THE LEADING WIRELESS WEEKLY

# Practical Wireless

3D

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## The "Pyramid" Portable Two


# ROUND *the* WORLD *of* WIRELESS

### Vienna and the *Blue Danube*

SIMULTANEOUSLY with the official opening of the new high-power transmitter, Vienna will adopt as an interval signal during radio programmes a few bars of *The Blue Danube* waltz. The Austrian relays will also abandon the ticking metronome in favour of abbreviated versions of local folk-songs, Graz taking as its distinctive signal an excerpt of the Styrian National Anthem (*Hoch vom Dachstein an*).

### Denmark's Super Station

ACCORDING to a report published in Continental papers, the new 60 kilowatt high-power transmitter destined to take over the duties of the Kalundborg station is now nearing completion and will shortly begin its tests.

### Czech Anti-propaganda Measures

THE Czechoslovakian authorities have issued a decree by which schools in that country possessing wireless receivers are forbidden the reception of German and Russian programmes. This step has been taken to combat Nazi and Bolshevik propaganda directed against the Czech State.

### Belgium and Private Radio Stations

FOLLOWING a recent decision taken by the Belgian Government, steps are being taken to close down some of the smaller privately owned broadcasting stations in the provinces. Officials of the PTT Administration recently suspended the transmissions of *Radio La Louvière*, which for some months was broadcasting Socialist programmes twice weekly.

### New Wave Plan for New World

THE Radio Conference which is taking place in the United States may decide to carry out a number of alterations in the wavelengths of North and South American transmitters. In view of the growth of broadcasting in Canada, Mexico and Cuba, it will be necessary to re-allocate channels if mutual interference is to be avoided. As the number of stations to be provided for is a very large one, it is hoped that some wavelengths may be conceded by the naval and aviation authorities.

### Seven Transmitters—480,000 Listeners

ALTHOUGH Austria already possesses seven broadcasting stations, according to the latest figures at the end of March, less than 480,000 licences have been issued. With the advent of the new high-power transmitter it is hoped to secure an increased number. The population of Austria to-day totals roughly six and one-half million souls, of which over 28 per cent. reside in the capital. With a view to an extension of the system to the Swiss and German frontiers a relay station is to be erected in the Vorarlberg district.



### The Matutinal Czech

PROGRAMMES to rouse the Czech at an early hour have been carefully prepared by the Prague studio. At 6.0 a.m. the station awakes him with a series of cock-crows, followed by a fifteen-minutes' course of physical jerks, repeated at 6.45 a.m. for stay-a-beds. During the interval a short concert of music is broadcast, and at 7.0 a.m. a news bulletin and suggestions to the housewife for the daily menu. In each instance the transmission concludes with a stirring military march. On Sunday the listener is given thirty minutes' grace as the physical exercises do not start before 6.30, and as a compensation for the earlier week-day hours he is treated to the relay of a good concert from the famous Carlsbad watering-place—and all this before breakfast!

### Radio Licence and Lottery Ticket

IN Hungary, to encourage the prompt payment of licences, the authorities have instituted a special lottery in which every listener who is not in arrears may secure tickets. By this method not only does the State hope to derive a good profit, but it is expected that the attraction will popularise radio, and that, in addition, all listeners will show their anxiety to pay their licence when it falls due.

### Sweden's Thirty-one Broadcasters

SWEDEN holds the record for its number of broadcasting stations; namely, thirty-one working on over twenty different wavelengths. Most of them, however, are of very low power; some putting out programmes on even less than 200 watts. The largest station is that of Stockholm with 75 kilowatts (435.4 m.), followed by the long-wave Motala (40 kW.). Sundsvall (541.5 m.), Göteborg (329.9m.) and Hörby (257.1 m.) are each rated at 15 kW. A great number of the smaller stations are not heard beyond the Swedish frontiers.

### Per Pro Radio Toulouse

RADIO AGEN (France), on 453 m., now broadcasts daily between 12.30 and 1.30 p.m., and again between 7.30 and 8.30 p.m. B.S.T., during which period in its announcements it acts as the mouthpiece of Radio Toulouse, of which the broadcasts have not yet been resumed. Every Friday on that wavelength towards 9.0 p.m. you may hear a concert given by Radio Agen's station orchestra of twelve instrumentalists.

### Trooping the Colour

IN celebration of the King's birthday, on June 3, the B.B.C. will relay to National listeners the Trooping of the Colour from the Horse Guards Parade.

# ROUND *the* WORLD *of* WIRELESS *(Continued)*

### A New Short-wave Portable

THIS receiver, an illustration of which appears on this page, is an ordinary standard 255 portable superhet, which has been adapted by Marconiphone to work on short-waves embracing 18–32 and 30–64 metres. The short-wave convertor consists virtually of a small superhet using an S21 valve. The controls are situated on the back of the receiver and are quite independent of the main controls. This portable, shown in the accompanying illustration, was presented to the Graphic Film Services, Ltd., under the direction of Mr. M. A. Wetherell, F.R.G.S., for use in Africa. The field of operations of this party will be largely Nigeria and the Cameroons. The object of the expedition is to follow the route taken by Livingstone to make a film entitled "Queen of the Okoyong." The exterior locations will be reproduced upon the actual locations and amongst the native tribes where this "queen" originally worked from the late 70's to 1915; South Nigeria, cross river, and in the country of the Okoyong. The well-known screen artiste, Miss Alma Taylor, will play the part of Mary Slessor, "Queen of the Okoyong."

The expedition includes a complete cinematograph and sound-on-film recording apparatus, and it is intended to receive Empire broadcasting on the short-wave portable to reproduce it on the sound track of the film. The film on completion will be shown in the principal picture theatres of the country. Mr. Wetherell's previous productions include "The Life of Livingstone" and "The Song."

### Frequency versus Wavelength

A NEW classification of radio channels is likely to be put forward at the Lucerne Conference, and if adopted will do away with all uncertainty as regards long, medium and short wavelengths. Up to the present, the International Consultative Committee for the Technique of Radio Electric Communications has placed wireless channels under the following headings: Long, 3,000 m. and upwards; medium, 200-3,000 m.; intermediate, 50-200 m.; short, 10-50 m.; ultra-short, below 10 m. The new method will take frequencies only into consideration and channels will fall into the following categories: Low frequencies, up to 100 kc/s (3,000 m.); medium, 100-1,500 kc/s (3,000-200 m); high, 6,000-30,000 kc/s (50-10 m.) and very high frequencies which cover all channels above 30,000 kc/s.

### Europe's 18 Million Listeners

IT is computed that in Europe alone some eighteen million people listen to the broadcast programmes daily. Denmark still holds the record in respect to the proportion of licence-holders to population, as 14.15 per cent. of its inhabitants own wireless receivers. England follows a good second with 11.95 per cent., Germany, notwithstanding its 4¾ million listeners, being sixth in the list with 6.9 per cent. Poland and Italy, in spite of their numerous stations, show up badly with respectively 0.97 per cent. and 0.67 per cent. In Switzerland the opening of the high-power transmitter has raised the figure from 2.15 per cent. to 3.68 per cent., a substantial increase. The figures given above are based on statistics published at the beginning of 1933.

## INTERESTING and TOPICAL PARAGRAPHS

A NEW SHORT-WAVE SUPERHET.


*Mr. Wetherell, F.R.G.S., and the Chief Sound Recording Engineer of Film Services, Ltd., examining the new Marconiphone Short-Wave set referred to in the first column.*

# SOLVE THIS!

### Problem No. 37

Robinson had read all about the advantages of iron-cored tuning coils, and decided to try the scheme. He accordingly found a No. 50 coil in his junk box and a number of iron laminations from a disused transformer. He packed these into the centre of the coil, but found that he could get no broadcast stations when it was fitted into a simple receiver. Why? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2, and mark your envelopes Problem No. 37. All entries must reach here not later than June 5th.

### SOLUTION TO PROBLEM No. 36

Franklin joined the two coils so that they were in opposition, and consequently instead of the inductances being additive, they acted as a variometer and reduced the range.

The following three readers received books in connection with Problem No. 35.

W. Burgess, 6, Prince Street, Ryde, I.O.W.; H. Rubenstein, 22, Faraday Avenue, Cheetham, Manchester "8"; L. Jans, 24, Whitworth Road, S. Norwood, S.E,25.

### Spreading Bolshevik "Kultur"

DURING recent months the Soviet authorities have largely increased public facilities for the reception of the radio programmes. Many trains have been equipped with receiving apparatus and from early morning passengers are fed with the previous day's news through loud-speakers in the carriage gangways. Loud-speakers on the public address system have been installed in most public squares, factory yards, workmen's clubs and even in hospitals and prisons. All schools are being equipped in a like manner.

### Listen to Algiers

ON some evenings, when conditions are favourable, broadcasts from Radio Alger on 363.6 metres, or just above Mühlacker, can be well received. It will be worth your while to turn to this station from time to time for interesting programmes, as, notwithstanding many difficulties, it transmits now and again concerts from Oran and Constantine, and will shortly link up with Tunis, Rabat and Casablanca. As the power of European stations is now on the increase, the Algerian authorities fear that their transmission may not be well heard in France, and propose to replace the present station by something much more substantial.

### Japan's Broadcasting System

ALTHOUGH Japan was comparatively a late-comer in respect to broadcasting, since 1930 the system has rapidly developed, and at the end of 1932 the country possessed over one and one half million listeners, of which some 600,000 alone reside in Tokio. (As a comparison note that Paris does not number more than 350,000!) At present Japan possesses 10 kilowatt transmitters at Tokio, Hiroshima, Sapporo, Nagoya, Kumamoto, Osaka and Sendai with a network of some fifteen smaller relays scattered over the country. There are two stations at Taihoku (Formosa), one at Dairen (Manchuria), and a 1 kilowatt transmitter at Keijyo (Chosen).

### B.B.C. Autumn Play Programme

FOR the autumn drama festival the B.B.C. has selected a number of new plays which include *The Use of Man* (Lord Dunsany); *The Mulberry Bush* (E. M. Delafield); *Tickets, Please!* a new musical production, and *The Game* (Philip Wade). The festival will cover the months of October, November and December, during which period twelve plays will be revived. *Danger* (Richard Hughes), one of the first dramas broadcast, will be followed by Reginald Berkeley's *The White Chateau*; *Pursuit* (Cecil Lewis); *Kaleidoscope* (Sievekking); *Carnival* (Compton Mackenzie); *Matinee* (Lennox); *Obsession* (D. Glasby); *Red Tabs* (Val Gielgud); *Romance* (Conrad); *The Path of Glory* (L. du Garde Peach), and a microphone version of Dumas' *The Three Musketeers*. Listeners may look forward to some pleasant autumn and winter evenings.

# THE CATKIN VALVE—1

## Details of the New Unbreakable Metal Mains Valves

THE new Marconi-Osram Catkin Valves are now available to the public, although all details concerning its construction, its characteristics, and its methods of manufacture were passed to us in confidence over seven weeks ago.

The first set of Catkin Valves to be released to the Press were handed to me by an official of the General Electric Company, Ltd., and I have therefore had sufficient time to submit the valves to a thorough test. I have not designed a special receiver round them for the purpose of my tests, for the all-sufficient reason that no special receiver is necessary. The Catkin Valve is a mains valve of the four-volt class. It employs a standard base, and therefore it may be tested in any standard receiver, and another great advantage is that the reader already possessing a mains set may change over the Catkin Valves at a total cost of valves only. The reader should not be misled into thinking that a special receiver must be built to accommodate them.

### Why Catkin?

The form of construction adopted for the Catkin, namely, a copper container in place of the customary glass globes, has been used for transmitting valves for a considerable time. This container or envelope forms the anode, and because in the transmitting valve this is water cooled they are designated "C.A.T." (cooled anode transmitters), hence the derivation of the name Catkin. The Catkin receiving valves are almost entirely constructed of metal. It will, therefore, at once be obvious that this will result in vastly greater strength, freedom from microphonics, smaller size, and most important of all, the valves can be mass produced to almost identical characteristics, which, of course, is not possible with a glass pinch.

The illustrations on the following page indicate that the grid and cathode follow the design of the latest glass valve type, but the method of assembly differs considerably. Owing to the elimination of bends and wells in the wire supports greater rigidity results. The electrodes are anchored together at the correct distances by mica spacing pieces which permits of considerable accuracy in the spacing of the elements. As every reader knows it is on the spacing of these elements that the uniformity of characteristics depends.


*The new Catkin valve. Note the metal envelope, which forms an air-cooled anode. This illustration shows type V.M.S.4.*

Another important point is the entire absence of electrostatic charges. With a glass valve one may touch the glass globe and set up microphonics and mains hum and the remedy is to use a metallised valve.

### Screening

The exterior of the Catkin valve being of metal also forms the anode or plate. This is totally screened by a metal tube extending the full length of the valve and embracing the valve cap. Dissipation of heat is ensured by the vents cut in the outer casing which is connected internally to the valve cathode terminal. Full advantage can thus be taken of the effective cooling afforded by the exposed anode which enables the rating of an output valve to be increased as compared with a glass valve. Readers will have noticed that in an orthodox valve the out-going leads are secured in a flattened glass portion (the pinch); the glass, therefore, will act as a dielectric and give rise to inter-electrode losses, and is really equivalent to a high resistance connected in parallel across the associated tuned circuits. With the introduction of Iron Core tuning coils and permeability tuning such a loss may impair the efficiency which results from this special tuning arrangement. It will thus be agreed that the substitution of mica for glass and the method of clamping the supporting wires together with the rigid clamp consisting of a steel clamping which locates the mica insulating pieces is an entirely new departure in valve construction. The only glass used in the Catkin is that used as an insulator for bringing the wires out at the base of the valve, but in this case the leads are spread out around the circumference, and thus have ample spacing between them. Another feature is the flexible mounting of the valve in the cap carrying the pin connectors. Formerly the connection was rigid, whereas the Catkin is held in a rubber ring and the out-going leads pass into a thin bakelite cap carrying the valve pins. This is bound to reduce the possibility of the valve being microphonic. Further, the limiting factor which governs the rating of a valve is its operating temperature which is responsible for the release of gas, but the generous air cooling of the anode prevents such trouble in the Catkin, and also effectively cools the grid, minimising the chance of gas generation. Another advantage of the Catkin is its compactness and durability. It is smaller than a glass valve, and will enable sets to be constructed much smaller in size. Because of the metal construction the valves can be placed much closer together.


