of the baseboard. The



Figs. 1 and 2.

ends of the winding are then permanently fixed under the screws. The baseboard should be about 9 in. square, thoroughly dried, and given two coats of shellac varnish.

The Switch Arms.

Fig. 2 shows a side view of the mounted coil and the arrangement of one of the swivelling contact arms. These arms consist of strips of spring brass, each about

3 in. long, which are swivelled to a piece of perfectly dry wood secured to the baseboard as indicated in Figs. 2 and 3. The outer end of each arm is bent as shown and made to press firmly on the coil winding, which is bared, as usual, where contact is made. A small manipulating knob may be fitted to each arm as shown.

Final Details.

The crystal detector F, and the .002 mfd. telephone condenser G (Fig. 3), may be purchased ready made or built up from parts in the usual way. A, E, and T represent the aerial, earth, and telephone terminals respectively. Ordinary single 18 bare copper wire is used for making the connections, each piece being covered with

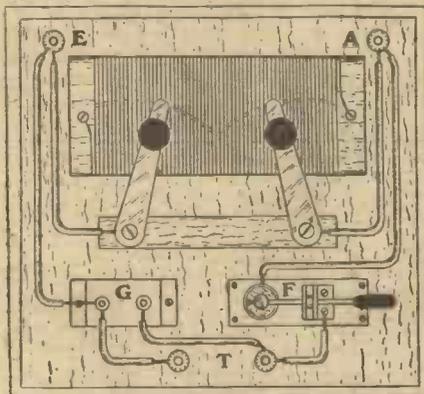


Fig. 3. The completed panel.

insulating sleeving and kept flat on the baseboard. If four short legs are attached to the under-side of the baseboard, the wires may be run underneath.

The connections are as follows: From aerial terminal to right-hand switch arm and crystal cup; from earth terminal to left-hand switch arm, one side of the telephone condenser, and left-hand telephone terminal; and from the other side of the telephone condenser to right-hand telephone terminal and detector pillar.

SERIES - PARALLEL SWITCHING.

ALL users of plug-in or otherwise interchangeable unit coils will find it a great advantage to be able to place the aerial tuning condenser either in series or parallel with the primary tuning coil. As our junior amateur adds any little refinement to his outfit so also is his knowledge increased, but it is important that each progressive step is thoroughly under-

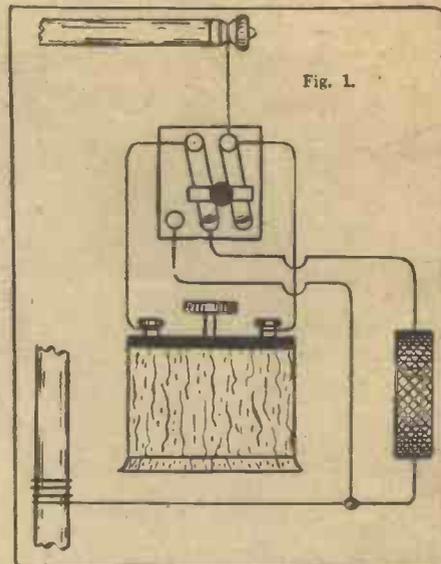


Fig. 1.

stood, so that in the end he becomes a really efficient operator by "knowing" his apparatus.

With the ordinary slide inductance, which is, of course, a variable tuning coil, such fine tuning is possible that the use of a tuning condenser is seldom necessary, but with honeycomb or basket coils the tuning condenser is essential, because accurate tuning cannot be accomplished by varying the number of turns, as in the case of the slide or tapped inductance. By employing a series-parallel switch the natural wavelength of a unit coil may be increased or decreased at will, so that our tuning condenser, in conjunction with the switch, becomes a really useful component.

Three Types of Switches.

A good all-round value for the condenser is .00075 mfd. (43 plates), but some prefer to use .001 mfd. (57 plates) on long waves, and .0005 mfd. (29 plates) on short waves. As an example of the wave-length variations of a No. 75 Burndep't coil, or a basket coil having about 75 turns, we can place the .00075 mfd. variable condenser in series with the coil and tune from 350 to 570 metres, but if we place the condenser in parallel we have a range of 700 to 1,100 metres. It will, therefore, be seen that the wave-length of the coil is decreased when the condenser is in series, and increased when in parallel.

Fig. 1 shows a very simple form of series-parallel switch which is becoming very popular on account of its very neat appear-

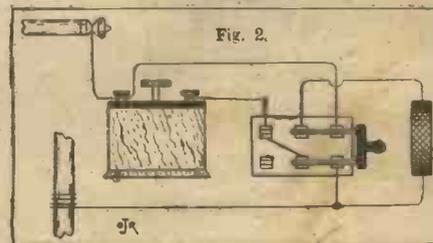


Fig. 2.

ance. The setting shown indicates that the condenser is in series with the coil, and by following the leads progressively, the wiring will be clearly understood. It will be seen that when the condenser is in series, as shown, the aerial currents go direct to one

(Continued on page 24.)

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A suggestion of "packing" is entirely unfounded, and next week we shall give a full description of its construction, which should be interesting to all.



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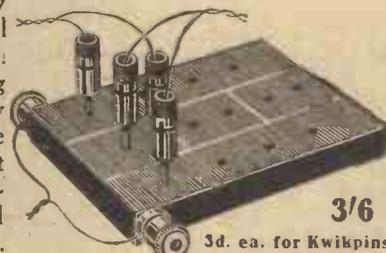
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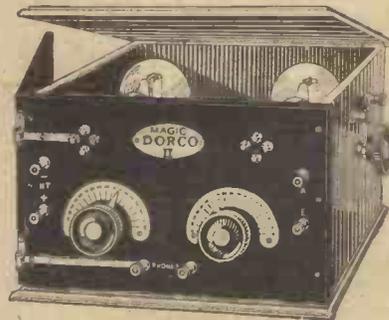
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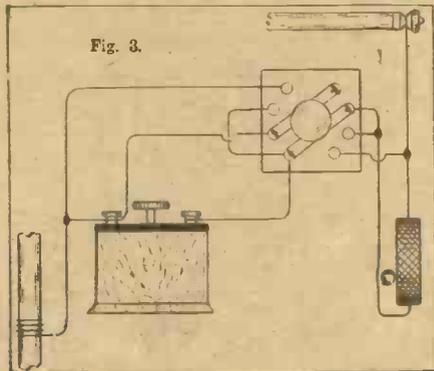
31, King St., Tower Hill, London, E.1.

Foot of Minories, three minutes' from Mark Lane Station.

SERIES—PARALLEL SWITCHING.

(Continued from page 22.)

side of the condenser through the condenser to one side of the coil via the left-hand switch-arm, and through the coil to earth. When in parallel (switch-arms thrown over to the left) the aerial currents pass simultaneously through the coil to earth and into the condenser. The capacity of the coil is thus greatly increased with the result



that an increase in the wave-length is also effected.

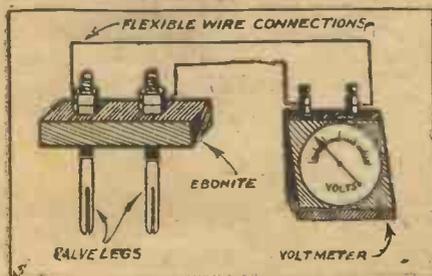
Fig. 2 shows how to wire up a simple D.P.D.T. knife switch to effect the same purpose, the setting shown indicating that the condenser is in parallel. And Fig. 3 depicts another form of series-parallel switch, which is particularly suitable for panel mounting.

A VOLTAGE TEST.

THE experimenter who has been using the ordinary bright emitter valves with, say, a 4-volt low-tension accumulator, and decides to replace such valves with dull emitters requiring anything from 1 to 3 volts, according to the make of valve, will do well to prepare a small device for testing the voltage across the filament terminals of the valve holder. The resistance of the ordinary commercial type of filament rheostat is often insufficient to reduce the voltage sufficiently when the accumulator is used, and it is better to test the voltage than to destroy the valve.

Protecting the Valves.

A simple arrangement is to have a piece of ebonite, 1 in. long, 1/2 in. in breadth, and 1/4 in. in thickness. Through this drill two holes, to suit two ordinary standard valve legs,



spacing them exactly the same distance apart as the filament sockets on the valve holder. Connect the two ends of the leads from the ordinary pocket type of voltmeter to these valve legs, as shown in the illustration, plug them into position, and switch on the current from the battery as if the valve were in place.

The reading of the voltmeter will then show if the rheostat is of sufficient value to control and protect the valve from excessive voltage. It will also enable the experimenter to judge the voltage passing at any position of the rheostat knob, and if desired, the voltage can be roughly calibrated on the panel.

HOME-MADE PLUGS AND JACKS FOR THE "P.W." SET.

THE commercial telephone plugs and jacks cost about three shillings a pair, and, as there are two in the "P.W." set, this item alone is responsible for six shillings. By the adoption of those described here, five shillings of that sum can be saved and devoted towards the purchase of a high-grade transformer. If the reader will examine the wiring diagram of the set he will see that jack No. 1 and jack No. 2 perform different functions. No. 1, by the insertion of the 'phone plug, disconnects the two leads of the primary winding of the low-frequency transformer, automatically putting the 'phones in circuit instead. In this position the set is working "crystal only" or "H.F. and crystal," according to the position of the change-over switches. Changing the plug into jack No. 2 automatically re-connects the transformer primary, at the same time inserting the 'phones in the "dual" circuit, which, normally, has the two legs of the jack short-circuited.

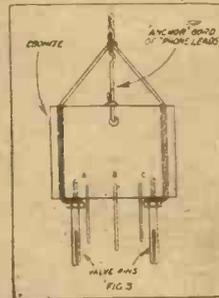
These operations are really very simple, though they sound a bit involved, perhaps, and may be provided for by valve sockets and pins, with a simple little switching arrangement of springy brass strip (or, better, phosphor bronze), suitably disposed between them. The figures 1 and 2 will make the arrangement clear.

Fig. 1, which is an elevation of jack No. 1, shows two valve sockets mounted one inch apart on the ebonite panel of the set. Two bits of thin, springy brass strip, about 1/4 inch wide, are bent (with round-nosed pliers) to the shape shown, and fixed with small bolts and nuts so that the curved upper extremities press

firmly upon their respective valve sockets. The lower portions, through which the holding-down bolts pass, are, of course, separated from each other. A reference to the wiring diagram will show that, with no plug inserted, the primary winding of the L.F. transformer is in circuit with the detector.

Construction of the Plug.

Now let us look at the plug (Fig. 3). This is a piece of ebonite 3/4 in. thick by 1 3/4 in. wide by 1 in. deep. At 1 in. centres two valve pins are fixed in one edge. This is done by drilling small holes slightly less than the threads of the pins and screwing the latter home with a pair of pliers. Alternatively, the holes may be tapped if the reader possesses suitable apparatus, but the other method will answer quite well if care is taken. The pins should have nuts on their shanks before screwing them into the ebonite, under which the leads of the telephone can be clamped. Two holes are drilled right through the ebonite, as shown by the dotted lines, through which these leads are threaded. The



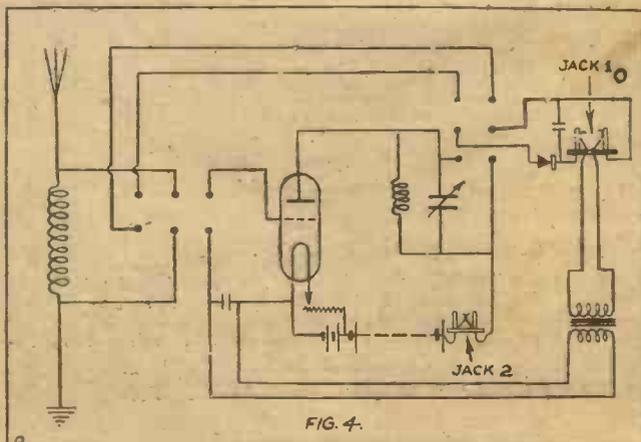
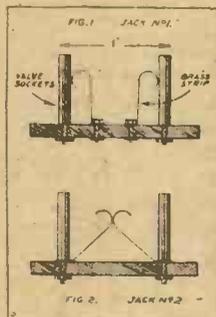
"anchor" cord of the 'phone leads (if any) may be tied to a hole drilled as shown.

We now come to a special and interesting feature of the plug, namely, three little insulating blades, A, B, and C (Fig. 3). These are cut from "ivory" name tabs, and inserted in small saw cuts made in the plug as shown, being fixed in their positions by a little secotinc.

The reader may see for himself what happens when this plug is inserted in jack No. 1. The pins put the 'phones in circuit, while, at the same time, insulating blades A and C pass between the springs and their valve sockets, thus throwing the L.F. transformer out of circuit. The middle blade, in this instance, does nothing.

The Second Jack.

Now look at jack No. 2. It is the same as No. 1 so far as the valve sockets are concerned, but the springs are arranged differently. Their function is to short-circuit the sockets when the plug is withdrawn, and are, therefore, arranged to meet in the centre, being thrust apart by the middle insulating blade of the plug when that is inserted.



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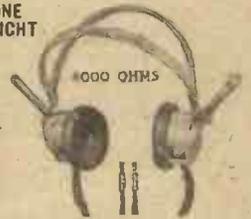
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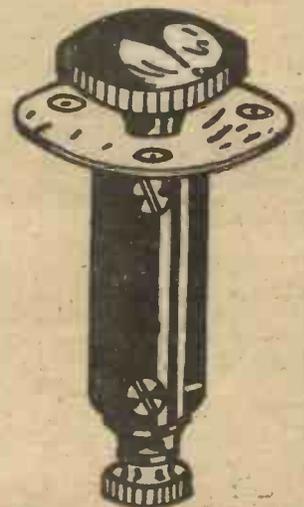
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Wireless Club Reports

The Editor will be pleased to publish concise reports of meetings of Wireless clubs and associations, reserving the right to curtail the report if necessary. Hon. secretaries are reminded that reports should be sent in as soon after a meeting as possible. Reports sent in cannot appear in this paper in less than ten days after receipt of same. An asterisk denotes affiliation to the Radio Society of Great Britain.

Barnet and District Radio Society.*

The history, aims, and objects of the amateur radio movement in this country formed the subject of a lecture given at a meeting of the society on Monday evening, February 4th., by Mr. L. F. Fogarty, the former treasurer of the Radio Society of Great Britain.

Hon. sec., J. Nokes, Sunnyside, Stapylton Road, Barnet.

Honor Oak Park Radio Society.

On Friday evening, at headquarters, Mr. Beadle, who is an ex-naval wireless operator, gave an interesting lecture on "Experiments with One Valve," demonstrating his remarks with an ordinary one-valve set.

Hon. assistant sec., H. Norris, 54, Boyill Road, Forest Hill S.E. 23.

Wimbledon Radio Society.*

At the weekly meeting of this society on Friday, 1st inst., at headquarters, Mr. C. E. P. Jones gave a lecture on "High Frequency Currents."

Hon. sec. (pro tem.), C. G. Stokes, Red Cross Hall, Wimbledon, S.W.19.

Battersea and District Radio Society.

At a meeting of the above society recently at their headquarters, 374, Wandsworth Road, Clapham, Mr. Welch, technical advisor of the Fuller United Electric Co., gave an interesting lantern lecture on the company's products, after which matters on wireless were discussed, and many tips were learned.

Hon. sec., T. M. Norris, 39, Warriner Gardens, Battersea.

Sale and District Radio Society.

During the past few months members of the above society have been engaged in the making of a 6-valve set which is now nearing completion, and would-be home constructors are specially invited, together with all interested as the society is out to help. An excellent syllabus has been arranged, including lectures, etc., and from time to time outings and rambles will be arranged during the summer months, and any suggestions for the improvement of any detail will be heartily welcomed.

The society's own headquarters are open every Monday and Thursday evenings from 8 p.m., when new members will be welcomed.

Hon. sec. and treasurer, Mr. H. Fowler, Wh. Ex., A.M. Inst. M.E., Alston, Old Hall Road, Sale.

Radio Transmitters' Society.

An informal meeting of this society was held on Friday, February 22nd, 1924, at 6.30 p.m., at the Institute of Electrical Engineers, when W. Kenneth Alford—2 DX, will open a discussion on "The Super Heterodyne and Short-wave Reception."

The Radio Society of Highgate.*

The hundredth meeting of the society was held on Friday, February 7th, when a most interesting lecture was given by Mr. G. G. Blake, F.Inst.P., M.I.E.E., on "The Modern View of Electricity and its Relation to Matter."

Hon. sec., J. F. Stanley, B.Sc., A.C.G.I., 49, Cholmeley Park, Highgate, N.6.

North Middlesex Wireless Club.

A meeting took place at Shaftesbury Hall, Bowes Park, N., on February 6th last. A small

committee of the club's experts was formed to give advice and members were invited to ask questions.

Hon. sec., H. A. Green, 100, Pollatt Grove, Wood Green, N.22.

Bristol and District Radio Society.*

Recently, at the University, a lecture was delivered to members of this society by their president, Prof. A. M. Tyndall, D.Sc. The subject of the lecture was "Oscillations."

Hon. sec., A. S. Harvey, 6, Woodleage, Sea Mills, Shirehampton, Bristol.



The transmitting plant at W J Z, the American broadcasting station which is to make special attempts to get over the Atlantic.

Bordon and District Radio Society.

The above society was inaugurated on February 13th, 1924, and will welcome inquiries for membership from enthusiasts in the surrounding districts, viz. Headley, Linford, Alton, Bentley, Oakhanger, Longmoor, Whitehill, and Deadwater.

Hon. sec., E. Terence Malloy, 170, Budds Lane, Bordon, Hants.

Catalogues Book Reviews Etc.



We have received two tuning units from Messrs. W. H. Agar, of 1A, Whitecross Place, Wilson Street, Finsbury, London, one of which is a variometer and the other an anode-reactance element. Both are supplied for panel mounting, and their neatness, efficiency and cheapness should ensure them

a continuance of the success and popularity we believe they have already attained.

Messrs. Wholesale Wireless Supplies, of 304, High Holborn, have produced a new crystal, "Holbornite," which retails at 1/- per specimen. A guarantee is given to every retailer that if a piece of crystal does not give satisfactory results they are authorised to apply for replacements.

We have received a sample "Connecticut" switch from Messrs. Smith & Sons (M.A.), Ltd., of Cricklewood Works, London, N.W.2. These switches, which are really intended for motor-car dashboard work, are highly nicked, and are very neat little fittings. The makers claim that they are suitable for wireless work, and we are inclined to agree that where a 1, 2 or 3 way single pole switch is required, the appearance of a panel would be enhanced by such an addition.

Notwithstanding the fact that there must be several hundred crystals on the market bearing different names, Tungstallite, Ltd., of 47, Farringdon Road, E.C.1., guarantee that their New Super Crystal is more sensitive than any other, and nevertheless is being sold at only 1s. per specimen in sealed tube.

Those who are always changing their circuits and want secure connection without the necessity of soldering, should certainly write to Loveland Bros. & Sons for a price list of their "Jiffy-Link" insulated connectors. These consist of lengths of copper wire with insulation in various colours, and with eyes fixed at both ends, which can be supplied to fit any size terminals. They are manufactured in lengths ranging from 1/2 in. to 24 in., advancing by quarters of an inch. Loveland Bros.' address is Crescent Magneto Works, Norbury, S.W.

The Amateur Wireless Service, 33, Elms Road, Aldershot, claim to be the first people to supply wireless masts especially for amateurs in connection with broadcasting. Fifty shillings for a fifty-foot mast, complete with all fittings and directions for its erection, seems a very reasonable proposition.

A vernier condenser is often a very useful addition to any circuit, and now that the "Eagle" Engineering Supplies, Ltd. are placing on the market a variable condenser with a vernier combined at a very reasonable cost, amateurs should avail themselves of this opportunity to obtain a good instrument cheaply. This and many other interesting components are shown in this firm's latest catalogue.

It is not necessary for us to comment on the general efficiency and high-class workmanship of the well-known Sullivan apparatus which is fully described in List W5 for 1924, and may be obtained from 368 and 369, Winchester House, E.C.2.

It is well known that crystals should not be fixed in their cups with ordinary solder, as the excessive heat is liable to destroy the sensitivity of the crystal. We have received a sample of "Gold Seal" Plastic Metal which, however, is suitable for this, and have found it very satisfactory. It is obtainable from most large dealers.