*Catkin M.H.4. Catkin M.S.4.B. Catkin M.P.T.4.*

By F. J. CAMM

Four types of A.C. mains Catkin valves are at present available, and the characteristics follow those at present possessed by the corresponding glass valves. These valves incorporate the latest type filament cathode design. The types (all preceded by Catkin) are the MS4B, VMS4, MH4 and MPT4. These are current types, and it is thus possible to design a receiver using Catkin valves throughout. It is the intention of the manufacturers (the Catkin has been produced jointly by the General Electric Company, Ltd., and the Marconi Company Ltd.) to apply the Catkin principle of design to other types for which there is a popular demand. Where output valves are supplied without the metal shield, the anode is fully protected by heat resisting and insulated enamel, the screen grid and detector valves are also available in this form.

I shall give further details of the Catkin Valve next week.

*(To be continued)*

*Sir Ambrose Fleming with his original valve, and one of the Catkin valves.*

# IMPROVING YOUR "EARTH"

## A Practical Article Explaining How to Get the Best Results from an Aerial-Earth System

By ERIC JOHNSON

MODERN receivers in general are so efficient that one is apt to forget that their performance may be made or marred by the aerial-earth system. It is really extraordinary what pains are taken in the erection of a good aerial, whilst the earth connection may be anything from a household poker to a tin-can. A little extra time spent on this very important adjunct will amply justify the trouble.

It is hardly necessary to remember that the wire to earth should be as short as possible, and the earth lead itself of wire at least as thick as the rest of the aerial system; furthermore, this wire should be insulated up to the point of entering the earth. So many listeners use bare wire for this purpose, and are surprised at the flat tuning which often results owing to the many semi-conducting paths so formed. This is where the popular water-pipe earth fails unless we can be assured of a short path to earth. Exactly the same applies to gas-pipes, which in any case are certainly not recommended mainly because of non-conducting joints, and also owing to the possibility, however remote, of fire. Bearing these points in mind, it can be seen that the best earth of all is undoubtedly an outside one.

*Fig. 1.—A cheap, simple, but very efficient earth.*


### Earth Tubes

There are a number of earth tubes on the market, all of which can be confidently recommended if driven into moist soil. It cannot be said, however, that the contact resistance is as low as it might be. This is certainly a strong point in favour of a buried copper plate, for it is surface area which counts. Copper being expensive, resource must be had to zinc or any other moderately non-corrosive metal. The so-called "tin" household articles are galvanized or zinced (to coin a word) iron, and will serve our purpose if large enough. An old bath immediately suggests itself and will answer our need excellently. It is little use going to all this trouble if the soil itself is dry or sandy. If we are so unfortunate as to be in this position, means must be found for remedying same. Sandy soil is a very poor conductor, but much can be done to improve matters by digging a pit and packing the tube or plate around with a mixture of coke and soot, both of which are comparatively good conductors; the idea may be gathered from the diagram, Fig. 1. Even this will not produce anything like the best results if the ground is more or less permanently dry; it is always wise, therefore, to make a habit, at least in the summer, to periodically water the surrounding soil. Most, if not all, earth tubes are hollow with perforated sides, which allows of pouring water inside when occasion demands. A good plan is to leave a large funnel in the top of the tube; this not only facilitates watering, but also gathers rain-water.

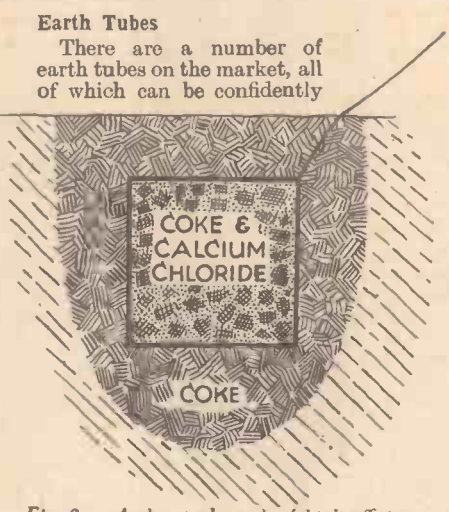
Some soils dry very quickly, and it is somewhat of a problem to keep the earth connection damp. It is for this reason that during the last year or so percolative earths have come very much to the fore. The underlying principle in all of them is the same, a conducting container filled with a hygroscopic substance. This latter has the peculiar property of extracting moisture from its surroundings. Thus we are assured of our earth being permanently damp.

A container, preferably of copper, should be obtained and a series of small holes drilled around the circumference. It is now only necessary to pack this with some kind of hygroscopic substance; to make the device still more effective, both the inside and outside of our percolative earth should be packed with coke. Fig. 2 shows the general principle. One of the most efficient chemicals to use for the inside is known as calcium chloride. This substance is so hygroscopic that it is impossible to keep it in the solid state for any length of time. It is doubtful, therefore, whether the average chemist would stock it, but luckily it is quite an easy job to make this at home with nothing more than household odds and ends and a little patience. The first stage is to obtain some ordinary chalk or marble. This should be crushed to a powder and hydrochloric acid ("spirits of salt") cautiously added to it. There will be an immediate evolution of gas, and more acid should be added until the chalk or marble is completely dissolved. For those readers who remember chemistry the following will explain the reaction:—

$$CaCO_3 + 2HCl = CaCl_2 + H_2O + CO_2$$

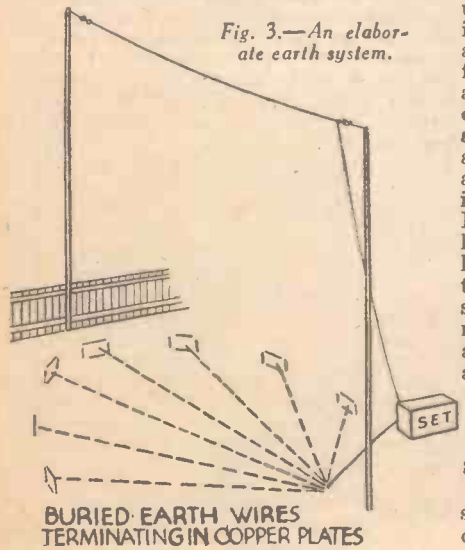
We are thus left with a solution of calcium chloride. This should be evaporated down to the dry state and then immediately mixed with the coke and packed tightly into our container. It will be as well to add that should our earth be made of zinc it is essential that all the acid should be completely neutralized, otherwise there will be very rapid corrosion. A percolative earth made according to the above will keep permanently damp under the worst conditions.

*Fig. 2.—A chemical earth of high efficiency.*




For those who have the necessary space a buried wire earth can be very effective. No earth plate or tube is used at all. Instead of which a number of wires are buried a few inches below the surface of the ground immediately below the aerial and radiating out in all directions. This earth may be made still more efficient by terminating the wires in buried copper plates, as shown in Fig. 3. One more type of earth is sometimes used, the counterpoise. This is somewhat similar to the one just described. No contact is made with the earth, and the arrangement is erected six to ten feet above the ground, as in Fig. 4.

*Fig. 3.—An elaborate earth system.*



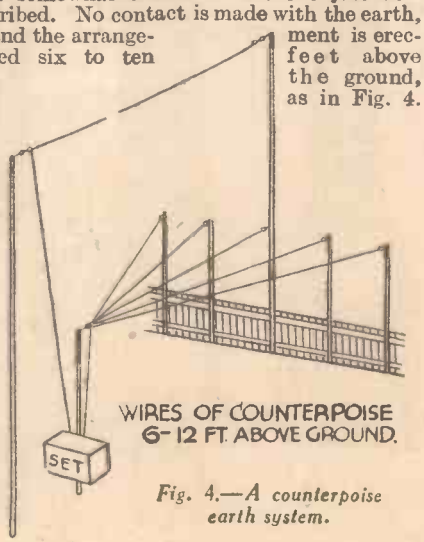




*Fig. 4.—A counterpoise earth system.*

# Range & Realism in Reproduction

A Talk on the Frequency Range of Various Musical Instruments and How Circuit Design Affects Reproduction. By W. J. DELANEY.

ZOOMP! Zoomp! Zoomp! goes the double-string bass. Zing! Zing! goes the cymbal. These are two items which are to be heard in practically any dance band, but which are hardly ever heard on the majority of broadcast receivers. You might say that you *can* hear the cymbal on your set, or perhaps the string bass, but whilst admitting that this may be true, do you hear them in their correct proportion compared with the remainder of the instruments? Look at Fig. 1. This is a chart which shows the range of frequencies produced by the majority of average musical instruments and voices. It will be seen that it is fairly extensive, but it gives only half the story. I do not wish to give any facts which will bore my reader, but there are certain things which must be explained if you are to understand the problem which is placed before your loud-speaker when you set it the task of reproducing the transmission which is received by your aerial.

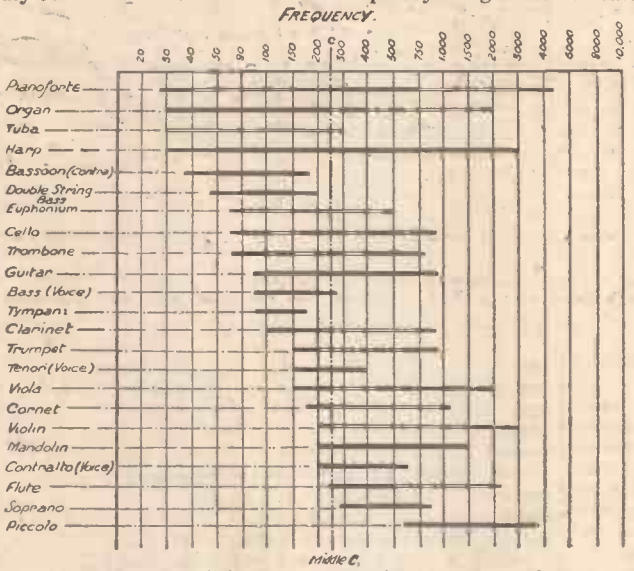



*Fig. 1.—The ranges of different musical instruments and voices.*

### Fundamentals and Harmonics

This looks a rather formidable heading for a paragraph, but actually there is nothing at all frightening in it. The central note on a piano keyboard is known as middle C. This is a note which vibrates at a frequency of 256 per second. If, however, this same note is played by the violin it vibrates at the same frequency, yet there is a distinct difference, and it is easily possible to distinguish between the two instruments. Why is this? The note has the same period of vibration, and a string forms the note, why then should there be a difference? The answer lies in the word "harmonics." When the middle C of the piano is struck the string emits, in addition to its standard note (known as the fundamental) multiples of this frequency which you can imagine as octaves. That is to say, the real note is produced by the frequency of 256 cycles, but there is also a vibration of double this, or 512 cycles, 768 cycles, and so on right up the scale. These multiples are termed "harmonics," and it is these, as distinct from the original vibration—or fundamental—which are responsible for the tone of the instrument, or what is known in technical language as the "timbre." The harmonics may extend so far in the audible frequency range as 20,000 per second, but—here is our first snag—the broadcasting stations of Europe are permitted to work with a separation of only 9,000 cycles. Our receiver must, therefore, to avoid interference between stations, be arranged with a circuit whicy will cut off at 9,000 cycles, and consequentlh no harmonics above this will be heard. What difference this can make may easily be demonstrated by carrying out the following test on your own receiver.

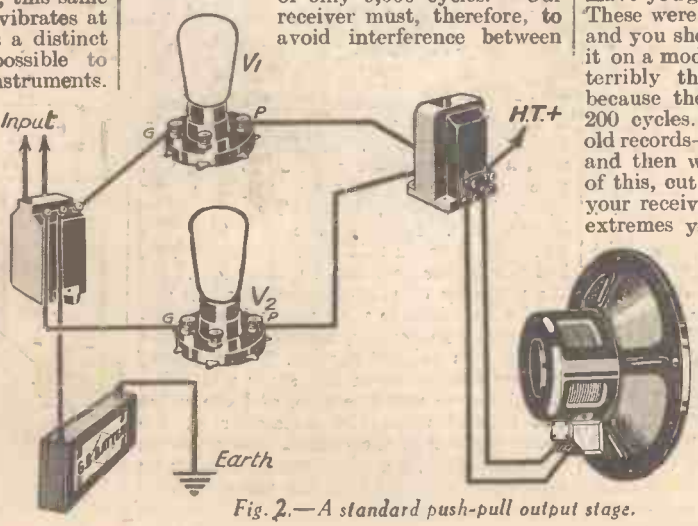



*Fig. 2.—A standard push-pull output stage.*

### High-Note Loss

With the average receiver all that is necessary to observe the effect of high-note loss is to turn up reaction to the limit before oscillation is reached. The quality of music suffers, but what is more noticeable is that speech becomes "woolly"; a violin sounds more like a 'cello, and similarly other instruments begin to lose their identity. A special record was once reproduced by the B.B.C. during a talk in which a violin, piano, and euphonium played the same note, and the higher frequencies were eliminated step by step until a point was reached where there was no distinction between the three instruments. So much, then, for the higher frequencies. When we come to the lower notes there is not the same need for idealism, but accompaniments in dance bands are principally on the larger instruments such as double-string bass, tympani, etc. The depth of a band is completely lost by failure to obtain these instruments with their correct balance. Have you got any old gramophone records? These were very deficient in the low notes, and you should try and obtain one and hear it on a modern gramophone. Music sounds terribly thin and lacking in life, simply because there is no response below about 200 cycles. If you can get one of these old records—preferably of a military band—and then when you have heard the effect of this, cut down the top note response on your receiver by the reaction method, the extremes you obtain should be enough to convince you that to obtain realism it is essential that the lowest *and* the highest frequencies must be reproduced, and the following notes show the principal causes of lack of both of these and how the failing may be corrected or compensated for.