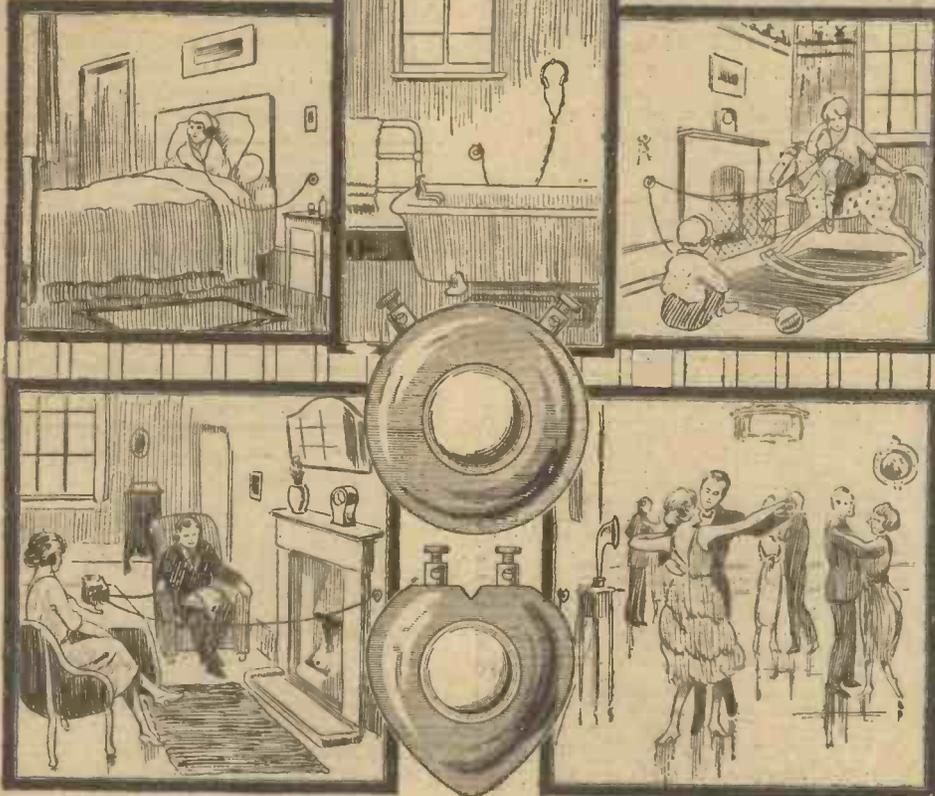
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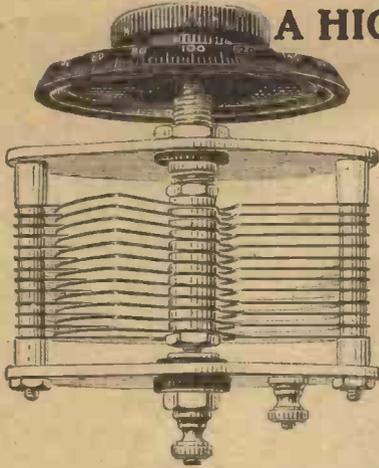
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All other makes of valves supplied	
Aerial Wire, 7/22, hard drawn copper, 100 ft.	
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Crystal Detectors, enclosed in glass, 1 3/4, 2, 2 1/2	2/6
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Crystal Cups	3d.
Ebonite, cut to any size by machinery per lb.	3/3
Switch Arms, with ebonite knob, complete	
with panel, bush, nuts or spring washer ..	8d.
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Potentiometers, superior make	7/-
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3/2; 23	3/4
Connecting Wire, 20, copper .. per yard	1d.
Variable Grid Leaks, 0.5 meg., Bretwood ..	3/-
Gold Cat's Whiskers	2d.
Silver Cat's Whiskers	1d.

Condenser Scales, 0-180	31d.
Basket Coils, set of 4 up to 2,000 metres	2/3
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Slider Knobs	2d.
Bornite	5d.
Genuine Hertzite, 61. Mixed, six kinds ..	9d.
Carborundum	5d.
Zincite	8d.
Ebonite Condenser Knob and Dial	1/3
H.T. Batteries: 30 volts, 5 6; 60 volts ..	8/9
Shellac, per bottle	9d.
Nuts, 2 B.A. per doz.	2d.
Nuts, 4, 6 B.A. per doz.	2d.
Washers, 4 B.A. per doz.	1d.
Washers, 2 B.A. per doz.	1d.
Contact Studs, nuts and washers, doz.	4 1/2
Terminals, with nuts and washers, each 1d. &	1 1/2
Large Spacer Washers	2d.
Small Spacer Washers	1 1/2
Telephone Terminals, with nuts and washers	
each 1d. per doz.	1/-
W.O. Terminals, with nuts and washers,	
each 2d. per doz.	1/6
Condenser Bushes, each 1d. per doz.	9d.
Condenser Bushes, bottom, each 1d., per doz.	8d.
Stops, with nuts	9d.
Valve Legs, with nuts and washers, each 1d.,	
Valve Pins, with nuts and washers, each 1d.,	
per doz.	9d.
Slider Rod, brass, 13 in. long, 1 in. square	
drilled	4d.
Condenser Spindles, vernier	2d.
Condenser Spindles, .001	3d.
Screwed Rod, 2 B.A., 12-in. lengths.	2d.
Screwed Rod, 4 B.A., 12-in. lengths.	2d.
Knife Switches, on polished ebonite base:	
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The W.S. Headphones, the finest made ..	10/6

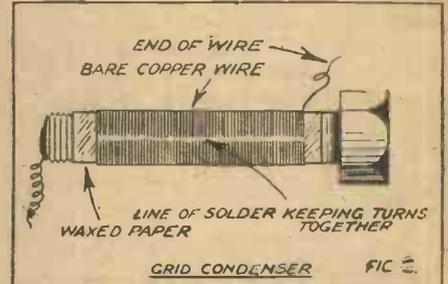
CONSTRUCTIONAL NOTES.

(Continued from page 16.)

of a dry cell for grid-bias; to high-tension battery; to the terminal pillar of a filament dry cell, if the nut is lost, or even to a spring-connector, if no sufficiently stout wire is available to insert into the latter.

Grid Condenser.

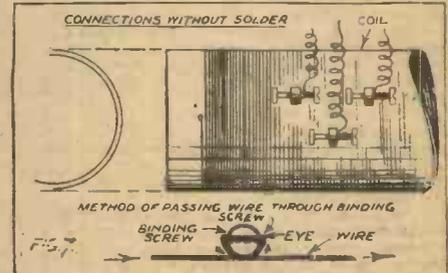
A grid condenser can easily be made by taking an ordinary iron bolt of suitable size, covering it well with waxed paper, and then winding bare copper wire upon it. A line



of solder may be run along the turns of wire, so as to hold them together. If the capacity is not sufficient, further turns may be added, and if the capacity is too high, some of the turns may easily be pulled off, the solder (if not too heavy) breaking away readily as each turn is unwound.

Connections Without Solder.

In winding an inductance coil, if it is desired to avoid soldering wires to the windings where the tappings are made, this may easily be done by means of binding screws



or connectors. There are various ways in which they may be connected, but that shown in the diagram is a simple one. In order to ensure the wire lying flat against the "former," the wire should be looped through the connector as shown.

A Vernier Tuner.

If it is desired to fit a vernier to the tuner, a simple one can be made from a filament rheostat, of the type having the wire wound round a "former" of circular or suchlike cross-section. For it will be seen that the coil will possess an amount of inductance so small that the device serves the purpose of a vernier to the main inductance tuner.

A Temporary Insulator.

If ever you are in want of an insulator for aerial use, quite a good one can be made from a bottle. There are certain kinds of bottles which have an enlargement at the lower end, as well as the usual flange at the neck. If a rough bridle of wire is made at each end of the bottle, secured to the flange, it will be found that an excellent insulator is obtained.

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144 pages (including 28 diagrams), 1/3 post free. SAXON RADIO CO. DEPT. 14), SOUTH SHORE, BLACKPOOL



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Coil Holders, 2-way ..	3/6 "
Coil Holders, 3-way ..	4/6 "
Detectors on Ebonite Turned	
Brass Ends ..	2/- "
Smaller ..	1/9 "
Perikons with fitted Crystal ..	2/6 "
Fixed Condensers ..	8d. "

Postage 3d. on all goods. Prompt Dispatch.

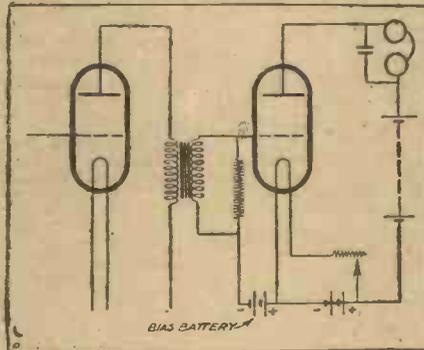
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RADIOTORIAL QUESTIONS & ANSWERS.

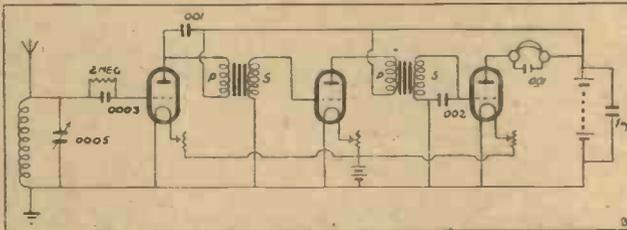
(Continued from page 29.)

For best results it is necessary to reverse the lead to primary of transformer until best position is found, or it may be an advantage to reverse the secondary leads in the same way. If a large fixed condenser (say .02) is placed across the H.T. battery, it has the effect of suppressing any slight irregularities that might otherwise be noticed.

B. M. (Bournemouth).—I wish to use a high voltage on my last valve (an L.F.) and intend using a small biasing battery, and have also been advised to connect a large resistance across my transformer. How are these connected, and what is the object of the resistance, and how many ohms should the resistance be?



The diagram herewith shows where the biasing battery is connected, and also includes a resistance across the secondary of the L.F. transformer. The use of this resistance is to eliminate distortion, and it should be of about 500,000 ohms, but may need varying.



S. N. (Brentford).—What do you consider the best straightforward three-valve circuit for loud speaker work from the London station only?

In this circuit, a detector valve is followed by two stages of low-frequency amplification. Such a receiver will, of course, be useless for reception of distant stations unless reaction is employed. To obtain reaction, a suitable coil is placed between plate of detector valve and transformer, and is coupled to A.T.I. The coupling should not be too tight, otherwise you will cause interference to other receivers in the neighbourhood, which, of course, is a breach of the regulations under which the licence is granted. Such a receiver is not selective, but presumably you only require it for the local station.

A. E. H. (Sunderland).—I have a four valve set employing valves which I find take about .7 amp., and require 4 volts on the filament. What should be the amperage of the accumulator? What H.T. voltage will be necessary?

In the first place, as regards the voltage of the accumulator, we recommend a six volt size if four valves are in use. As regards the capacity, this depends more or less on your pocket. Of course, the larger the capacity the longer you will be able to use it without recharging. A 20 amp. actual accumulator you will see will only give about seven hours' service if fully charged, while one of 60 amps will last you for a week, using it three hours daily. Don't forget when ordering to specify the "actual" capacity, otherwise you may be given one of, say, 60 amps. intermittent capacity, and you will find that it will only last for the same time as one of 30 amps. actual

capacity. The high-tension voltage should be about ninety, but this will vary a good deal for different types of valves.

C. E. F. (Bournemouth).—I wish to make a fixed condenser to go across my 'phones. What should be its capacity? How many foils shall I require?

This condenser should have a capacity of approx. .001 mfd. If you use mica .002 in. thick as dielectric, you will require in all six foils with an overlap of 2 by 1 cms.

"CAESAR" (Sheffield).—I have made a crystal set which has cost me, complete, less than ten shillings. Being a schoolboy, I have heard that there is a special cheap licence for a case like mine. Is this so? Where do I apply for same?

No; we are afraid that the only licence to cover the set you have built is the "Home Constructors" licence, which you can obtain from your local post-office for 15s.

J. B. L. (Balsall).—My crystal set, which employs a Hertzite crystal, is giving me very good results, but I have been told by a friend that if I use a potentiometer with it my signals will be greatly increased. Do you advise this?

We do not think that a potentiometer would improve at all in your case. Only a very few crystals, chief among which is carborundum, require an applied potential.

W. B. D. (Leeds).—I see in the circuit given to "Diaz" (Gainsborough) in "P.W." No. 88, that three batteries are shown. I can follow the H.T. and the L.T. but cannot understand what the third is for. Will you help me?

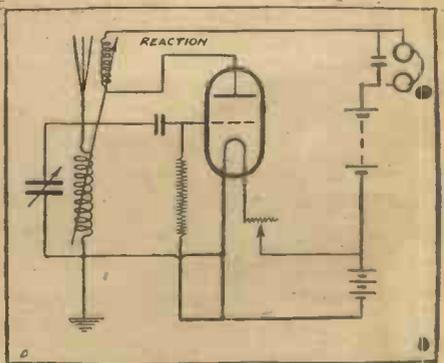
This extra battery is a grid biasing battery. The most common value used is 3 volts, but provision should be made to increase this, as it may be found necessary to do so.

P. E. C. (Brixton).—I have built a portable receiver and have a constructor's licence, and wish to carry out experiments in the neighbourhood. Is this covered by my licence?

We believe that the receiver may be used within a radius of ten miles of the address at which the set is installed upon notification being given to the P.M.G.

E. A. L. (Woodbridge).—Which is the simplest single-valve circuit employing reaction? I have been told that if I place my leak between grid and one of my batteries I will improve results. Is this so? How is the leak connected in this case?

The grid leak in the above circuit is shown connected between grid and L.T. negative instead of across the grid condenser, but in practice we have not



found either method of connecting the leak better than the other. For broadcasting wave-lengths the following should be the sizes for coils, which may be wound in basket fashion. A.T.I. 1 1/2 in. centre diameter former, 40 turns 22 S.W.G. Reaction, about 50 to 60 turns of the same wire on a similar former. The aerial tuning condenser has a capacity of .0005 mfd., the grid condenser .0003 mfd., and the condenser across 'phones .001 mfd.

CORRESPONDENCE

AMERICAN BROADCASTING.

The Editor, POPULAR WIRELESS.

Sir,—I have been experimenting with a two-valve set during the last few weeks, with an idea of finding whether atmospheric conditions govern the reception of American broadcasting, and below are the results of my experiments.

I built the two-valve set, eliminated capacity effects as far as possible, and sat up for nine nights, and heard the transmission from KDKA eight nights in succession.

One night atmospheric conditions were very bad, but I still got him in the loud speaker, and he could be heard 15 feet away.

Another night 6 XX, who is only about a quarter of a mile away, was calling A R R L, and using much power; but, in spite of this, I still learned that "apples in Chicago were four and a 'heff' dollars per barrel."

I am confident that he can be heard using one valve, but as I had no switching arrangements, I could not use only one valve.

My earth was a combination of gas and water pipes, and later I took the outdoor aerial away from the set and used an indoor aerial, and heard "Indiana Love Lyrics"; and, much to my surprise, the transmission was much clearer.

Yours truly, H. CONSTABLE.

6, Leysfield Road, Shepherd's Bush, W. 12.

The Editor, POPULAR WIRELESS.

Sir,—It may interest readers of POPULAR WIRELESS to know that I succeeded in receiving KDKA, Pittsburg, U.S.A., direct, not relayed, last night, using only as an aerial six yards of ordinary copper wire strung across my operating room, fastened to the picture rail, without any insulators whatever.

The dinner concert and the evening programme broadcast from the studio of the "Pittsburg Post" included, among other things, a medical lecture on Health, a story about Abraham Lincoln told by a lady, and announcement of the day's market prices, etc., etc.

On three valves signals were very loud and clear in headphones; on four valves at good loud-speaker strength, and could be heard all over my house.

Is not this a record in reception of U.S.A. broadcasting, bearing in mind the aerial used was six yards of copper wire, indoors? I am quite confident that the experiment can be repeated any night that reception conditions are moderately good.

Yours faithfully, P. S. SIDNEY.

4, River Terrace, Sunbury-on-Thames.

THE "P.W." SET IN AUSTRALIA.

The Editor, POPULAR WIRELESS.

Sir,—Being a reader of your paper from the first number, I have tried every super-circuit, etc., including the Armstrong, Flewelling, etc., and find the Flewelling to be the best. I then tried the May circuit. At first I had a great amount of trouble, but the after-results I obtained were well worth the trouble. Using an Ediswan A.R. Valve and a 4-megohm leak, I received at Melbourne the Sydney broadcasting station, 600 odd miles away, also South Australian telephony.

I then tried the set on long wave, and received Bordeaux, Nauen, New York, Carnarvon, and several other stations. I then undertook the construction of the "P.W." Combination Set. The only difference was that I had all the apparatus mounted on a baseboard instead of an ebonite panel. The results were startling. I received Sydney, Adelaide, and New Zealand telephony; the latter was very loud and clear for the distance.

As I make a pastime of making sets and giving demonstrations, that one night a boy friend who heard the New Zealand telephony decided to buy the set.

Wishing you and your paper every success.—I remain, yours,
C. R. BEAUCHAMP.
35, Herbert Street, St. Kilda, Melbourne.

NOVEL L.F. AMPLIFIER.

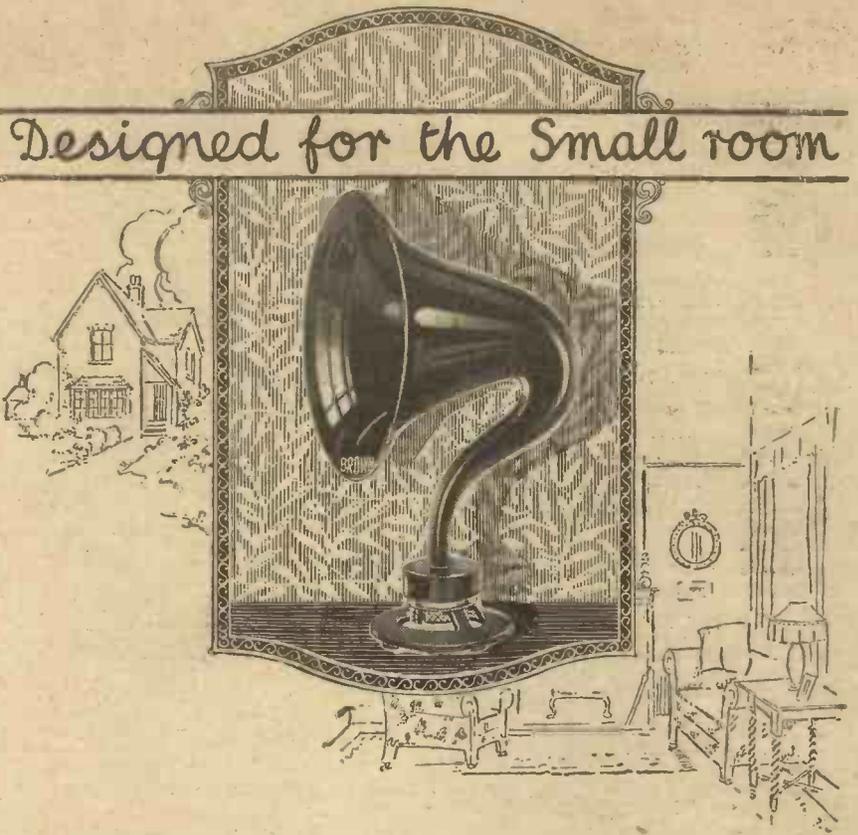
The Editor, POPULAR WIRELESS.

Dear Sir,—Your article on "A Novel Note Magnifier," which appeared in POPULAR WIRELESS for August 27th, prompts me to tell you of the success which I had with a note-magnifier of this type, which I experimented with some months ago. I used a two-stage amplifier, employing three valves, and the freedom from distortion was quite noticeable after using an ordinary note-magnifier. I encountered no trouble, although I used a common H.T. battery for all the circuits. In your article a separate grid battery is shown in Fig. 3 for each valve, but I used a common grid battery for all three valves. Whatever extra cost is entailed by the use of extra transformers and valves is more than compensated for by the freedom from distortion which is gained by their use.

Yours faithfully,

Manchester.

"VARIOTRON."



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Leak and Condenser, '0003	5/-
Anode Resistance, 100,000 ohms	5/6

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Amplion Junior	42/-
Amplion AR43	63/-
Amplion AR13	105/-
Baby Sterling	55/-

VALVES

MARCONI D.E.R.	21/-
EDISWAN A.R.D.E.	21/-
EDISWAN COSSOR P-1	12/6
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Post 1/- each.		

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WITH DIAL 2/-
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2/- each. Post 6d. each.

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B.B.C. CRYSTAL SET

Very handsome little set, with Pair of 4,000 ohm 'phones, wire etc. 30/-
Post 1/-

SHAW'S GENUINE HERTZITE

1/- post 6d.

GUARANTEED GENUINE.

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60 v. . .	8/6	9/-	10/6
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With finished brass bush for panel mounting. Resistance wire wound on insulating rod, thereby giving perfectly smooth adjustment. 3/6

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AJAX. Guar. 464 ohms	6/6
AJAX Vernier Rheostat 30 ohms	6/-
AJAX Amplifier Rheostat 25'3 ohms	4/-
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80 ohms with brass dial	4/6
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ENCLOSED PERIKON 1/11, 3/-	
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EXTRA SPECIAL DETECTORS, Handsome Designs, Ebonite Base, glass enclosed (Whisker) 2/6 Nickel Post 1s. each extra.

SWITCH ARM, EBONITE KNOB, 4-leaf Laminated, complete with 12 studs and nuts, 1/- By post, 2s. set.

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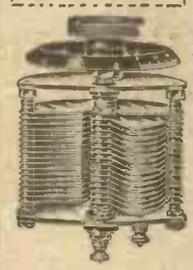
Switch Arm, one-hole fixing (best)	1/3
Above, with 12 best 1/4 by 1/4 studs and nuts ..	2/-
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Valve Windows	1/-
Ebonite Dial and Knob, hand-polished	2/-
Ebonite Dial (scale 0-180), hand-polished	1/6
Dial and Knob, scale 0-180, two designs	1/6
1/2 in. Ebonite Condenser Ends and Bushes .. pair	1/9
Spade Terminals, screw pattern	12 for 1/6
Pin Terminals, screw pattern	12 for 1/6
D.P.D.T. Nickel Switch on Ebonite	3/6
S.P.D.T. "	2/4
D.P.D.T. Switch for Panel Mounting	2/-
S.P.D.T. "	1/9
'Phone Cords, double, 54 in. long	pair 1/6
'Phone Cords, double 72 in. long	2/-
100 Feet Aerial Wire and 4 Egg Insulators ..	3/9
Hand-polished Ebonite Valve Holders, 3 nuts ..	1/6
Ebonite (Moulded) ditto	1/2
Twin Flex for long leads	doz. yds 2/3
High-class Rubber Lead-in	10 yds. 1/9
Bell Wire, D.C.C. I.R.C. (not rubbish!) ..	20 yds. 1/6
Coil Plugs, Ebonite, not substitutes	pair 2/-
Ditto on Stand, with Terminals	2/-
Single Holder and Plug for Basket Coils	1/3
Basket Coils, set of 6 (up to 3,500 metres) ..	2/6

Raymond Fixed Condensers, guaranteed :-	
'0001 to '0005	1/3
'001 to '005	1/4
'006	2/-
Filament Resistance (Edison Bell)	3/-
Filament Resistance, with Dial	2/6
Crystal Detectors, very fine value, nickel-plated, extra quality	4/6
Telephone Terminals and Nut	doz. 1/6
Large W.O. Pillar and Army Type	doz. 1/9
Small Pillar	1/4
Extra Large for Aerial and Earth	2 for 9d.
Tinned Copper—	
14-gauge, 1/-, 10-gauge, 10d. for 36 ft.	
18-gauge, 9d.; 20-gauge, 8d., for 36 ft.	
Sleeving for 14- and 16-gauge	3 yds. 1/9
Sleeving for 18- and 20-gauge—	3 yds. 1/6
Engraved Scales, 0-180	9d.
Filament Dials, 0-10	1/-
Ditto with Knob	1/3
Circle Scales, 0-300, Black or White	9d.
0-100	9d.
Set of 12 Names, Black or White	1/-
Gold Seal Plastic Metal	9d.
Grid Leak, 2 meg. 1/6; with '0093 Condenser	2/6
Valve Sockets with Shoulder	doz. 1/6
Ditto plain, all with 4 nuts	1/3
Special Screw Crystal Cup, quick fix	6d.
Telephone Wood Screw Terminals6 for 1/-
100,000 ohms resistance	2/6
Ebonite Panels, —, best quality :-	
6 x 9, 2/6. 8 x 6, 3/3.	
9 x 6, 3/6. 12 x 9, 5/3.	
12 x 12, 6/-.	
Lissenstat Minor	3/6
Lissenstat	7/6
Watzel Grid Leak	2/9
Igranic Concert Coils, set of 4 :	
Wave-length range with '001 mfd. condenser in shunt.	
C 1 110—285 metres } £1	
C 2 205—500 " } the set	
C 3 348—706 " } of	
C 4 495—1,050 " } 4 Coils.	