### Getting Bass

It is almost safe to say that,

(*Continued on page 386.*)

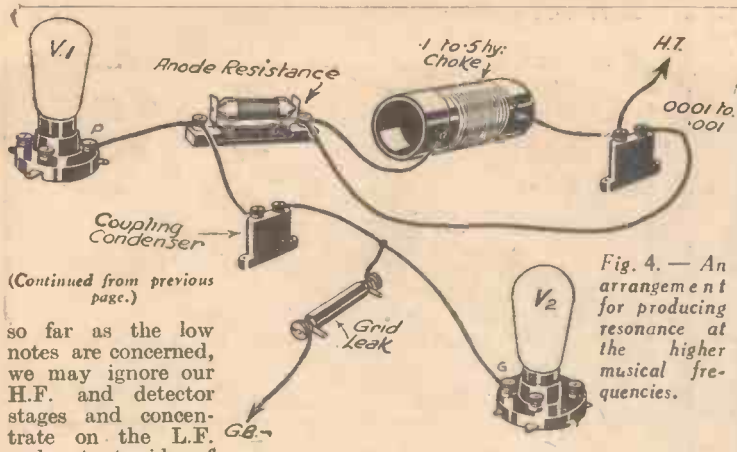



*Fig. 4. — An arrangement for producing resonance at the higher musical frequencies.*

(Continued from previous page.)

so far as the low notes are concerned, we may ignore our H.F. and detector stages and concentrate on the L.F. and output side of our receiver. I will start at the loud-speaker, as this is the weakest link in the chain. Obviously, if we are anxious to reproduce the lowest frequency transmitted by the B.B.C. we must use a moving-coil loud-speaker with a correctly-designed valve. It is hopeless to expect to reproduce a thirty-cycle organ note, for instance, on a moving iron loud-speaker; and this part of the subject has already been dealt with by me in the articles entitled "Loud-speaker Design," published in these pages. I must therefore simply state here that a good moving-coil speaker and an efficient baffle are the starting-off point. The output valve should *not* be a pentode, if you are searching for idealism. Two super-power valves (each with an impedance not higher than 3,000 ohms), arranged in push-pull, with a correctly-matched output transformer, will deal with the largest of grid swings, and obviously mains valves with 40 or 50 volts grid bias will be sufficient for domestic requirements. The principal points to watch are—large grid bias and correctly-matched output transformer. As an input transformer is required for push-pull working, this must be of high quality to avoid loss of bass, and preferably resistance-fed to avoid saturation of the core. If the coupling condenser has a value of .1 or .2 mfd. a slightly resonant circuit is formed, and assists in the maintenance of a straight line down to the bottom of the scale. Fig. 2 shows the circuit arrangements so far described, and the next problem is the supply for this stage. I personally would not recommend a further L.F. stage if you are out for idealism. A detector, operating on the power-grid principle, will fully load the output valves and will give practically straight-line results.

**The Detector.**

There are three methods of detection—anode-bend, grid leak and power grid. Without going into figures, it can be definitely stated that anode bend is the ideal method *provided* a sufficiently powerful signal is supplied to the detector valve. Power grid is next and ordinary grid leak last in the order of quality detectors. The grid condenser is responsible for the slight failing of the two latter forms of detection, and this is due to its impedance varying at different frequencies, and also its ability to deal accurately with transients. These are sudden changes and are typified by such items as cymbal crashes, pistol shots in radio plays, and other similar "sudden" noises. The condenser is unable to respond to these quick changes and rounds off the effect, and also has a different resistance for various frequencies. Its absence in the anode-bend detector accounts chiefly for the good response given by this method of rectification, but in power grid detection the value of condenser used is so small—usually of the order of .0001, that its effect is not too bad. The ideal receiver should, therefore, employ power grid detection, or a grid leak and condenser of such a value that the particular valve which is employed works on the correct part of its curve. To avoid distortion due to the presence of H.F. currents in the L.F. stage, an efficient H.F. filter must be provided in the anode circuit of the detector valve. Fig. 3 shows the best form for this, and provided a good make of choke is employed, the filtering is sufficient for normal requirements.

**H.F. Stages and Top Notes**

There only remains the question of the H.F. part of the receiver, and as the principal requirement of the detector is that it should be fully loaded, the H.F. stage will depend upon your situation. Obviously, close to a regional station, less H.F. amplification will be required than for the reception of Rome. One efficient variable-mu stage should enable the English stations to be received in this country with high quality, but the foreign stations will naturally not be of quite the same standard. As selectivity will be required, we enter the field of top-note response, and the first point is therefore not to utilize too selective a tuning arrangement. Band-pass tuning, with a correct square peak of 10 kc/s, will give adequate high-note response for domestic purposes, but will not prevent heterodynes. Reducing the peak to 8 kc/s will help to avoid this form of interference, but the higher harmonics will be lost. On the majority of transmissions the loss will not be sufficient to spoil musical reproduction, and we may say, therefore, that from 8 to 10 kc/s is good enough. The choice of by-pass condensers in this stage will affect the high-note response also, and the value will depend upon the remainder of the characteristics of the circuit. Experiments should, therefore, be conducted with different values to find the most suitable for the particular range of response desired.

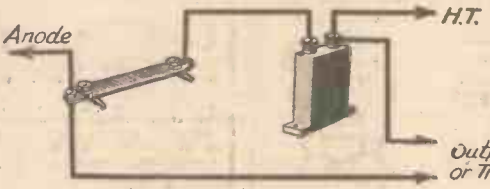



*Fig. 6.—Reducing top-note response*

**Tone Compensation**

Much can be done with a receiver to improve response by arranging tone correction circuits, and this is a most exhaustive subject, and will only be briefly touched upon here. High notes may be strengthened by resonant circuits in the L.F. stages, a resistance in series with a condenser being joined across the transformer primary or the output choke. Bass response may be improved by arranging a resonant circuit in a parallel-fed transformer stage, the fixed condenser used for coupling being chosen in conjunction with the impedance of the transformer primary. A reduction in the high-note response (especially in the case of a pentode valve) will enable the lower notes to appear more prominent. These methods are illustrated in Figs. 4 to 6. I hope I have said sufficient to enable the reader to endeavour to improve the range of his response, and I am sure he will find in this subject the source of many hours of interesting experiment, all leading to better radio.

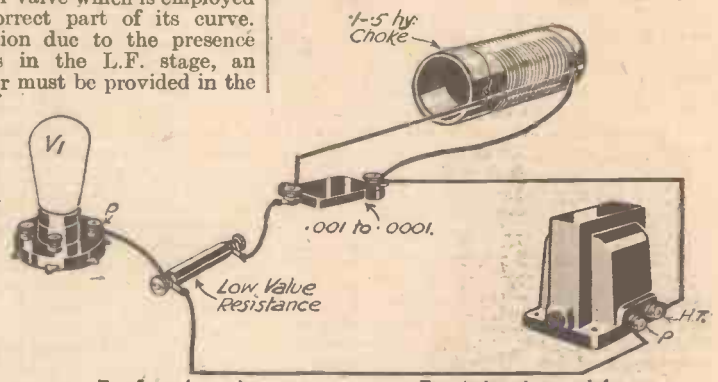



*Fig. 5.—A similar arrangement to Fig. 4, but designed for Transformer coupling.*

**Loud-speaker Characteristics**

When choosing the loud-speaker it must be remembered that the response curve may not be perfectly straight. For instance, some speakers are designed especially for the reproduction of gramophone records, and therefore, have a very definite cut-off at the higher frequencies in order to reduce needle scratch. The design of the actual receiver or amplifier must, therefore, be arranged to work in conjunction with the actual loud-speaker which is in use, or a speaker chosen which has a straight-line response from the lowest to the highest frequency which it is desired to receive.



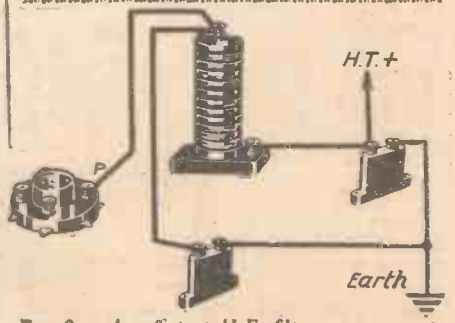



*Fig. 3.—An efficient H.F. filter arrangement*

# A SIMPLE DISTRIBUTOR SWITCH

## How to Construct a Useful Device for Controlling Three Loud-speakers.

THE more simple a wireless receiver is to control, the more enjoyment one can get out of it. Likewise, the fewer wires and odds and ends external to the set, the more it is appreciated by the "weaker" sex.

The simple multiple switch described in this article is the outcome of (1) a desire to listen to various items from the programmes whilst in my workroom, or in the garden, without depriving those in other parts of the house of their regular supply; (2) another desire to eliminate all connections and disconnections when changing over to other rooms; (3) still another desire to have any two speakers at normal strength, working at the same time, thereby necessitating series wiring by means of a suitable switch.

After several experiments, I eventually overcame the difficulty by constructing the "gadget" to be described, which makes change-over operations a very simple matter.

A glance at Fig. 1 will show the layout of the panel, which can be made of either ebonite or a piece of well-seasoned wood, well shellaced, or french polished, back and front.

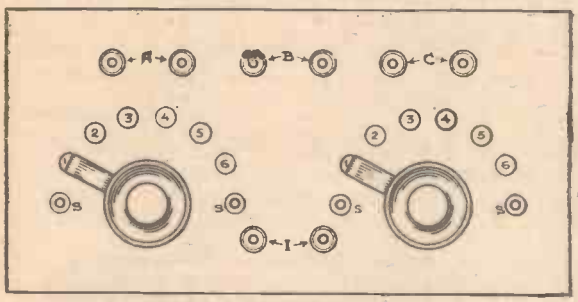



*Fig. 1.—The panel arrangements.*

### Preparing the Panel

Having decided on the material, cut a piece measuring 8in. by 4in. by ¼in. thick, and if you decide on a panel of wood, do all shellacing or polishing at this stage. Now set out the panel, and drill according to the layout at Fig. 3, which may be used as a template.

The twelve contact studs should now be mounted, and care should be taken to make each one very firm. Then with either a file or a piece of emery cloth held round a block of wood, clean up the contact surfaces, and bring them all to the same level, carefully cleaning away all filings and metal dust between each stud when the job is finished, otherwise, short circuits or leaking are almost certain to crop up when the switch is in use. The four stop pins should now be mounted in the holes marked "S" and eight terminals in the holes A B C and I. We are now ready for the switch arms. These should, if possible, be obtained complete with panel mounting bushes of brass, as a much neater and more efficient job is thus assured. Mount the bushes, and before screwing the nuts down, place a piece of sixteen gauge wire, bent to the shape shown at Fig. 4, over the protruding end of the bush, then tighten up so that the wire rests near the panel. The use of these short wires will be seen at the wiring stage. Insert the switch arm spindle, and secure at the underside by means of spring washers and lock-nuts so that an even pressure is exerted on each stud.

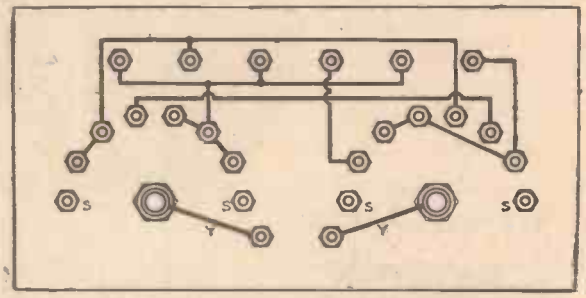



*Fig. 2.—The wiring diagram. The leads Y are referred to in text and Fig. 4.*

### Making the Connections

That completes the assembly of the panel, and the wiring can now be done. This is very simple, and if the diagram at Fig. 2 is followed, it is impossible to go wrong (this diagram represents the panel from the underside). Sixteen gauge wire will be found most suitable. The two wires we attached to the bushes will be seen connected to the terminals I, as this eliminates the use of any flex, so that nothing can go wrong once the switch is boxed in. This can be done in any way that most appeals to the constructor. A simple container is, however, shown at Fig. 5.