For Lissen, Radio Instrument, Igranic and proprietary articles see separate announcements.

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NATIONAL LABORATORY CERTIFICATE NEW MODEL One Hole fixing

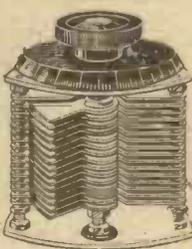


Cap. Guaranteed. Minimum space required. Finely adjusted '073 in. spacers. Aluminium ends. Fully assembled for panel mounting as sketch. Including Knob and dial.

'001 - - -	8/3
'00075 - - -	7/3
'0005 - - -	6/3
'0003 - - -	5/9
'0002 - - -	5/-
'0001 - - -	4/4

Post Free.

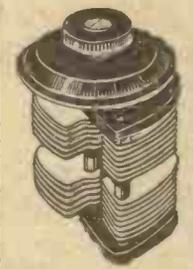
OUR USUAL CONDENSER ONE HOLE FIXING



'088 spacing. Fully assembled for panel mounting. Complete with Knob and Dial. If no dial required deduct 6d.

'001 - - -	6/6	'0003 - - -	4/6
'00075 - - -	5/9	'0002 - - -	3/6
'0005 - - -	5/-	'0001 - - -	3/2
Vernier - - -	3/-		

Post Free.



DUPLEX CONDENSERS

This Condenser is composed of two equal units, of '0025 mfd., operated by one Knob and Dial, thereby enabling you to tune two circuits by one turn of the dial. Can be used in series or parallel. Complete as shown with aluminium ends, Knob and dial. Post free

13/6

CONDENSER and VERNIER COMBINED

Require no Flowery Language to sell them. Complete with Knob and Dial.

'001	'0005	'0003
12/6	10/6	8/6

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Telephone, Pillar W.O.	each 1d.
Large size, Pillar 2 B.A.	each 3d.
Various	1d. & 1 1/2 each.
Valve sockets	doz. 10d. & 1/-
Contact Studs	doz 4d.
2, 4, 5, 6 B.A.	3 doz. 6d.
2 B.A. Rod	2 ft. 5d.
4 B.A. Rod	2 ft. 4d.
Valve Pins	doz 6d.
Brass Bushes	1d.
Spade Tags, best quality	doz. 4d.
Screw Spade Terminals	2 for 2d.
Pin Screw	each 1d
Stop Pins	2 a 1d.
Plug and Socket	pair 1 1/2d.
Easyfix Cup	1 1/2d.
Switch Arms	8d., 9d. & 10d.
Ditto, with 12 Studs and Nuts	1/-
English Flash Lamp Batt.	doz. 4/3
H.T. Batteries, 36 v.	4/9 & 5/6
H.T. Batteries 60 v.	8/9 & 10/6
Filament Res., with Dial	2/-
Set of Names (12)	5d.
0-300 Dial	5d.
Scales (Engraved) 0-180	4d.
Multiphone Terminals	9d. & 1/-
Insulators, Egg; 4 for	6d.
Large Shell	7d.
Small Shell	4 for 6d.
Aerial Wire	100 ft. 1/10
Extra Hard Drawn	100 ft. 2/4
Valve Windows	3d.
'es. Dials 0-100	4d.
Ebonite Dial and Knob, 0-180	1/1 & 1/3
Filament do. & Knob, 0-10	9d.
Filament Dial 0-10	6d.
Fixed Condensers to '001 10d.—'003-'005 ..	1/-
'006	1/6
Ins. Screw Eyes	1d.
4 Cats' Whiskers (one gold)	3d.
Gold Whisker	1d.
Shaw's Hertzite	1/-
Gecosite (G.E.C.)	1/6
Zincite, 6d.; Boronite	1/6
Coil Holders and Plug	1 1/2 & 1/3
Coil Plugs, Ebonite	7d. & 9d.
Do., on Base	1/- & 1/3
Best Valve Holders	1/3
3 makes, above	10d., 1/- & 1/3
Tinned Copper, 16, 18, 20-g., stocked	
Copper Foil	ft. 3d.
Filament Res., good	1/6
Formo, ditto	2/6
Rubber Lead-in	10 yds. 1/- & 1/3
Bell Wire, D.C.C., I.R.C.	10 yds. 5d.
Twin Flex	12 yds. 1/6
Heavy Rubber Lead-in	yds. 2d. & 3d.
Basket Coils (6 up to 3,500	1/9
Waxless (5)	1/11
D.P.D.T. Switches for Panel	1/6
S.P.D.T. "	1/3
Telephone Cords, pair 9d.—72 in. long ..	1/4
Ebonite Ends (1) and bushes	pair 1/3
Alum. Ends and Bushes	pair 1/3
Grid-leak (2 meg.) 1/-, with condenser ..	1/9
Empire Tape	yard 1d.
Adhesive do.	roll 4d.
A.A. Earth Clips	7d.
Washers, 2 and 1 B.A.	3 doz. 2d.
100,000 ohms Res.	1/6
Tel. Term. Wood Screw	1d.
Shellac (good)	5d.
Knife Switches, S.P.D.T.	1/3
Ditto, D.P.D.T.	2/-
Earth Wire, Single 18	yard 1d.
Machine-cut Screws, Countersunk, in Stock.	

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with polished double Duranium headbands
4,000 ohms .. 16/-
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PIVAL SINGLE RECEIVERS

2,000 ohms .. 6/-
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PIVAL SPARE PARTS
Earcaps .. 1/- Double headbands, 4/-
Diaphragms, 2d. Headphone cords, 1/8
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FRENCH THOMSON-HOUSTON HEADPHONES

(With two year guarantee.)

4,000 ohms with horn headbands 19/-
8,000 ohms with horn headbands 24/-
4,000 ohms with tortoiseshell headbands .. 22/-



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2,000 ohms .. 8/-

FRENCH THOMSON-HOUSTON SPARE PARTS

Earcaps .. 1/- Tortoiseshell
Diaphragms .. 4d. headbands .. 7/-
Horn headbands, 4/- Headphone cords, 3/-
Single receiver cords .. 2/4

DAVENPORT HEADPHONES

4,000 ohms (Stamped B.B.C.) .. 17/6

ECCENTRO CRYSTAL DETECTOR, 8/-

(The best on the market.)

FIXED CONDENSERS, '001 and '002, 6d. each

TWO SPECIAL LINES

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"DYNA" LOUD SPEAKERS

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"DYNA" CRYSTAL SET complete with an Eccentro Detector (double slider), 15/6

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THE WEEK'S BROADCASTING PROGRAMMES.

LONDON (2 L O).

Sunday, March 2nd.—Organ Recital from the Concert Hall of the National Institute for the Blind. The Rev. J. Scott Lidgett.
Monday, March 3rd.—B.B.C. Literary Critic, "The Dogs of Devon" or "Foiled Again."
Tuesday, March 4th.—Nautical Programme.
Wednesday, March 5th.—B.B.C. Dramatic Critic, The Wireless Orchestra.
Thursday, March 6th.—B.B.C. Musical Critic, John Drinkwater reading from his works. The Savoy Bands.
Friday, March 7th.—B.B.C. Film Critic. Symphony Concert from the Central Hall, Westminster.
Saturday, March 8th.—Popular Music, and "Carmen" from the Old Vic.

BOURNEMOUTH (8 B M).

Sunday, March 2nd.—Organ Recital. Address, The Rev. Father Palmer. Readings from Browning's Works.
Monday, March 3rd.—Programme mainly from London.
Tuesday, March 4th.—Sir Arthur Sullivan Night.
Wednesday, March 5th.—Wessex Music Night.
Thursday, March 6th.—Popular Night.
Friday, March 7th.—Programme mainly from London.
Saturday, March 8th.—Request Night.

BIRMINGHAM (5 I T).

Sunday, March 2nd.—"The Creation." The Rev. E. Leach. Address.
Monday, March 3rd.—Musical Comedy and Dance Programme.
Tuesday, March 4th.—Popular Night.
Wednesday, March 5th.—Concert Party Programme.
Thursday, March 6th.—Old Memories Programme. Readings from the works of Browning.
Friday, March 7th.—Popular Classics Programme.
Saturday, March 8th.—Programme mainly from London.

MANCHESTER (2 Z Y).

Sunday, March 2nd.—The Rev. Princtip Moulton. Address.
Monday, March 3rd.—Programme mainly from London.
Tuesday, March 4th.—International Dance Programme.
Wednesday, March 5th.—Orchestral and Choral Concert.
Thursday, March 6th.—Spanish Talk, Musical History, French Talk.
Friday, March 7th.—Programme mainly from London.
Saturday, March 8th.—Light British Music.

NEWCASTLE (5 N O).

Sunday, March 2nd.—The Rev. G. C. Jefferys. Address. The Orchestral.
Monday, March 3rd.—Programme mainly from London.
Tuesday, March 4th.—The Wireless Orchestra and "Elegant Edward."
Wednesday, March 5th.—Grand Opera Night.
Thursday, March 6th.—Orchestral Night.
Friday, March 7th.—Programme mainly from London.
Saturday, March 8th.—Orchestral Night.

GLASGOW (5 S C).

Sunday, March 2nd.—Band of the 6th Batt. Highland Light Infantry. The Rev. W. H. Wiggett. Address.
Monday, March 3rd.—Programme mainly from London.
Tuesday, March 4th.—Nautical Programme.
Wednesday, March 5th.—Professor Donald F. Tovey. Musical Talk.
Thursday, March 6th.—Our Birthday Celebrity Evening. Address by the Lord Provost of Glasgow.
Friday, March 7th.—Programme mainly from London.
Saturday, March 8th.—Popular Dance Night.