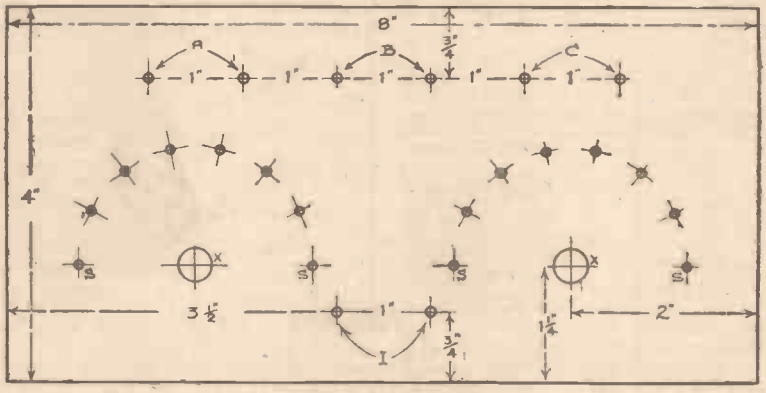



*Fig. 3.—Drilling dimensions.*

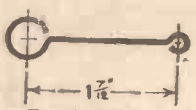



*Fig. 4.—Wires Y of Fig. 2.*

The component is now complete and can be secured in its permanent position, and this should preferably be somewhere near the set. External wiring should now be carried out. Twin leads should be run from each pair of terminals A B C to the loud-speaker points in the respective rooms. "A" will no doubt be the room where the set is installed, and suitable terminals should be provided at the various points. Remember to keep all leads as short as possible—many yards of wiring can often be saved by a careful survey in advance of actual wiring—and use care in stapling or you may either short or break your wire, a fault not too easy to discover. All that remains is to connect the L.S. terminals on the set to the terminals I on the switch. If you are lucky enough to possess three speakers, connect one at each point, if only two connect up at the two points most used, shorting any points not connected. Assuming that the set is switched on and everything O.K., you can now control any speaker from the set end. The relative switch positions are easy to follow, as whatever combination of speakers is being used, the two switch arms are in similar positions. Reading clock-wise, and calling the bottom left-hand stud on each switch No. 1, the second No. 2, and so on, the readings and combinations are as follow:—

| | | |
|---|---|---|
| Both arms at | No. 1. | Reception at Room A. |
| " " " | No. 2. | " " " B. |
| " " " | No. 3 | " " " C. |
| " " " | No. 4. | " " Rooms A & B |
| " " " | No. 5. | " " A & C |
| " " " | No. 6. | " " B & C |

It is advisable with an ordinary battery-operated set, to use either a transformer or choke filter output, otherwise the demand on the H.T. battery may be found somewhat excessive. With mains-driven sets, however, such output is essential in order to avoid possibility of shocks through contact with unprotected metal on the switch.

The advantages of constructing this little component are many. For instance, you may be busy near the set and someone else is in another room, also busy, when an important item is announced. You just switch over to No. 4.

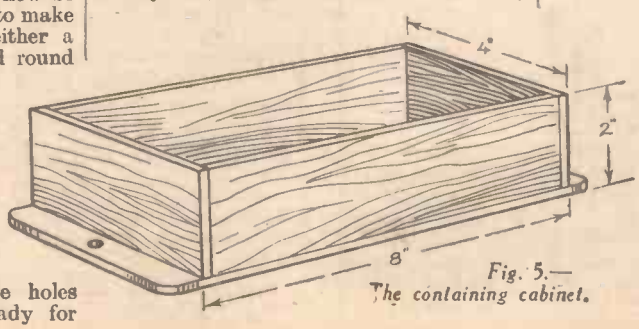
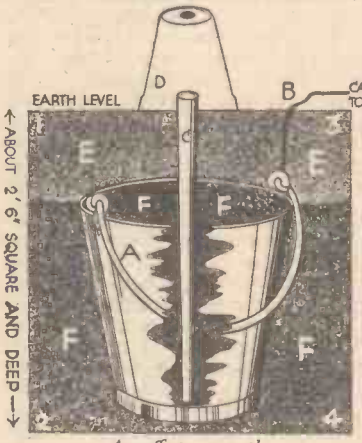



*Fig. 5.—The containing cabinet.*

# The HALF-GUINEA Page — READERS' WRINKLES

### An Efficient Earth

AFTER a long period of experimenting, I have found that the earth system, shown in the accompanying sketch, has a very low resistance, is cheap, and has an extremely long life. The sketch is more or less self explanatory, but there is one

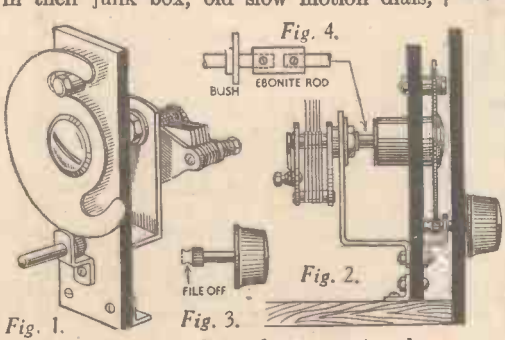



*An efficient earth*

important point which needs emphasis. If maximum results are to be obtained the lead from the set must be well soldered to the pail. Being galvanized, this is best done in the following manner. Pierce a hole just below the rim, and thoroughly tin all round same inside and outside, using spirits of salts. After this operation, well clean with strong soda water so that no trace of spirit is left. After cleaning the bared end of the cable for about six inches, twist it in and out of the hole and well solder, using plain resin. Pack the pail with broken coke and cinders and place a layer of the same materials at the bottom of the hole. Lower the pail and pack all round with the same mixture. Place a piece of wire netting over the pail which can then be filled with water. In very dry weather, water can be poured down the tube.—C. F. CATHERY (Wimbourne).

### Slow Motion Device for Reaction Condensers

THE accompanying sketches show a useful slow motion device for a reaction condenser. Most constructors have in their junk box, old slow motion dials,

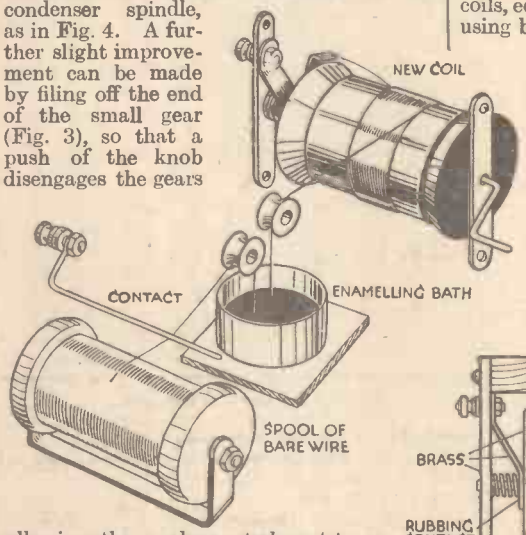



*A slow motion device for reaction condensers*

### THAT DODGE OF YOURS!

Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS." George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

which will answer the purpose. Strip the gears from the old dial and assemble the parts as shown in Figs 1 and 2, the centre portion of the large dial being reversed. It is necessary to slightly countersink the end of the bearing to insure a good fit. Of course, it is essential that the moving plates be earthed, unless a bush and ebonite rod is inserted on the condenser spindle, as in Fig. 4. A further slight improvement can be made by filing off the end of the small gear (Fig. 3), so that a push of the knob disengages the gears



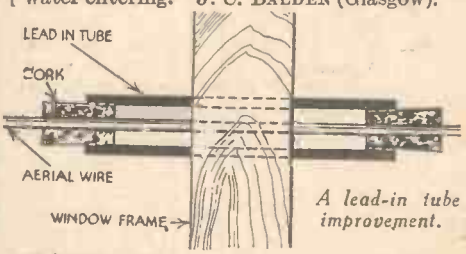

allowing the condenser to be set to any degree and left without any danger of it being accidentally turned.

The main bracket can be made to individual requirements and the small gear set at any point of the circumference of the large gear, not necessarily at the bottom. This latitude gives the constructor a wide choice in arranging the position of the knob and at the same time allows the condenser to be offset if other components are in the way.—H. A. SANDERS (Highgate).

### Lead-in Tube Improvement

EBONITE lead-in tubes as commonly used require frequent attention in order to keep the contact under the wing-nuts clean and prevent loss of signal strength. Loss of efficiency from this cause can be avoided by detaching the wing-nuts at each end, extricating the brass rod running through the centre, and then passing the aerial wire through the hole direct to the set, thus preserving the continuity of the wire and eliminating all trouble from this source.

If the lead-in tube is of a large enough inside diameter a small rubber cork with a vent hole running through the centre, such as fitted to some types of accumulators, can be threaded on the aerial and pushed into the hole to prevent draughts or rain-water entering.—J. C. BALDEN (Glasgow).

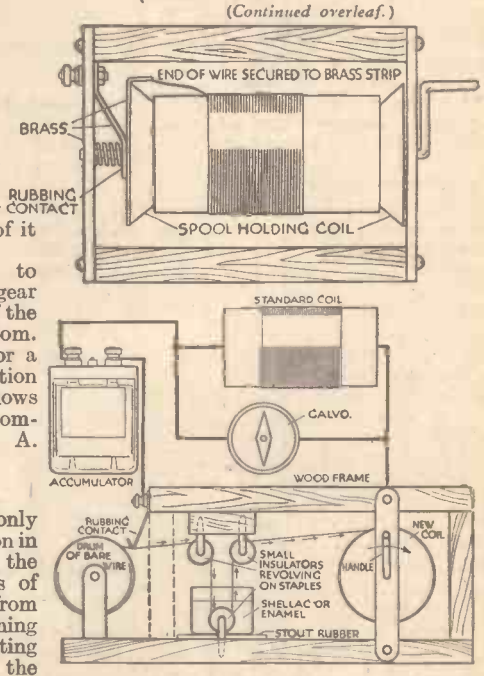



*A lead-in tube improvement.*

### Balancing Coils

THE accompanying sketches illustrate how I have made and balanced several coils, equal in resistance to standard ones, by using bare wire running through a tin of shellac. If a brush is used as a guide on the coil being wound, a neat job will be the result. It is necessary to put on at least three-quarters of the windings before placing the galvanometer in circuit, as a big kick would damage the needle. When the galvanometer needle is steady at zero, the wire should be cut at the sliding contact point. This method is not suitable for gauges below 40, owing to the tension required in winding.—ROBERT E. SINFIELD (Manor Park).

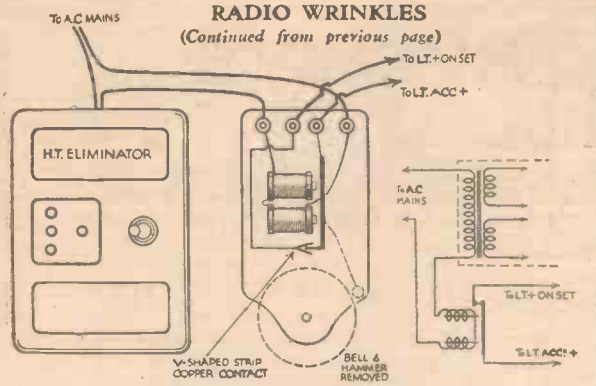
(*Continued overleaf.*)




*Diagrams showing how coils may be balanced.*

## RADIO WRINKLES

(Continued from previous page)



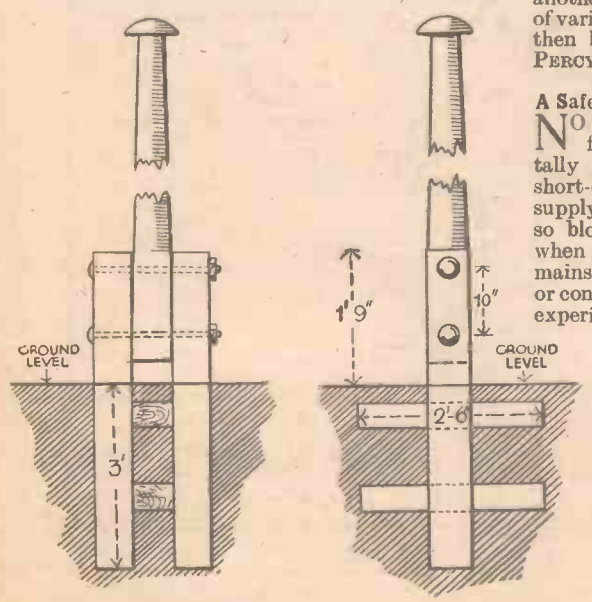

*An automatic L.T. switch.*

### An Automatic L.T. Switch

WHEN a battery type of set is worked from the mains through a mains unit, it is not always convenient to remember that the push-pull filament switch must be worked as well as the mains switch for H.T. I accordingly devised the idea shown above. An old electric bell was handy, and the striker of this was broken off, and the gong removed. The adjusting screw was then arranged so that when a current was passed through the windings, the vibrating arm was drawn down and made a very firm contact on the screw. The terminals of the bell were then joined in series with the input leads to the eliminator, and the result is that the push-pull switch in the L.T. circuit may then be pulled out and ignored. When the mains switch is operated the current flowing through the bell draws down the arm and the L.T. circuit is completed through the two leads A and B, which are connected to the arm, and the contact screw. This device requires no adjustment and works very nicely.—L. GREENSMITH (Leeds).

### Erecting An Aerial

A GOOD deal of the trouble often experienced with broken aerials can be avoided if some means are provided for easily lowering the aerial when necessary. The accompanying sketches show a simple arrangement that will enable a mast to be lowered in a few minutes. The materials required are two pieces of 4in. by 3in. wood 4ft. 9in. long; two pieces 2ft. 6in. long; and two ½in. bolts 10½in. long. The crosspieces are nailed between the uprights, in the position shown, to provide a firm anchorage in the ground. The two bolts hold the mast in place, the lower one acting as a pivot when the mast is lowered. T. HAYWOOD (Birmingham).

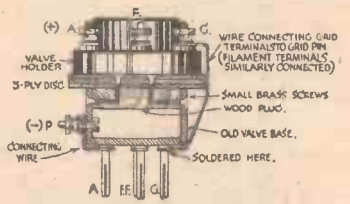



*A useful hint for erecting an aerial.*

### A Split-Anode Adaptor

WHEN making valve tests with a milliammeter, I have hitherto been in the habit of breaking connections in the set, but at last came to the conclusion that a split-anode adaptor would be very useful. I therefore evolved the simple gadget illustrated in the accompanying sketch. I purchased a small valve-holder for sixpence, found an old valve, and built up an efficient adaptor in the manner shown.

The base of the old valve is cleared out, and a small terminal (P) inserted in the side in line with the anode-pin. The wood plug and disc enable the valve-holder to be attached, and connections are made, as shown, with soldered joints to the valve-pins. The grid and filament pins are



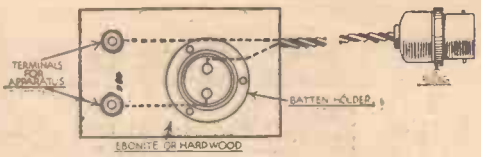

*A novel method of making a split-anode adaptor.*

connected directly to the respective terminals of the valve-holder, but the anode-pin is connected to the side terminal P, which now becomes the negative connection for the milliammeter, the A terminal being the positive.

By cutting down the height of the valve-base to a minimum a very neat adaptor may be made. If desired, the grid connection may also be "split" by inserting another side terminal, and the effects of various values of grid-stoppers can then be very conveniently tried.—PERCY J. FOSTER (Cardiff).

### A Safe Connector for the Mains

NO great harm is likely to result from accidentally causing a short-circuit on the supply mains, and so blowing a fuse, when testing the mains for polarity, or conducting other experiments with the supply. The annoyance attendant on this accident can, however, be avoided with the aid of the simple device illustrated. On a small




*A safe connector for mains use.*

ebonite or hard-wood panel mount a standard electric light batten holder, and also two terminals, spaced well apart. Connect a length of lighting flex as shown, taking one lead direct to a terminal, and the other through the connections of the lamp-holder to the other terminal. Fit the other end of the flex with a socket adaptor or a wall plug, as required. When you have an experiment to make, put a bulb in the holder, connect your apparatus to the terminals, and then plug into the mains and switch on with the ordinary wall switch. If you should happen to short the terminals accidentally, the bulb will light up in the ordinary way, and no harm will result. Note that this device affords no protection against shocks, so that the usual precautions should not be neglected.—A. V. D. HORT (Wembley).

### A Spare Speaker

A SPARE speaker for experimental purposes is often required in addition to the one in permanent use. Many of us also possess those old horn units which were popular some years ago but are now regarded as obsolete. By cutting the diaphragm as shown in Fig. 1 we can make quite a useful reed. The single thickness will be greatly improved by placing the pieces (*a*) and (*b*) on either side and clamping all three together with two 6 B.A. bolts and nuts, as shown. The operating rod is a piece of 6 B.A. screwed rod held in place in the centre hole by two nuts (Fig. 2). To facilitate mounting, the "nozzle" is sawed off as shown in Fig. 3. The cap may now be screwed direct to a crosspiece, or holes can be drilled in the back of the unit for the same purpose. It will probably be found that the arrangement shown is the more convenient.—J. H. ROWE (Dublin).



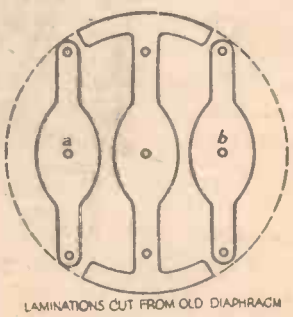



*Fig. 1.*

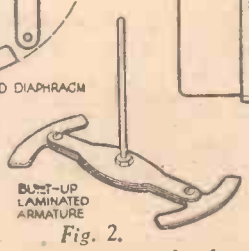



*Fig. 2.*

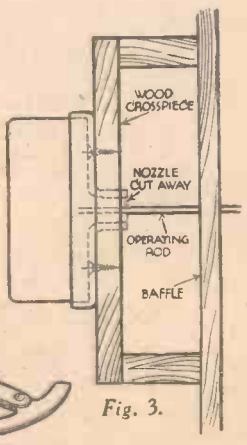



*Fig. 3.*

*Figs. 1 to 3.—Fitting up a spare speaker for experimental use.*

# ADJUSTING AND OPERATING THE RADIOPAX CLASS "B" FOUR

## Some Points to Watch when Installing This New Four-Valve Receiver and the Method of Operation

By the "Practical Wireless" Technical Staff

BRIEF operating instructions were given last week, and these will now be expanded so that those who have only just commenced the receiver will not need to refer back for hints on operation. The first and most important point is, of course, the accurate matching of each circuit. It is hardly necessary to explain how the valves are inserted, as the photographs which have appeared, and the other illustrations of the lay-out should have made this clear. In case of doubt, however, the screen-grid valve is the only one on the right-hand side of the baseboard, and the Class B valve is inserted in the seven-pin valve-holder. Of the remaining two valve-holders, the detector valve is the one nearest the panel. The accumulator is simply joined to the two L.T. leads, and H.T.+1 is tapped into a voltage between 60 and 80, whilst H.T.+2 is inserted in the maximum H.T. plug. The value of the first tapping may have to be modified, and you must wait until the receiver is working before you can tell just what voltage gives the best results. The G.B. leads are inserted in the following order. G.B.+ obviously goes into the positive end of the battery, and the lead from the potentiometer goes into the other end of the battery. The lead from the L.F. transformer is then inserted in a tapping round about 9 volts. This may have to be adjusted later on. Assuming that these voltages are all correctly adjusted, we are now ready for the preliminary test, so we join the aerial to terminal A and the earth to terminal E and rotate the combined on–off switch until we hear a click. This first part of the movement switches the receiver on, but the potentiometer is now at its minimum position and probably nothing will be heard from the loud-speaker.

### Trimming

Rotate the knob of this control a little farther, and when a slight rushing is heard in the loud-speaker rotate the main tuning knob. This is the knob beneath the window. No doubt a station will be heard as this is rotated, and if so, the loudest point should be found on this dial alone. If no station can be heard as the dial is turned through its complete rotation, advance the potentiometer control a little farther and turn through the tuning range again. Do this until you hear a station. Having found the loudest setting on the main tuning control, reduce the potentiometer until the signal almost disappears, and then carefully turn the trimmer on the top of the condenser pack nearest the panel, and see if any improvement is made in the signal strength. As soon as the signal is strengthened reduce it again by means of the potentiometer, and proceed to make a *small* adjustment of each of the remaining two trimmers. Always keep the signal as weak as possible, and if convenient take a station at the lower end of the medium waveband for this preliminary adjustment. When it is found that any further adjustment of these trimmers results in weaker strength turn to the long waves and see if any alteration is required on this range. There should be no necessity to touch anything if the wiring has been well carried out.

### Operating the Controls

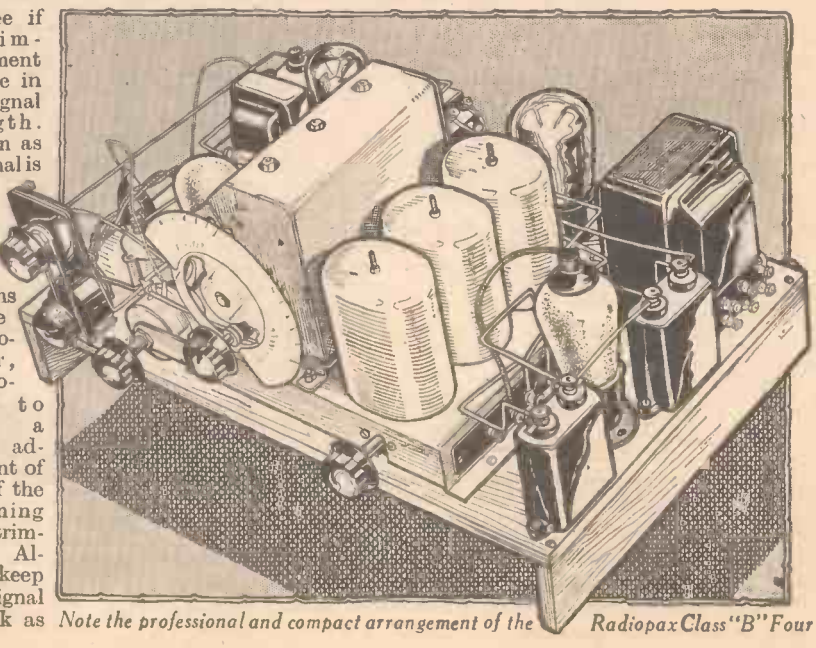
The receiver may now be said to be in its most efficient condition, and all that remains to tune in to any station is to advance the potentiometer control until the rushing noise is heard and then turn the tuning dial to the approximate position. A slight adjustment of the potentiometer and the tuning control should then enable the station to be received at good strength, and free from interference. Suppose, however, that, owing to the closeness of a local station, the desired signal is interfered with. The potentiometer should be reduced until the strength has fallen away to practically nothing, and then the reaction control should be advanced to bring back the strength. In this way it will be found that the interfering station will fade away into the background. If a desired station can only be heard faintly, reaction should be employed to bring up the strength.

### COMPONENTS FOR THE RADIOPAX B.4.

One British Radiophone Band-Pass "Radiopack" with Gramophone Switch.
Three 1 mfd. Dubilier Type B.B. Fixed Condensers.
One 2 mfd. Dubilier Type B.B. Fixed Condenser.
Two .0001 mfd. Dubilier Type 670 Fixed Condensers.
Two 1 meg. Graham Farish "Ohmite" Resistances.
One 30,000 ohm. Graham Farish "Ohmite" Resistance.
One 10,000 ohm. Graham Farish "Ohmite" Resistance.
One .0003 mfd. Graham Farish "Litlos" Reaction Condenser.
One Bulgin Standard H.F. Choke.
One Varley Type D.P. 40 Class B. Driver Transformer.
One Varley Type D.P. 42 Class B. Output Transchoke.
One Lissen Tone Control Hypernik Transformer and Resistance.
Three Clix Chassis Mounting 4-pin Valve-holders.
One Clix Chassis Mounting 7-pin Valve-holder.
One Pair Bulgin No. 3 Grid Battery Clips.
One Peto Scott Baseboard Mounting Component Bracket.
Two Belling-Lee Terminal Mounts.
Four Belling-Lee Type B Terminals—Aerial, Earth, and Pick-up (2).
One Belling-Lee 5-way Battery Cord.
Two Belling-Lee Wander Plugs marked G.B.+ and G.B.—.
One Blue Spot, Type 45 P.M. Loud-speaker.
One 220 V.S.G. Cossor Valve.
One 210 Det. Cossor Valve.
One 215 P. Cossor Valve.
One 240 B. Cossor Valve.
One Smiths 2RGN7 2-Volt Accumulator.
One Smiths Anodex 120 volt Class B H.T. Battery.
One Smiths Anodex 16.5 volt G.B. Battery.
Two Coils Glazite, Length of Flex, Screws and Sundries.

AERIAL AND EARTH EQUIPMENT.

One Graham Farish "Filt" Percolative Earth.
One "Goltone" "Metocel" Screened Down Lead.
One Graham Farish Gard Lightning Arrester.



*Note the professional and compact arrangement of the Radiopax Class "B" Four*

By
H. J. BARTON CHAPPLE, Wh.Sch., B.Sc.(Hons.),
A.C.G.I., D.I.C., A.M.I.E.E.

PART I.

# CHOOSING A CHOKE

AMONG the various types of component which go to make up a radio receiver, there is one class which seems to me to be rather neglected—namely, chokes. This may be due in part to the somewhat insignificant form of its diagrammatic representation, and in part to the fact that in many cases—though not in all—the exact value of its electrical properties is not so critical, so far as circuit efficiency is concerned, as those of, say, a tuning coil or a variable condenser.

But, however this may be, chokes of one sort and another do play rather important parts in the receiving equipment of to-day, and when it is desired to purchase one it is well worth choosing a type which is in every way suitable to the job in hand and likely to give long and satisfactory service.

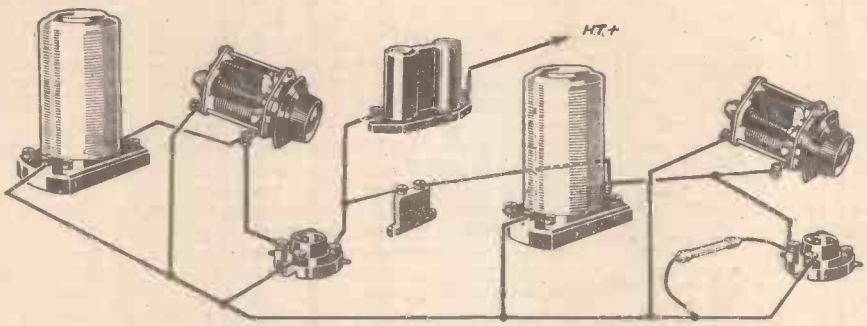



*Fig. 1.—A choke used for coupling purposes in an H.F. stage.*

**Functions of a Choke**

In order to be able to make a wise selection, however, it is necessary to understand exactly what a choke is, and what are its functions in a circuit, as well as the different kinds of chokes, which have been evolved for different purposes. To begin with, then, a choke is, essentially, a coil of wire, and its principal property, on account of which it finds application in radio circuits, is impedance. This at once calls for further explanation.

You all know that when a direct current is passed through any piece of apparatus, the value of the current flowing is limited by what is known as the *resistance* of the apparatus, resistance being the opposition which the apparatus offers to the flow of current. If, instead of passing a direct current through the apparatus, we apply an alternating current, the apparent resistance may, or may not, be the same as when a direct current was applied. If the apparatus consists of, or contains, a coil of any kind, the apparent resistance to alternating current will be much greater. In fact, it is possible to design a coil which has a very small resistance to direct current flow, but a very large apparent resistance to the passage of an alternating current—and such a coil is called a choke.

**Impedance**

Now why should a coil offer a higher opposition to alternating current than to direct current? The answer is, because it possesses the property of inductance. As the alternating current grows from its zero value to its maximum value, a magnetic field is built up in the coil and its neighbourhood, and the growth of the magnetic field within the coil *induces* another electromotive force in the coil, in opposition to that originally applied, and thus tending to prevent the original current from flowing. Similarly, when the alternating current is dying away, a back "E. M. F." is self-induced, tending to maintain the flow. The coil thus presents a different form of opposition than that due to pure resistance, although its effect is precisely similar, that is to say, it limits the value of the current. This opposition is termed "impedance," and it is measured in ohms in the same way as resistance.