ABERDEEN (2 B D).

Sunday, March 2nd.—Orchestral Night. The Rev. Findlay Clarke. Address.
Monday, March 3rd.—Programme mainly from London.
Tuesday, March 4th.—Chamber Music.
Wednesday, March 5th.—Songs of the Hebrides, and from London.
Thursday, March 6th.—Popular Programme.
Friday, March 7th.—Programme mainly from London.
Saturday, March 8th.—Dance Night.

CARDIFF (5 W A).

Sunday, March 2nd.—An Hour of Good Music. Wharton "James Howell" Choral.
Monday, March 3rd.—Programme mainly from London.
Tuesday, March 4th.—Shakespeare Night.
Wednesday, March 5th.—Popular Night.
Thursday, March 6th.—Some Pleasant Songs and Solos.
Friday, March 7th.—Programme mainly from London.
Saturday, March 8th.—Popular Night.



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More "LAKER" Masts are sold than all other makes combined. Each mast is a standing testimonial. Made from best Steel Tubing 2" dia. in 10 ft. sections. Quickly assembled and erected. 25 ft. 35/-, 30 ft. 45/-, 35 ft. 52/6, 40 ft. 63/-, 45 ft. 75/-, complete with all accessories. Ask your dealer or order from us direct.

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THE WONDER CRYSTAL : : The Marvel of the Age. Has no equal. 1/6 post free. From GRAHAM & THOMPSON (Dept. 2), 819, Rochdale Road, Queen's Park, Manchester.

TROUBLE : Poor reception.
CAUSE : Battery run down.
REMEDY : Use HOMCHARGER.

Clip on after every concert and ensure maximum enjoyment from the next. Connects to any lamp socket or wall plug—A.C. and D.C. types available.

AT ALL DEALERS.

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TELEPHONES REWOUND

To 4,000 ohms. Guaranteed. All makes 5/-, except Brown "A" 6/-, and Sullivan, Wax-filled, 7/- per pair. Ex-Army converted to high resistance, 2/6 each earpiece. Remagnetising, 9d. per earpiece. John W. Miller, 70-71, Farringdon St., E.C.4. Phone: CENTRAL 1950.

ALL BRITISH 1 VALVE AMPLIFIER

unassembled, comprising mahogany cabinet, drilled ebonite panel, L.F. transformer, terminals, rheostat, wiring diagram, everything complete, 22/6, post 1/-. Complete parts for Crystal Variometer Receiver, including slope front cabinet, drilled ebonite panel, wiring plan, etc., everything complete. 12/6, post 1/-. Particulars and general list post free.

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Fix your crystal in GOLD SEAL PLASTIC METAL.

It is positively the best contact possible, and results in LOUDER AND CLEARER SIGNALS.

Guaranteed to contain no mercury. Price 6d. per packet, sufficient for 5 to 4 crystal cups. Of all Wireless Stores.

Wholesale Enquiries (or sample pkt. 6d.) to SAMUEL LEVY, 53, Ben Jonson Road, Stepney, London, E.1.

COILS! Prices include postage. 600 metres, 20 tappings, 1/6 ea. 1,200 metres, 20 tappings, 1/9 ea. 1,600 metres, 20 tappings (new B.B.C. wave-length), 2/- ea. 900 metres, slider coils, 6"x2", 1/3 ea. 1,600 metres, slider coils, 8"x3", 1/9 ea. Coils for "P.W." Comb. Set, 3"x2", 1/6 pair. Cash with order.—The Northern Radio Co., Gladstone Mews, Wood Green, N.22.

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After many months of experimenting we have produced a Cat's-whisker which increases crystal reception so much as to obviate the use of an amplifier. RESULTS GUARANTEED.

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AGAIN:—34ft. HANKS OF STRANDED COPPER RUBBER COVERED WIRE 1/3. Post 3d.

Valves Repaired

WITH NEW BULBS AND FILAMENT. 6/6 POST FREE.

TECHNICAL ODDS & ENDS.

(Continued from page 12.)

A Valuable Electron.

The Nobel Prize for physics has been awarded to Dr. R. A. Millikan, of the California Institute of Technology, for his well-known work on the isolation of the electron and the determination of the electronic charge. The value of the prize is about £8,000. Dr. Millikan's method consists, briefly, in allowing minute water-drops or oil-drops to become charged, owing to their acquiring electrons from surrounding ionised air, and then finding the vertical electric intensity necessary to balance the weight of the drops or to make them fall at any particular rate. His determinations of the value of "e," the electronic charge, are the most accurate that have ever been made.

Portable Transmitter and Receiver.

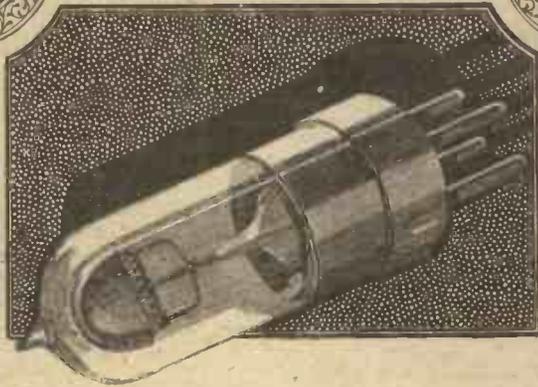
A new portable outfit, which should prove very handy for explorers, sportsmen, and travellers in out-of-the-way parts, has just been put on the market. It consists of two portable sets capable of transmitting or receiving at 300 or 350 metres. The aerial wire is in two sections, with an insulator between. One section of the wire is used for transmitting, the other for receiving, the receiving part of one set being tuned to the transmitting part of the other. The outfit is made in two powers of 5 watts and 50 watts.

Wired Wireless.

The system known as "wired wireless" is not used to any extent in this country at present, although such great strides have been made in its use in America that it seems more than likely that we shall eventually see it developed over here. It consists essentially in the sending of wireless waves in association with existing conducting lines, such as electric power lines, telephone cables, and so on. It is, in a sense, "guided radio," and actually goes by this latter name in some parts. The advantage is that a number of separate messages or conversations can be carried on over the same wires without interference. The Bell telephone system in the United States has now 20,000 miles of line equipped for carrier current telephony, and 88,000 miles equipped for carrier current telegraphy. It has been found possible to establish a system of "guided broadcast" (to use a somewhat contradictory phrase) so that houses fitted with the telephone, or even with the electric light, may be supplied with the broadcast without the system interfering either with the conventional broadcast or with other systems of guided broadcast.

Action of the Valve.

This depends upon the different mobilities of the positive and negative ions under an electric field. When the cup is negative, a larger current can flow through the tube than when the cup is positive, and so the tube acts as a rectifier. Two such valves can be used, in a well-known manner, to rectify alternating-current supply, and if proper filter circuits are employed, direct current may be obtained for use in wireless



Cossor

— where quality
is paramount

GLASS, brass, nickel, tungsten, platinum and bakelite—these constitute the raw material from which the Cossor P.1 and P.2 and most other Valves are made.

And wherein lies the difference? Firstly, the design—secondly, the meticulous care paid to every process (there are 101 of them) during manufacture.

The curved filament, tucked away high up inside the hood-shaped Grid and Anode, ensures that practically the whole of the electron stream is used. And because it is arched it is immensely strong—a guarantee of longer life—and definitely prevents all risk of microphonic noises.

None but those able to follow, step by step, the progress of a Cossor Valve during manufacture can appreciate the careful attention to small details that only skilled and experienced workers can give—even the filament, for instance, is curved to micrometer exactness.

TYPES :

P.1. For Detector and L.F. use 12/6
P.2. (With red top) for H.F. use 12/6

A. C. Cossor, Ltd. — Highbury Grove, N.5.

Cossor

(Continued on page 36.)

TECHNICAL ODDS & ENDS.

(Continued from page 35.)

transmission. In the process of manufacture of these S tubes, the glass vessel is highly exhausted and then helium gas is introduced up to a pressure of about 12 millimetres of mercury.

Loud-Speaker Horns.

This is a subject which has always given rise to a great deal of controversy. It seems to be a general impression that resonance frequencies, within the range in question, should be carefully avoided. A good deal of experimental work has been lately devoted to this subject, both in England and America, and the impression mentioned above has been decidedly confirmed. In fact, it is considered by many investigators that the best results are obtained from a "dead" material, such as ebonite. Horns made from this substance certainly give excellent results. The "deadness" appears to be due to the peculiar structure of the material, which, without lowering the rigidity (in the ordinary sense) very much, nevertheless causes an absorption of the energy of self-vibrations.

Grid Leaks.

The desirability of a variable grid-leak, or, in fact, of several grid-leaks of different values, does not appear to be generally realised. If the value of the leak is too low, the set will not work at its best, whilst if it is too high, it will be found difficult to manipulate a reaction circuit. Two megohms is an all-round average value, but it is well to try three and four megohms in case better results may be obtained with these higher values. On the other hand, experimenters using wave-lengths much shorter than the broadcast length might try smaller values of the grid-leak with advantage. It should be mentioned that the exact value of the grid-leak is not very important, but a "best" value for the set can be found by a little experimenting. This value will probably be found to vary a little from time to time.

Correct Voltage for Filaments.

When the filament voltage is stated by the makers of a valve, it is assumed that this is the potential difference which should exist between the filament terminals when the current is actually running through the filament. If you apply a battery of sufficient capacity, these conditions will be pretty well fulfilled, but if the accumulator is of too low a capacity, or if it is a little run down, it is impossible to know exactly what is the potential difference between the filament-terminals on closed circuit, even though you know the static potential difference of the battery on open circuit. It is a good

plan, therefore, to use a voltmeter, so that the actual potential difference at the filament terminals can be tested whilst the latter is glowing. If the battery is not standing up to its rated voltage at the time, the proper filament voltage can then be obtained by means of the filament rheostat.

Rheostats.

A rheostat seems a fairly straightforward piece of apparatus, and it might be thought by a beginner that there was not much room for good and bad in rheostats. An important point to look for, however, is the regular winding and spacing of the turns of the wire, which should all be of the same height where the sliding contact passes over them, so as to ensure even regulation and to prevent the end of the contact arm from catching against the wires. Care should also be taken to see that the turns of the resistance wire are securely wound on the "former," and that the resistance unit is fixed securely to the base, so that there is no shifting as the contact arm is moved to and fro; any looseness of the latter kind will be found very annoying.

A Novel "Frame" Aerial.

All kinds of collapsible loop aerials have been brought forward lately, specially designed from the point of portability. I hear of a new one in which the wires are attached to the inner tube of a bicycle tyre, and all you have to do when you want to erect the aerial is to blow up the tube with a small tyre pump.

The Telephone number of the Radio Refinement Co. of Harlesden, is WILLESDEN 985, and not as incorrectly printed in last week's advertisement.

YEARS OF AMUSEMENT FOR 10/6.
THE ESCO "BIG FOUR" B.B.C.