One point must be made clear—every choke has, in addition to its impedance, which is only operative on alternating current—a certain amount of resistance, which is effective with both direct and alternating current. The resistance, apart from any increase owing to high-frequency effects, is unvarying in value, and depends entirely upon the length, diameter and material of the wire. The impedance, on the other hand, is not constant in value—it varies according to the frequency of the alternating current, being higher at high frequencies than at low frequencies. This is because the "back E.M.F." depends upon the rate at which the magnetic field changes, and the rate of change is, of course, greater when the frequency is higher.

It is for this reason that a choke should never be specified as a choke of so many ohms impedance, because although it is possible to measure the impedance, it is necessary to state at what frequency the measurement is made. It is customary, therefore, to specify a choke as of so many henries or microhenries inductance, for, knowing the inductance, it is possible to calculate the impedance at a given frequency. This is, however, seldom necessary on the part of the constructor, as in most set designs the correct inductance is quoted.

**H.F. Chokes**

Now let us see in what ways the special properties of chokes are employed in radio circuits. Chokes are used for various purposes in both the radio-frequency and low-frequency portions of receivers, as well as in power supply units. We will begin with high-frequency chokes. Their applications are many, but in all cases they are used primarily to "choke back" or block the passage of high-frequency currents—hence their name. For example, a choke is frequently inserted in the anode circuit of a screened grid high-frequency valve, between the anode and the H.T.+ terminal (Fig. 1), its object being to permit the flow of the mean anode current, which is naturally a direct current, but to oppose the flow of the radio-frequency variations, which are by-passed *via* the coupling condenser to the tuned grid circuit of the detector valve. Of course, it is not absolutely necessary to use choke fed tuned grid coupling—the older tuned anode circuit is just as effective, but tuned grid coupling has the advantage that the moving plates of the tuning condenser may be earthed because the coupling condenser isolates the tuned circuit from the H.T. supply.

Then a high-frequency choke is often used in the anode circuit of a high-frequency valve without a tuned grid coupling, in such sets as portables (see Fig 2). Its action is very similar to the first application except that the extra amplification obtainable with the tuned circuit is not achieved. A third use for a high-frequency choke

(Continued on page 396.)

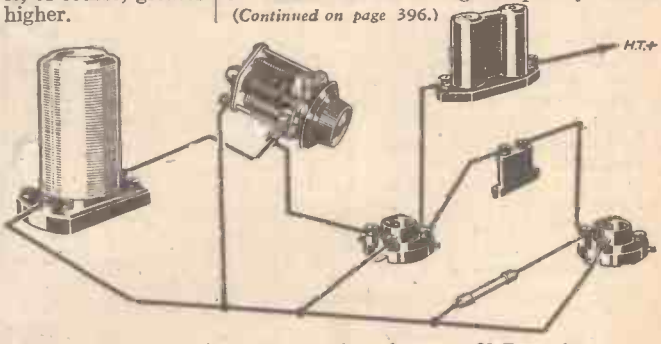



*Fig. 2.—Aperiodic coupling between H.F. and detector stages.*

# The "Py

## An Economi

## By

IN a previous article published in Nos. 19 and 20 of PRACTICAL WIRELESS I dealt in general terms with the design and construction of portable receivers of more or less standard type. Whilst the kinds of sets described are ideal for many purposes, they have the distinct disadvantages of being fairly heavy, since they weigh twenty pounds or more. Thus such sets would be of no use whatever to the hiker, cyclist, or, indeed, to anyone who has to "travel light." Moreover, from the correspondence received since the article was published it is quite evident that the simplest of the circuits suggested (a Det.-2 L.F.) has proved most popular with readers, and I have been very pleased to have letters from a few enthusiasts who have made up a set of that type with gratifying results. With the above-mentioned facts in mind it was thought fit to write further on the subject of portables, this time dealing with those of the ultra-simple lightweight kind which can really be carried about without the need for Herculean strength.

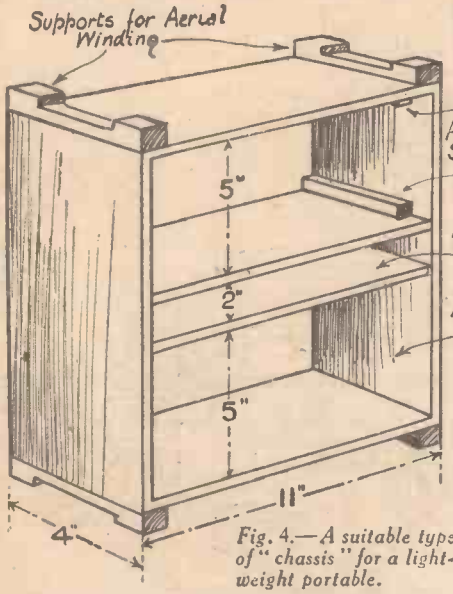



*Fig. 4.—A suitable type of "chassis" for a lightweight portable.*

There is no doubt that the lightweight portable has many uses, both for the traveller and for the experimenter, for it opens out a new sphere of interest. Besides this, such a set is invaluable to the camper who proposes to take up temporary residence away from "the madding crowd," and yet who feels that he must keep in touch with the affairs of the world. He might only require to listen to news bulletins and weather reports, but a little receiver will easily justify its existence on these grounds alone. The type of set to which I shall refer is of such a pattern that it can be made for a very modest expenditure, and, in many cases, from the contents of the junk box.

### The Requirements of a Lightweight Portable

In the first place let us see what is required of the lightweight portable. Obviously, it must be really light—certainly not weighing more than ten pounds. It should be compact and rigid and must be capable of giving good reception over distances of 100 miles or so without the use of any external aerial. The heaviest parts of the normal portable are the batteries, so we must cut down weight in this direction. That means that we shall have to be content with 60 volts H.T., and so the use of a loud-speaker is at once precluded. But a speaker would not be called for in any case, because considerations of space would not permit of its inclusion. Low tension might be derived from a small unspillable accumulator or from dry cells; the former will be better if the set is to be used for long spells, but the latter are excellent for intermittent work, and have the advantages of lightness and small dimensions. [We disagree with some of these conclusions.—ED.]

Provided we choose a good circuit arrangement, two valves will prove ample for our requirements, and these can be operated very economically.

### The Circuit

It is not proposed to offer any particular design, but, instead, to make suggestions which may be modified to suit your own ideas, so it is recommended that before commencing the construction of the actual portable a few circuits should be tried out on a rough baseboard to find which best meets with your own needs. As a basis for experiment you cannot do better than try the simple Det.-L.F. circuit shown in Fig. 1. This uses a tapped frame aerial of which one portion is tuned by the usual .0005 mfd. condenser, whilst the other provides reaction. Detection is on the usual leaky grid principle, and the two valves are coupled together through a small L.F. transformer. The second valve is of the "L" type—this is better than a power valve for "phones"

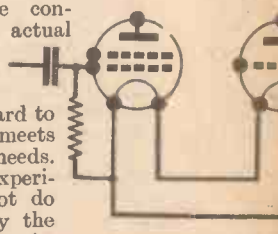


*Fig. 6.—When low 4½-volt dry battery wired*

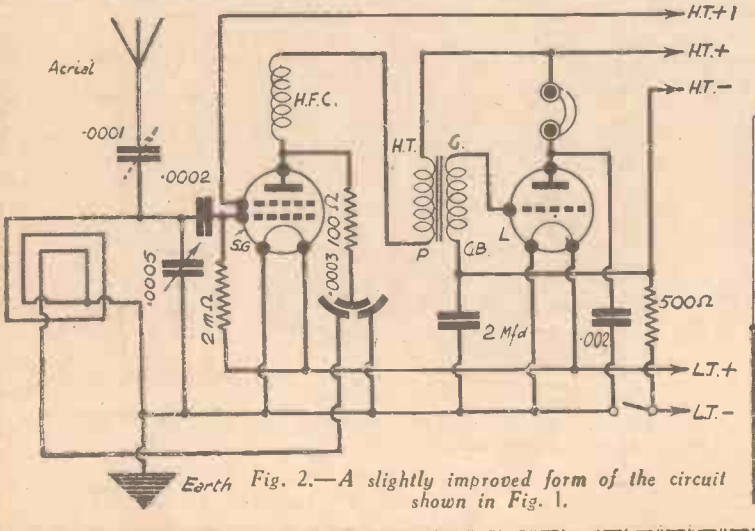



*Fig. 2.—A slightly improved form of the circuit shown in Fig. 1.*

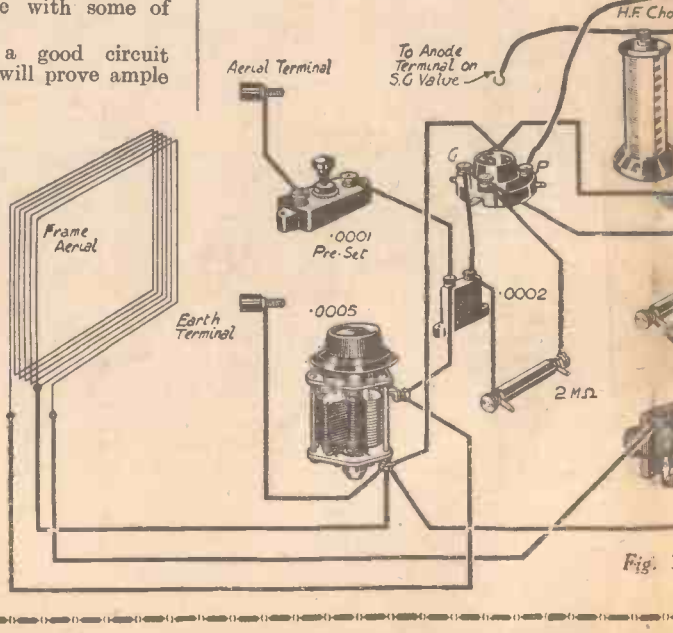



*Fig.*

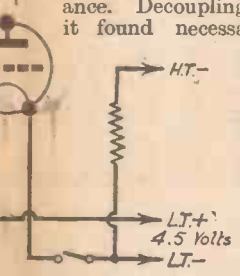
# ramid PORTABLE TWO

## Cheap & Simple

ical Local Station Receiver.

F. PUMFREY

work, since it gives more amplification and requires less H.T. current. To save the necessity for a G.B. battery and also to ensure that the correct grid-bias voltage will always be applied, irrespective of the condition of the H.T. battery, the second valve obtains its bias "automatically" by the voltage drop across a 500 ohm fixed resistance. Decoupling is not provided, nor is it found necessary, for the detector valve. Provision is made for using an outside aerial and earth when they are available.




*tension is taken from a the filaments should be in series.*

This circuit is really good, despite its simplicity and can be built up from odd parts, which almost any constructor will have on hand. At the same time, however, it may be improved upon in some minor details. For instance, the type "HL" detector might be replaced by a screened-grid valve, whilst the reaction control would probably be improved by inserting a 100-ohm resistance between the anode of the detector valve and the reaction condenser. A pentode might give rather better results than the ordinary L.F. valve, but it is doubtful whether this change would prove worth while, especially in view of the heavier consumption of H.T. which would necessarily follow.

A circuit which includes the two refinements recommended is shown in Fig. 2, and for the assistance of those who do not quite trust themselves to interpret this, a pictorial wiring plan is given in Fig. 3.

### The Frame Aerial

The only component of which Fig. 3 does not provide adequate particulars is the frame aerial. It is impossible to give full details of this, since they will depend upon the size of container it is proposed to use, and upon whether medium-wave or long-wave reception is required; windings for both could be included, but in the interests of simplicity I strongy commend you to keep to one or the other. On the assumption that your container will have an approximate perimeter of just about 4ft., the frame will require a total of twenty-one turns for medium-waves and of sixty turns for long waves, a tapping being taken after eighteen or fifty-four turns, respectively. The winding can consist of 24 gauge d.c.c. in either case.

I do not think I need say anything about the model of operation of the receiver since it will not differ in the least from that of an ordinary "fixed" one of similar type.

### "Housing" The Set

What about the containing case? It can be an attaché case, a gramophone record carrier of the size holding 25 records, or a simple box made of three-ply. In any event some kind of framework will be required to take the aerial and to hold the set, batteries and phones. This can be made up as shown in Fig. 4 from a few lengths of ⅜in. thick board or five-ply. The general appearance of the set as fitted into an attaché case measuring 14in. by 11in. by 4in. deep can be seen from Fig. 5.

### L.T. from Dry Battery

It was mentioned previously that low-tension could, if preferred, be obtained from a dry battery. In that case it would be better to employ a 4½-volt unit, and to wire the filaments of both valves in series as shown in the diagram of Fig. 6. Theoretically, a small resistance should be included in series with the supply to cut down the voltage from 4½ to 4, but in practice this is quite unnecessary.