Crystal Receiving Sets Stand SUPREME for efficiency. There is nothing like them on the market. Maximum signal strength with perfect reception within 30 miles of a Broadcasting Station. These are the only Sets fitted with "Escolite" super-Crystal. Specification: Polished Case of Solid Mahogany, Ebonite Top, Lacquered Brass Fittings. Every Set will last for years, and bears our Each set stamped B.B.C. full guarantee. 14 Days' Trial Given.

We hold large stocks of component parts.

No. 1	No. 2	No. 3	No. 4
Square Type	Oblong Type	Slope Top	Lid Top
10/6	12/-	14/-	16/6

Agents Wanted Everywhere. Liberal Trade Terms. THE ESCO WIRELESS CO., (Dept. P.W.), 100 Houndsditch, London, E.1.

A WIRELESS BUSINESS IS VERY INTERESTING.

It can be made very profitable, but you must have the right stock. Don't overstock with a lot of expensive sets, but have an assortment of COMPONENT PARTS. Our business is to stock Wireless Dealers, and if you saw our post you would say we were doing it. You can be one of our customers, and we should like to hear from you.

THE NEWTONIA WIRELESS FACTORY,
13/15, Whitcomb St., W.C.2.
Excess cash with all Mail Orders always returned with goods.

"GEJE"

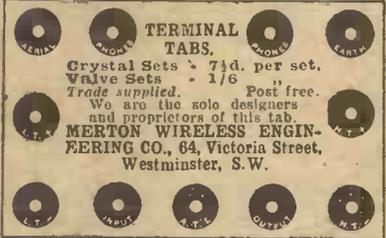
You are not getting the BEST from your set unless you are using a "GEJE" Cat's-whisker. A GEJE fitted=increased VOLUME. Set. post free. Obtainable only from manufacturer—G. H. JEFFERY, 38, Blackhouse St., S.E.15.

Boxes & Cabinets for Home Constructors

A good box or cabinet enhances the value of the set you make. We have a selection to fit your panels. Write for particulars. Trade Supplied.

THE TECHNICAL INSTRUMENT CASE
Manufacturing Co., Ltd.,
45, Johnson Street, Westminster, S.W.
Phone: Vict. 9070.

TERMINAL TABS.



Crystal Sets 7/6 per set.
Valve Sets 1/6 Post free.
Trade supplied.

We are the sole designers and proprietors of this tab.

MERTON WIRELESS ENGINEERING CO., 64, Victoria Street, Westminster, S.W.

PROVINCES PLEASE NOTE!!

The 80-Mile Crystal.

↓

HELENITE

Every Spot Sensitive. **1/-** Every Piece Guaranteed. **POST FREE.**

Trade Inquiries Invited. Send Postal Order to: **CENTRAL SERVICE,** 203, Strand, London, W.C.2.

Be sure to mention **POPULAR WIRELESS** when replying to Advertisements

CRAWFORD'S JACKS

PUT ONE IN EVERY ROOM

There are several make-shift ways of wiring a house, but why not use the jacks designed for the purpose?—which are simple, effective and inexpensive.

SEND FOR SAMPLE 2/6 TRADE SUPPLIED

108, CARLINGFORD RD., LONDON, N.15

SUCCESSFUL NEW FORTNIGHTLY.

Few fortnightly publications have met with such a wonderful reception as "Countries of the World"—its success was never in doubt from the moment Part 1 appeared, and the sales increased rapidly day by day. Part 2 is now on sale, and with its eight superb coloured photographic plates of Andalusia, in Southern Spain, is certain to be in equally great demand. "Countries of the World" is a work of almost magical charm and the method of publication in fortnightly parts, at 1/6 each, brings it within the reach of every purse.

Max-amp



The quality Transformer noted for high amplification factor with complete absence of distortion. "Amateur Wireless" (Issue Oct. 27th) says: "A really good Transformer." Price 18/6. Sold only by **PETO-SCOTT CO. LTD.,** 64, High Holborn, W.C.1. and branches.

L.F. Transformer

BATTERY CHARGING. Ward & Goldstone enamel-lead slate switchboard, shunt and series resistances, voltmeter, ammeter, D.P. switch, fuses and automatic cut-out, G.E. Co. Dynamo shunt, 4 amps 25 volts at 1,400 r.p.m. Too small for use quite new. Cost £18. Sell for £8. — **TEMPLETON, Barnhill Iron Works, BLANTYRE.**

ADVERTISEMENTS FOR THESE COLUMNS ARE ACCEPTED UP TO FIVE P.M. THURSDAYS FOR THE FOLLOWING WEEK'S ISSUE. RATE—25/- PER INCH; MINIMUM SPACE ACCEPTED HALF-INCH AT 12/6. CASH MUST ACCOMPANY INSTRUCTIONS AND BE SENT TO THE SOLE ADVERTISING AGENTS,

JOHN H. LILE, LTD.,
4, LUDGATE CIRCUS,
LONDON, E.C.4.
TELEPHONE: 10806 CENTRAL.

OVER TWO MILLION SATISFIED CUSTOMERS

SAVE MONEY BY STUDYING OUR ADVERTISEMENTS

ELKAY WIRELESS CO.

BRITAIN'S LARGEST EXCLUSIVE WIRELESS STORES

QUALITY, QUANTITY AND CONSISTENCY OUR MOTTO

PIONEERS of CHEAP PRICES

SEE OUR 7-WINDOW DISPLAY OF BARGAINS

THE FAMOUS RADIO EQUIPMENT CO.'S HEADPHONES 4,000 ohms. Leather Covered Headbands. Stamped B.B.C. Maker's Price 25/- OUR PRICE 16/9

ELKAY Lightweight Headphones 4,000 ohms, all guaranteed, per pair **12/9**
FELLOWS' New Lightweight Phones, 4,000 ohms, stamped B.B.C. **18/6**
SUPER PHONES, Light, Easy Adjustment, 4,000 ohms, guaranteed N & K (The genuine article), 4,000 ohms, all guaranteed, per pair **13/9**
ALSO BROWNS, BRUNET, THOMSON-HOUSTON (FRENCH), ETC. **12/6**

ALL MAKES OF VALVES IN STOCK.
MARCONI R., EDISWAN, MULLARD, and GOSSOR (Red and Plain Top).

DULL EMITTERS, EDISWAN AND MARCONI.
 In stock also D.E. 306, etc.

STATE WHAT MAKE OF LOUD SPEAKER YOU REQUIRE EVERY TYPE IN STOCK. PRICES RIGHT. COME TO ELKAY AND SAVE MONEY

DUTCH VALVES 5/11 & 6/11
L.F. TRANSFORMERS, Ratio 5 to 1. All guaranteed (postage 1-) from 8/11
CRYSTAL DETECTORS 1/9, 1/3, & 10 1/2 d.
CRYSTAL DETECTORS, enclosed in glass case 2/6, 2/3, 1/6
AERIAL WIRE, 7/22, guaranteed hard-drawn copper, 100 ft. (postage 1-) 1/10d.
CONDENSER VANES, fixed or moving, per doz. 3 1/2 d.
REAL GOLD CAT'S WHISKERS, each 2d.
REAL GOLD CAT'S WHISKERS, per doz. 1/5
SILVER CAT'S WHISKERS, each 1d.
SILVER CAT'S WHISKERS, per doz. 7d.
CONDENSER SCALES, 0 to 180 each 3 1/2 d.
IVORINE LABEL SET, 12 different titles, the set 6 1/2 d.
BASKET COILS, set of 6, up to 3,000 metres 1/11
SLEEVING, 3 yds. assorted colours, for NUTS, 2 B.A. per doz. 2 1/2 d.

FILAMENT COMPLETE 5d.
RESISTANCE SCALES, 0 to 300 each 6d.
BELL WIRE, tinned copper, 12 yds. each 1d.
VALVE LEGS, nut and washer per doz. 9d.
VALVE PINS, nut and washer each 8d.
PLUNGER SPRINGS, complete each 1d.
SLIDER ROD, brass, 13 in. long, 1/2 in. square, drilled each 3 1/2 d.
SLIDER KNOB each 2d.
SWITCHES ON EBONITE, S.P.S.T. (quality the best) each 1/5
SWITCHES ON EBONITE, S.P.D.T. (quality the best) each 1/9
SWITCHES ON EBONITE, D.P.D.T. (quality the best) each 2/6
CONDENSER SPINDLES, all sizes in stock, from each 1 1/2 d.
SCREWED ROD, 2 B.A., 12 ins. long, each 3d.
SCREWED ROD, 4 B.A., 12 in. long, each 2 1/2 d.

VARIABLE CONDENSERS of high quality. With aluminium top and bottom plates. Complete with knob and dial, guaranteed accurate:
 Vernier 4/- .0005 6/-
 .0001 4/- .00075 7/-
 .0002 4/6 .001 8/-
 .0003 5/6
REAL EBONITE 3-WAY COIL HOLDER 5/9
O.B.A. NUTS per doz. 4d.
DETECTOR ARMS, Ball Joints, Ebonite Handle and Whisker Holder 3 1/2 d.
WOOD SCREW TERMINALS each 1 1/2 d.
SHELLAC per bot. 10 1/2 d. & 6d.
AERIAL PULLEYS, each 10 1/2 d., 8 1/2 d., 6d., & 4 1/2 d.
TINFOIL large sheet 3d.
COPPER FOIL, 6 in. wide per ft. 4d.
GRID LEAKS, 2 1/2 and 2 meg. each 10 1/2 d.
FLEX (Twin), various col., best qual., per yd. 2d.
CONNECTING WIRE, tinned copper, 20 gauge 3 yds. 2d.

OUR NEW BRANCH NOW OPEN

159, BISHOPSGATE, E.C.2

12 Doors from Liverpool St. Station—Same Side

NUTS, 4, 5, 6, and 8 B.A. per doz. 2d.
WASHERS, 4 B.A. per doz. 1d.
WASHERS, 2 B.A. per doz. 1 1/2 d.
CONTACT STUDS, with nuts and washers per doz. 4d.
TERMINALS, with nut and washers, each 1d., 1 1/2 d., & 2d.
EBONITE KNOBS, 2 B.A., each 1 1/2 d. & 3d.
SPACING WASHERS, large per doz. 2 1/2 d.
SPACING WASHERS, small per doz. 1 1/2 d.
CRYSTAL CUPS, 2 screw each 1d.
CRYSTAL CUPS, 4 screw each 2d.
FIXED CONDENSERS, all capacities, each 8 1/2 d.
EBONITE, cut to any size by machinery while you wait per lb. 3/6
TELEPHONE TERMINALS, nuts and washer each 1 1/2 d., per doz. 1/3
W.O. TERMINALS, nuts and washers, each per doz. 1/7
PANEL BUSHES, drilled each 1 1/2 d.
TOP CONDENSER bushes per doz. 1/3
BOTTOM CONDENSER bushes per doz. 9d.
SWITCH ARMS, 4 laminations, ebonite knob, complete with panel, bush, nuts, and spring washer 8 1/2 d.
STOPS, with nuts per doz. 6d.
FILAMENT RESISTANCES, smooth action, marvellous value 1/6
 With engraved dials 2/-

RUBBER-INSULATED LEADING IN WIRE per yd. 1 1/2 d.
VARIABLE GRID LEAK, pencil type 1/11
INSULATORS, white reel, 2 in., each 1d.
INSULATORS, white egg, each 2d., per doz. 1/8
WOUND INDUCTANCE COILS, (postage 9d.): 12x4 8x4 8x2 1/2 6x3 6x2 2/5 2/3 1/11 1/8 1/5
TAPPED INDUCTANCE COILS, 20 tapings, wound to 1,600 metres each 1/11
VARIOMETERS (Tube type), complete with knob 3/11 & 2/11
DOUBLE PHONE CORDS, full length 11 1/2 d.
HERTZITE, Genuine, in box 8d.
TALITE, Genuine, in box 8d.
PERMANITE, Genuine, in box 2d.
ZINCITE, Genuine, in box 8d.
BORNITE, Genuine, in box 6d.
MIXED CRYSTALS (6 kinds) 9d.
CARBORUNDUM 5 1/2 d.
ZINCITE AND BORNITE, both in box 1/-
COIL PLUGS, real ebonite, 1/3, 10 1/2 d., and 9 1/2 d.
H.F. PLUG TYPE TRANSFORMER:
 1 ... 150 to 450 metres 3/9
 2 ... 250 to 700 " 4/-
 3 ... 450 to 1200 " 4/3
 4 ... 900 to 2000 " 4/6
 5 ... 1000 to 3200 " 4/9
 6 ... 2200 to 5600 " 5/-
EBONITE CONDENSER KNOB AND DIAL 1/-
SUPER QUALITY 2-WAY COIL HOLDER 4/6

ENAMEL WIRE, in 1/2, 3/4, and 1lb. reels:
 22 24 26 28
 per lb. 2/4 2/8 3/2 3/6
 Note: Bobbins 2d. each extra.
POTENTIOMETERS, guaranteed up to 500 ohms, superior make, compact size 6/6
CRYSTAL DETECTOR, glass enclosed, fitted on 4 x 2 ebonite panel with terminals for aerial, earth and phones already wired and beautifully finished 4/3
VALVE HOLDERS each 10 1/2 d. & 1/3
BATTERIES, H.T., dry, 4 1/2-volt, per doz. 3/3
 30 volts, including Wander Plugs 4/9
 60 volts, including Wander Plugs 7/6
AMALGO-PLASTIC METAL, for fixing crystals. No Wood's metal necessary 6d.
GOLD SEAL PLASTIC METAL, for fixing crystals 6d.
IVORINE NAME-PLATES, all readings, each 1d., per doz. 8d.
EARTH CLIPS, Copper adjustable, each 5 1/2 d.
FILAMENT RESISTANCES, smooth action, marvellous value 1/6
 With engraved dials 2/-
FILAMENT RESISTANCE DIALS 8 1/2 d.
WELL-MADE MAHOGANY CABINETS, from 2/6
THE WONDERFUL RADIONETTE
CRYSTAL SET, stamped B.B.C., including 1 pair of 4,000 ohms head-phones, aerial wire, insulators, leading-in wire, lead-in tube, earth, clip, etc. Maker's price, 3 guineas. Our price ... 37/6

Mail Orders Despatched Same Day as Received.
 Please Remit Ample Postage.

"ELKAY" WIRELESS CO.

225 & 227, BISHOPSGATE, LONDON, E.C.2
 Open Saturday all day. Sundays 11—2.30. Trade Counter now open.

SPECIAL TERMS TO RADIO CLUBS. Telegrams { ELKAYWIRY AVG., LONDON Telephone { CENTRAL 3544, RETAIL. BISHOPSGATE 2313, Wholesale.

REMEMBER—DON'T PAY MOR.

Be careful of that minute energy—

Guard it against loss at every point of the path along which it travels—only too easily will it leak away and take other paths than those for which it is intended. Wrong and ill-made, or well-made but incorrectly designed parts in your receiver will uselessly dissipate that vital energy. It is precisely because the total energy dealt in by your receiver is small that all minute losses must be avoided. Every LISSEN Part is made to direct to its proper purpose every impulse that comes to it. That is why a receiver BUILT WITH ALL LISSEN PARTS yields that extra efficiency which is particularly noticeable on long-distance reception.

STRONG MAGNETIC LINKAGE BETWEEN LISSENAGON (prov. pat.) COILS

The magnetic linkage between LISSENAGON (prov. pat.) coils is such that a transfer of energy will be effected even though the coils are comparatively a great distance apart. LISSENAGON coils will oscillate easily, even though far apart, and by keeping them as far apart as possible all electrostatic effect is eliminated and the tuning characteristics of each coil are mutually unaffected. Tuning is extremely sharp and selective because the farther apart the coils are kept the sharper and more selective tuning becomes.



It is partly due to the strong magnetic field between LISSENAGON coils and partly due to the negligible losses in the coils themselves that LISSENAGON coils will oscillate easily, though at a considerable distance apart, as there are practically no damping losses to be overcome even on the extremely low wave-lengths.

LISSENAGON TUNING CHART. Note the New Coils : Nos. 30, 40, and 60.

TABLE 1. Wavelength range when used as Primary Coils with Standard P.M.G. Aerial and .001 mfd. condenser in parallel.			TABLE 2. Wavelength range when used as Secondary Coils with .001 mfd. condenser in parallel.		
No. of Coil.	Minimum Wavelength	Maximum Wavelength	Minimum Wavelength	Maximum Wave length	PRICE.
25	185	350	100	325	4/10
30	235	440	130	425	4/10
35	285	530	160	490	4/10
40	360	675	200	635	4/10
50	480	850	250	800	5/-
60	500	950	295	900	5/4
75	600	1,300	360	1,100	5/4
100	820	1,700	500	1,550	6/9
150	965	2,300	700	2,150	7/7
200	1,835	3,200	925	3,000	8/5
250	2,300	3,800	1,100	3,600	8/9
300	2,500	4,600	1,400	4,300	9/2

Picking up WGY, WOR, and WJAZ.

"I believe that I could not have picked up these stations had I not used the LISSEN Variable Grid Leak, as the adjustment was very critical." A unique resistant element is used in the LISSEN Variable Grid Leak. It is covered by definite patent claims and cannot be duplicated. Valves vary in characteristics, and it is an excellent thing to be able to alter the leak resistance to make full use of the critical features of the valve. With some valves and in some circuits the LISSEN VARIABLE LEAK will be found invaluable. Exact value of leak resistance can be selected to suit every working phase of the valve, and thereby obtaining correct grid potential all the time.

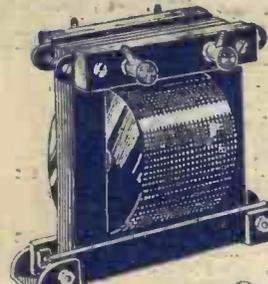
LISSEN ONE-HOLE FIXING POSITIVE STOPS BOTH WAYS .. 2/6



HOW LISSENSTAT CONTROL IS SPREADING—

A user writes:— "First I tried one, and then I fitted five LISSENSTATS." That is how the use of LISSENSTAT control spreads. It is such a beautiful control that it is impossible to do other than appreciate it. It gets you through to a distant station after you have tried all your other controls in vain. It saves your valves and keeps them quiet, so that you tune in THROUGH A BACKGROUND OF SILENCE. It is made to last, too. Easily fitted. LISSEN ONE-HOLE FIXING, OF COURSE!

LISSENSTATS (prov. pat.) are sold at the same thing as an ordinary rheostat. LET THEM TRY THE DIFFERENCE.



AUDIO FREQUENCY in REFLEX CIRCUITS

It has been found that the LISSEN T2 Transformer is an ideal transformer in these circuits, where it yields very powerful amplification with great purity of tone .. 25/-

AN EXCELLENT LIGHT TRANSFORMER.

The LISSEN T3 is one of the best light transformers made, and actually compares with many much more expensive transformers because of its skillfully balanced design. 16/6



BUILD UP BEAUTIFUL TONE QUALITY
For immediately after the detector valve, a wonderful power amplifier too, this incomparable transformer can also be used throughout. It has a coil which would amplify without any iron core at all 30/-



LISSEN PARTS IN JUTLAND—No fading

"I have now fitted the LISSEN-REGENERATIVE REACTANCE and two of your H-way Reactances. I am more than satisfied. . . . Principal advantage is that there is now practically no fading away of signals once they are tuned in, beside a considerable increase in strength."

Every Receiver should have one stage of Lissen Radio Frequency

It builds up wave energy before passing it on to the detector. Where aerial reaction is used LISSEN REACTANCE ALSO SHOULD BE ADDED to bring in signals with greater certainty and with much greater strength.

Its simplicity of control has made H.F. amplification extremely easy and increasingly popular. Blue print with each shows the easy connections. 150-1,000 metres 19/6 - 150-600 metres 17/6

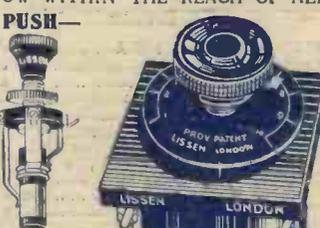
LISSEN REACTANCE IS NOW WITHIN THE REACH OF ALL

YOU JUST GENTLY PULL OR PUSH—

and you hear these little switches "make" with a reassuring click. The contacts do not short when changing over—they are self-cleaning—there are no neuter or handier switches. LISSEN ONE-HOLE FIXING, OF COURSE.

LISSEN Two-way Switch (prov. pat.) 2/9
LISSEN Series Parallel Switch (prov. pat.) 3/9

Successfully used in the Reception of American Telephony—No aerial reaction need be used, for the LISSEN REGENERATIVE REACTANCE (prov. pat.) will take its place. It is non-radiating—replaces plug-in coils—it is lower in cost than a set of plug-in coils to cover the same wide range; it is easier to handle, one knob controls tuning and reaction—reception is often possible with both aerial and earth connections dispensed with; cuts out the local station and tunes in the others with full build-up strength. Continental stations come in easily. Introduced into the anode circuit, it forms an unequalled first stage radio frequency. Blue print with each shows the easy connections; unbroken regeneration possible over the whole range; complete with internally connected switch; no soldering. LISSEN ONE-HOLE FIXING, OF COURSE .. £2 - 12 - 6
Tune always with a vernier condenser, preferably the LISSEN Vernier, which is specially designed for fine tuning in H.F. circuits (barely 1-inch diameter, 12/6).



CHOOSING A TUNER—

If you do not wish to use plug-in coils there is the LISSEN Tuner, with its simplicity of control, its switch complete, its sharp tuning on all ranges with full efficiency at every point, negligible H.F. resistance, large inductance for a given length of wire—LISSEN multi-wound—150 to 4,000 metres range with a .005 condenser (preferably use the LISSEN Mica Variable Condenser, 22/6)

For full descriptions send for "The Text Book of LISSEN Parts," post free, 8d. Free if applied for on trade headings.

LISSEN LIMITED

8-16, Woodger Rd., Goldhawk Rd., Shepherd's Bush, London, W.12.

OWN A RECEIVER BUILT OF ALL LISSEN PARTS

All applications for Advertisement Space in POPULAR WIRELESS to be made to JOHN H. LILE, LTD. (Sole Agents), 4, Ludgate Circus, London, E.C.4. Phone : 10806 Central.