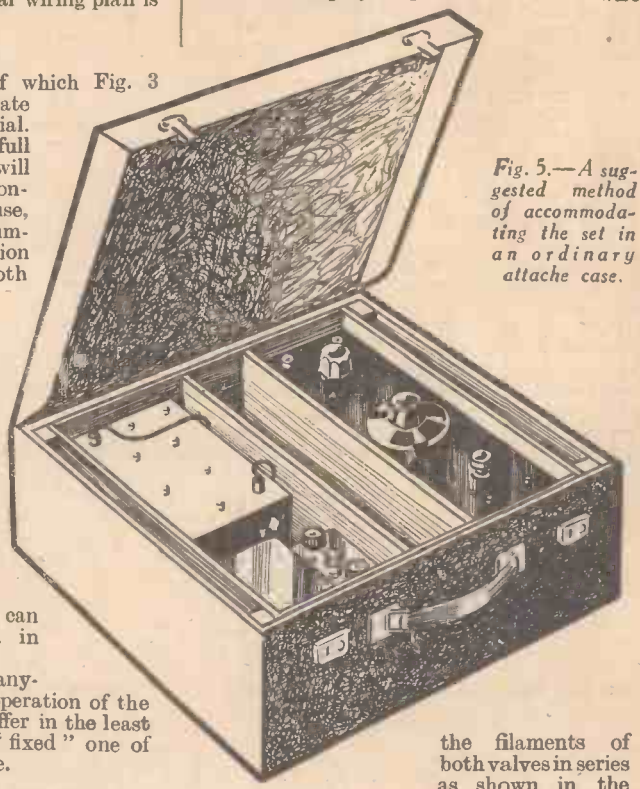
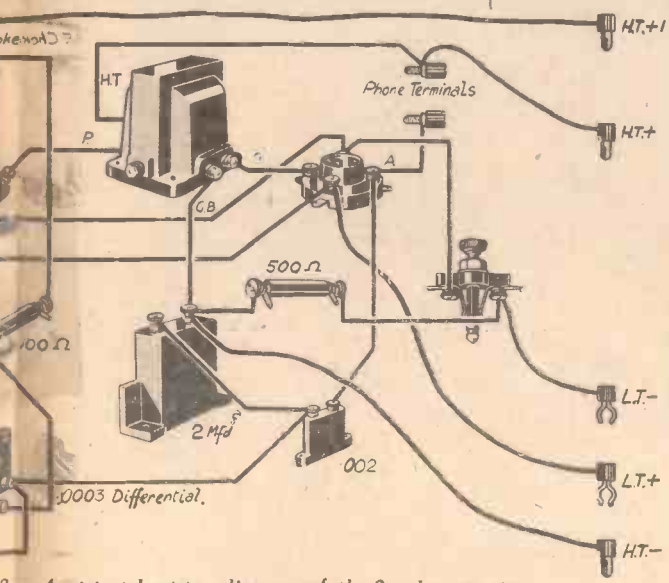


*Fig. 5.—A suggested method of accommodating the set in an ordinary attache case.*




*3.—A pictorial wiring diagram of the 2-valve circuit illustrated in Fig. 2.*

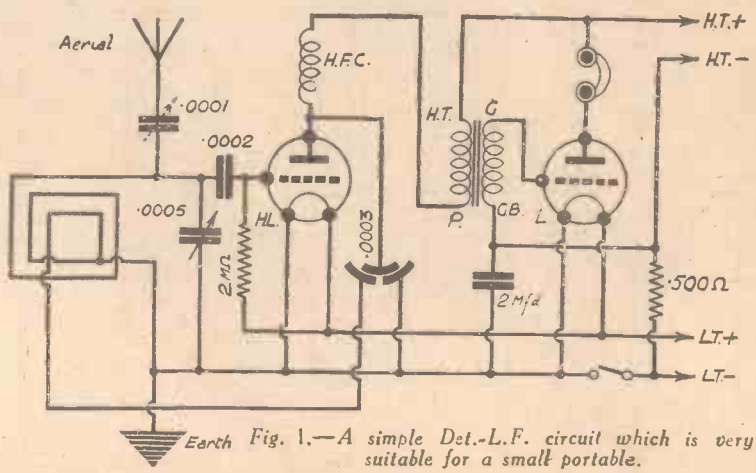



*Fig. 1.—A simple Det.-L.F. circuit which is very suitable for a small portable.*

(Continued from page 393)

is in the anode circuit of a detector valve, as indicated in Fig. 3. Here its function is to pass the direct current component of the anode current and also the low-frequency modulation, at the same time, due to its high impedance at radio frequency, choking back the radio frequency component which is thus diverted through the reaction coil.

CHOOSING A CHOKE

| Purpose. | Inductance. | Self Capacity | D.C. Resistance |
|---|---|---|---|
| Coupling for S.G. Valves | 200,000/500,000 | 1/3 mmfd. | 200/500 |
| Standard H.F. Coupling | 100,000/200,000 | 2/4 mmfd. | 300/800 |
| Ordinary Reaction | 50,000/200,000 | 1/3 mmfd. | 200/700 |

### Special H.F. Chokes

It is clear that chokes for any of these purposes should have as high an impedance as possible at the frequencies at which they will be operated. As the range of frequencies to be covered in radio reception is very wide, it has been found impossible to design one type of choke which can be used indiscriminately on all frequencies. There have, therefore, been developed what may be termed "general purpose" high-frequency chokes, suitable for use on either the medium or long broadcast bands. These are the chokes usually specified in normal broadcast receivers. For short-wave working, special short-wave chokes are marketed.

On the other hand, for use in superheterodyne receivers, on the intermediate frequency side, owing to the lower frequency, it is necessary to employ chokes of higher inductance than for ordinary straight broadcast receivers. For use in the anode circuit of a detector valve as in Fig. 3, a choke of the standard type is correct.

The first point to make certain when choosing a high-frequency choke, therefore, is that it is of a type suitable for the frequency upon which it will be used—or rather the band of frequencies. This will be clearly stated by the maker, and you can hardly go wrong on this score if you tell your dealer for what purpose you require to use the choke. Furthermore, in PRACTICAL WIRELESS Data Sheet, No. 6 (dated 21/1/33), practical values for H.F. chokes were given, and these are reproduced here for reference purposes.

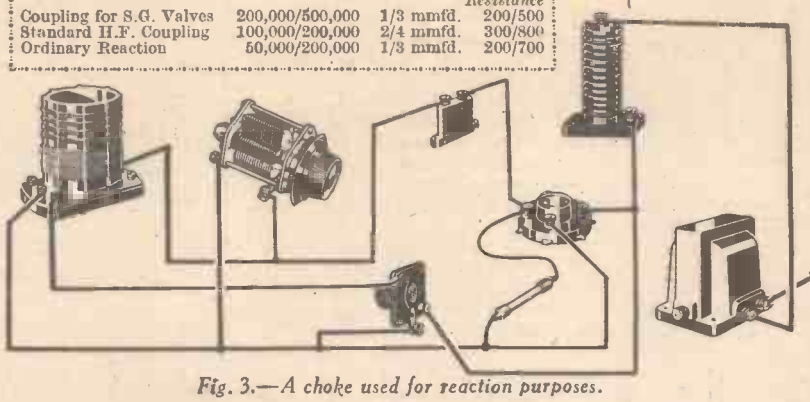


*Fig. 3.—A choke used for reaction purposes.*

Next, we must pay attention to the design of the choke. In order to obtain the necessary amount of inductance, a large number of turns of wire have to be wound on the choke. These turns act as the plates of small condensers, so that there is a tendency for the high-frequency current to pass from turn to turn through this self capacity, thus defeating the object of the choke, which is to block off one circuit to the passage of the high-frequency current and shunt it along another path. The higher the frequency the easier it is for the radio frequency current to take this short cut past the choke; so another feature of a good high-frequency choke is low self capacity—or what is termed low loss construction. This is particularly important in the case of short-wave chokes.

The next point calling for attention is the matter of interaction. It is obvious that a choke comprising a number of turns of wire will produce a considerable magnetic field of its own, and the magnetic effects may cause unwanted coupling with other parts of the circuit, resulting in instability. Conversely, the windings of the choke may in their turn pick up either by magnetic or electrostatic coupling, impulses from some other part of the set, which again might introduce unstable operation.

### Reducing Interaction

The self field of a choke can be reduced by winding the coil "binocularly," *i.e.*, as two coils side by side. This results in a much more concentrated field, having very much smaller external influence. For many purposes, however, especially in sets of advanced design and very great sensitivity, it becomes essential to screen the high-frequency chokes by enclosing them completely in metal cans or covers. Here, however, a further risk may be introduced, for if the screen is so designed as to be close to the choke winding, the screen and the choke will in their turn act as the plates of a condenser, and valuable high-frequency energy will be by-passed to earth and lost. Hence in selecting a screened H.F. choke, choose one in which there is generous spacing between the windings and the case.

Finally, the general mechanical design of the choke should be sound. We must usually trust to the maker to see that all internal connections are well made, and the winding properly insulated between sections and between the wire and the case. But we can select types which have sensible terminals or connecting lugs, and fixing holes which are in convenient positions, and will take screws or bolts of reasonable size, and we can see to it, too, that the choke we buy is of a general design which will withstand normal usage without damage. *(To be continued.)*

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# TROUBLES IN BATTERY-FED AMPLIFIERS

*(Concluded from page 362, May 27th issue)*

### Distortion in Output Stage

The output stage usually takes the blame for distortion occuring in receivers, but from what has already been said, it is clear that the major causes of distortion lie in the previous stages. However, distortion peculiar to the output stage does occur. The commonest is that which occurs in receivers, such as shown in Fig. 1, where the speaker is directly in the anode circuit of the last valve. What happens is this. A certain anode voltage is applied; for the sake of argument, 125, and the grid bias for this voltage is applied. Supposing we take Fig. 5 as an example for this, and for convenience take the anode current to be 10 mA. Now 10 mA. flowing through a speaker of the balanced armature or reed type having a D.C. resistance of 2,000 ohms (which is not an unusual resistance for this type) will drop 20 volts, but of course, this would mean that 10 mA. would not flow. Anyhow, the actual voltage lost would be near this figure, and from what has been said, it will be clear that through this we introduce our old enemy "bottom bend" distortion. Apart from this, the speaker carrying the current may become saturated at certain frequencies, resulting in the effect which is so common, that of certain notes "blasting" or distorting when the rest of the reproduction is perfect. The cure for these two types of distortion is choke output. The fitting of choke output has been described from time to time in previous issues, but a diagram of the connections is given in Fig. 7. Of course, the distortion caused by incorrect matching of speaker to output valve must not be forgotten, especially where moving coil speakers are concerned. For full particulars of this, refer to PRACTICAL WIRELESS dated March 25th, page 7.

### Choke Output

The importance of choke output deserves stressing, as it is clear from the above remarks that it stops speaker distortion, and also, as the voltage drop across it is negligible, it allows the full voltage of the H.T. battery to be applied to the anode of the valve. Therefore, Fig. 8 has been included to show a further development of the decoupling unit. In this illustration it includes choke output. *Decoupling and choke output complete in one little unit which can be separate from the receiver and needs no more complicated a connection than an H.T. battery.* Everybody with a battery receiver is advised to construct such a unit, and those more advanced will, by adding further resistances and condensers, be able to adapt it for their own special purpose for any type of battery-driven multi-valver. It is certain to repay in the long run, as further life will be obtained from the H.T. battery, and where H.F. stages are employed, a noticeable improvement in stability will result. In certain cases, a lot of annoying little noises and "jumpy" reaction control will disappear. The best type of resistances to use are those of the metallized type, and the choke should be of good make, with an inductance of about 30 henries. The complete unit is connected in the same way as the decoupler, except that in addition, the speaker is connected to it. The speaker terminals on the receiver should be "shorted" by connecting a wire from one to the other, otherwise no H.T. will reach the output valve.

# A SHORT-WAVE ONE-VALVER

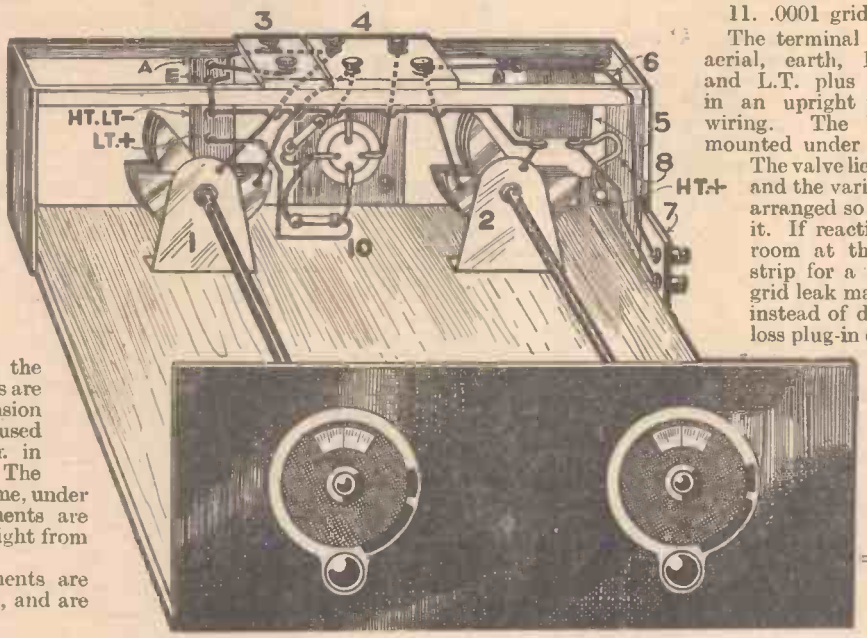
By F. N. PANTER

THE layout of the one valve short-wave set shown in the accompanying sketch is rather an unusual one, but has given excellent results. By placing the coils and valves in the positions shown very short wiring may be obtained, actually considerably shorter than appears from the sketch. Extension handles have been used to avoid hand capacity in preference to screening, as if the latter method is used very great care must be taken to ensure that no losses result through the metal being too close to coils or other components.

No definite measurements can be given for the baseboard or height of the frame supporting the coil-holders, as they depend chiefly on the size and span of the condensers. To give an approximate idea of the size, the following measurements are those of my set. Extension handles 6in. long, were used with a baseboard 10in. in depth by 9in. wide. The actual depth of the frame, under which all the components are placed, is 4in., and height from baseboard 4½in.

The various components are numbered in the sketch, and are as follows :—

1. .00015 variable condenser for grid coil.
2. .00025 variable reaction condenser.
3. Aerial coil-holder (variable coupling).
4. Grid and reaction coil holders.
5. 2 mfd. by-pass condenser.
6. H.F. choke.
7. Phone terminals.
8. 15,000 ohm decoupling resistance.
9. Low-loss valve-holder.
10. 4 megohm grid leak.
11. .0001 grid condenser.




*An original and efficient layout.*

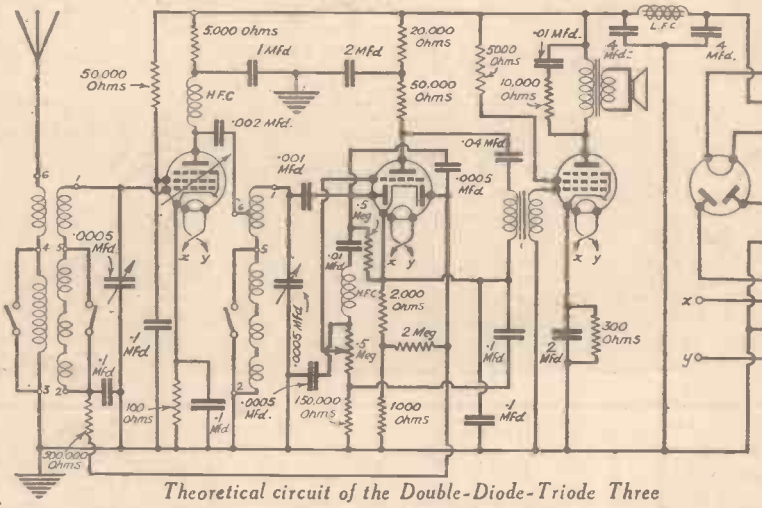
The terminal strip, on which are the aerial, earth, L.T. and H.T. minus and L.T. plus terminals, is mounted in an upright position to give shorter wiring. The H.T. plus terminal is mounted under the by-pass condenser.

The valve lies in a horizontal position, and the variable condensers must be arranged so that the vanes just clear it. If reaction is "fierce," there is room at the base of the terminal strip for a potentiometer, and the grid leak may then be taken to this instead of direct to L.T. plus. Low-loss plug-in coils are used. This little set has provided some really excellent results, broadcasting stations in North and South America, Australia, Canada, Africa, Russia, and other nearer countries have been heard well.

# The Double-Diode-Triode Three

**The First "Practical Wireless" Receiver to Employ the New Valves. As usual, It is an Outstanding Receiver, placed Before Our Readers after the Design has passed Rigid Tests**

A GREAT deal has been written lately concerning the newly developed valves, and the double-diode-triode has been introduced as the most useful development. This, as has already been pointed out (see PRACTICAL WIRELESS dated April 22nd, page 190), is actually two two-electrode and one three-electrode valves in one glass envelope and its principal use is as a half-wave rectifier, automatic volume control device and ordinary L.F. valve combined in one. The variable-mu screen grid valve has also been found very useful in the past, but the variable-mu pentode proves even more efficient in an H.F. stage. Accordingly, we have decided to combine these two new valves in our latest receiver, and the result is shown in the diagram Fig. 1. As will be seen the H.F. stage is of the variable-mu pentode type coupled to the first diode of the double - diode - triode valve. The remaining diode portion is utilised to act as a volume control on the H.F. stage and enables fading to be satisfactorily overcome. It also avoids overloading in the output stage, and so results in much better reproduction being obtained. Coupling from the triode portion of the detector stage is by a parallel-fed transformer, a pentode being utilised as the output valve. The loud-speaker is directly coupled, and the voltage supplies for the entire receiver are obtained from a small mains unit which employs a valve as a full-wave rectifier. The smoothing arrangements are carefully designed and carried out and the receiver is delightfully free from hum. In addition, the operation of the receiver is exceedingly simple as there is no reaction and no actual volume control adjustment. The single knob is used to tune in the station, and the automatic volume control device enables the volume to be kept at the correct level. If this is provisionally adjusted to be just too loud for such items as speech, etc., the manual volume control may be operated, but in general it will be found much easier to arrange that the automatic volume control delivers just sufficient volume on all types of broadcast to suit normal domestic requirements, when the receiver becomes a very simple 'one-knob' set. With the efficient H.F. stage the majority of the worth-while European stations may be received and although not capable of such great things as a receiver employing separate controls for the various purposes, it may be used as an ideal family receiver, possessing none of the complications which render the ordinary type of receiver unsuitable for the feminine sex in the home.




*Theoretical circuit of the Double-Diode-Triode Three*

The choice of components in a receiver has always been stressed by us as being critical, and we have repeatedly advised our readers not to depart from the specification which we give. In this type of receiver the choice is even more limited, and on no account should any attempt be made to vary the values given, or to use components other than those specified. The reasons for this are not far to seek. The combined valve has three separate functions to perform, and whilst a separate part of each valve is employed for the individual functions there must be some combinations which will result in either the maximum performance from the individual sections, or a falling off in one part or another. The resistances, for instance, are of the non-inductive type and it might be thought that Spaghetti resistances could be used in place of those specified. It is quite true that the smallness of the diameter of the average Spaghetti resistance renders it practically non-inductive, but the length of the majority of such resistances is such that loops are invariably formed, and with the large number of resistances employed in this receiver any amount of trouble will be in store for you if you attempt to replace the resistances with those of Spaghetti type. Similar reasons govern the choice of the remaining components, and therefore the specification should be rigidly adhered to.

### The Double-diode-triode

It is not necessary to explain the function of the Double-diode-triode, as this has already been explained in the article above referred to, but the degree of automatic volume control which is required in a receiver employing only one H.F. stage is not very great, and therefore certain modifications have been made in this circuit to permit of the maximum effect on both H.F. and output loads. However, further details will be given in the constructional article which will appear next week.

### The Output

The actual output may be arranged to be approximately 2 watts, but it must not be taken for granted that the A.V.C. device will enable every station to be reproduced at that strength. As explained elsewhere in this issue, the controlling of volume is only carried out in one direction, that is, it does not increase the strength of a weak distant station. Consequently a number of stations will not be heard on a receiver of this type, owing to the fact that there is no reaction control to be used as a signal strengthening device. This is compensated for, however, by the high efficiency of the H.F. pentode.

**LIST OF COMPONENTS FOR THE DOUBLE-DIODE-TRIODE THREE.**

One Polar Uniknob .0005 mfd. Condenser.
One pair Colvern Coils, Types K.T.F. and K.G.R.
One Graham Farish H.M.S. Choke.
One Wearite H.F.P.A. H.F. Choke.
One Igranic T.24.B. L.F. Transformer.
One Wearite T.21.A. Mains Transformer.
Thirteen Graham Farish Ohmite Resistances (one each 100, 300, 1,000, 2,000, 10,000, 20,000, 150,000, and two each 5,000, 50,000 and 500,000 ohms.
One Graham Farish 2 megohm Grid Leak.
Three Dubilier .1 mfd. fixed condensers, Type B.B.
Three Dubilier 1 mfd. fixed Condensers, Type B.B.
Two Dubilier 2 mfd. Fixed Condensers, Type B.B.
Two Dubilier 4 mfd. Electrolytic Condensers.
One Dubilier .002 Fixed Condenser, Type 670.
One Dubilier .001 Fixed Condenser, Type 670.
Two Dubilier .0005 Fixed Condensers, Type 670.
One Dubiller .04 Fixed Condenser, Type 9200.
Two Dubilier .01 Fixed Condensers, Type 670.
Two Clix 5-pin Chassis - mounting Valveholders.
One Clix 7-pin Chassis - mounting Valveholder.
One Clix 4-pin Chassis-mounting Valveholder.
Two Belling-Lee Terminal Mounts.
Four Belling-Lee Type B terminals Aerial, Earth, L.S. + and L.S. —.
One R. & A. Challenger Moving-coil Loud-speaker.
One Carrington Cabinet.
One Watmel .5 megohm Volume Control.
One Lissen Mains Smoothing Choke.
One Ferranti VPT.4 Valve.
One Ferranti H.4.D. Valve.
One Mazda A.C./Pen Valve.
One Mazda UU2 Valve.
One Bulgin On-Off Toggle Switch, Type S.80.
Two coils Glazite, flex, bayonet plug, etc.
Aerial and Earth Equipment :—
Pressland Cop.
Tin of Filt.


By E. REID-WARR

IT is sound psychology to ensure that the approach of summer brings lists of records in which lighter music predominates. Orchestral, instrumental, and vocal classifications—all seem to show a seasonal uplift to brightness. Appropriately, artists are in full song just now.

One of the first I came across (*Brunswick* 1467), was that very tuneful trifle *My Darling*. The Danish tenor, Eric Bertner, puts tremendous allure into it whilst singing delightfully. *Sweetheart* backs it up. Two popular classics next. Gretl Vernon sets out to give two show-pieces in *Il Bacio* and *For You Alone* on *Imperial* Z142. The singer is apt to overdo the vocal interpolations, but the record still remains startling. Then Francesco Vada sings *On With the Motley* and (a) *La Donna é Mobile* (b) *Questa o Quella* on *Broadcast* 3296. The singer is definitely good, and the performance is straightforward and correct. Despite his name, his English is perfect!

Essie Ackland is a fine contralto. She has done *Great is Jehovah* and *Knowst Though The Land* (*Mignon*) on *H.M.V.* *C*2535. The first is the more successful, perhaps, but each reaches a very high level of artistry. Good contralto records are scarce.

*Believe me, If all those Endearing Young Charms*, and *Mother Machree*, constitute, on one disc, the first of the records made by a new discovery—Danny Malone. The romantic career of this singer has been a nine-days' wonder, and there is no question of the melodic quality of his voice. Many will find his rich brogue fascinating and if he continues to sing Irish songs, all will be well, for these songs are quite the "real thing."

I think the vocal gem of the month is Tauber's performance of Schubert's *Serenade*. It is simply delightful, and it is sung *as* a serenade. I have heard it sung many times, but this is the real thing. The backing is the same composer's *Phantom Double*. On *Parlophone RO*20217. A famous continental artiste re-appears in Claire Dux, soprano. Her singing of Schubert's *Ave Maria* and Strauss's *Morgen* on *Parlophone RO*20218 is a model of sweet richness.

A magnificent tenor of the Munich Opera—Julius Patzak—has done *Siciliana* (*Cavalleria Rusticana*) and *Lebwohl, Mein Bluitenreich* (*Madame Butterfly*) on *Decca Polydor* *PO*5007. This is a beautiful example of clear, clean singing, entirely without operatic mannerisms, as a record of this kind should be.

It is a far cry to the *Jolly Roger*, but the *Vocal Gems* from this now famous play are admirably done by the *Columbia Light Opera Company* (*DX*463). Who the artists are I know not, but the very catchy music is handled by some very able singers.

To round off the vocals, that new star, George Dosher, a negro bass, sings *In Santa Lucia* and *More Beautiful Than Ever* on *Sterno* 1150. Here is a voice of superb quality and strength. He will be heard of a great deal in the future.

**Orchestra**

Orchestral pieces are not so plentiful this month, apart from the classical category, but there are a few which can go into the collection for next year with safety. Dol Dauber's Orchestra have played two very pleasant light numbers; *The Clock in the Black Forest* and *The Clock is Playing* on *H.M.V.* *B*4371. The horological effects are excellent, and the performance artistic to a degree. There is a first-rate "fantasy" *Fledermaus* on *Columbia DB*1082. You will find the playing of the Bohemians as clever as usual; and they are always good. Then to Russia, for a *Russian Fantasy* on *Decca* *F*3471. This is an extraordinarily accomplished piece of work by Livschakoff's Dance Orchestra.

In an entirely different plane of Russian music are Rimsky-Korsakov's *Storm Music* and *Dance of the Tumblers* on *H.M.V.* *DB*1698. Here the London Symphony Orchestra show what atmosphere in music means. The first piece is terrific. Not everybody's choice, certainly, but the gateway to a new world in emotion.

Italy next—the *Capriccioso Italien* of *Tschaikovsky* on two *Decca Polydors* *LY*6066-7. A glorious performance by the Berlin State Opera Orchestra in which the recording is also of a very high order.

Two interesting performances are on *Brunswick* 1470. Here Wayne King's Orchestra play a part of Kreisler's *Caprice Viennois* and *O Star of Eve*. These are *not* orthodox from any standpoint of orchestration or arrangement. But they are, nevertheless, clever as examples of a new school of modernism which is always entertaining if its ambition is kept within proper limits.

Finally, three normal, but very good records of the pleasant, non-dated type. The *Pavilion Orchestra* have an *A to Z Potpourri*, which includes popular numbers from the masters—their names being taken alphabetically (*Parlophone R*1467). The organ is used with fine effects, as is so often done by the *Commodore Orchestra*, who play a selection from *Maid of the Mountains* on *Winner* 5544. This orchestra can always be relied on to entertain. Then, two dainty little trifles (not orchestral) by *Fred Hartley's Quintet*. You will like *Musette* and *Marigold* on *Regal Zonophone* *MR*878; they are a soothing pair.

Here is another overture, *Orpheus in the Underworld*, which ought to be in everybody's library. This has much in common with the *Barber of Seville* in its cheerful music. Offenbach can dispel dullness in no uncertain manner, and here is a fine example of his skill. Hear *H.M.V.* *D*1293 on which the Berlin State Opera Orchestra play this fine overture splendidly.

(*Continued on page 408*)

# Our Views on Receivers

## The Six-Sixty A.C. SUPER-FIVE

Tested by the "PRACTICAL WIRELESS" TECHNICAL STAFF.

THIS is a most attractive receiver made by the manufacturers of Six-Sixty Valves. There are one or two novelties, one of the first making itself evident as soon as the receiver is viewed from the rear. This is the patent method of covering the valves—which instead of being of the usual aluminium colour are coated with a green material. The H.F. valves, which are of the Screen Grid type, are also shielded in a novel way, small metal capes fitting round the upper portion instead of the more customary metal cylinder surrounding the valve. The two tuning coils are enclosed in copper cans, and the entire metal chassis is of the usual finish. The cabinet is of walnut and possesses pleasing lines, and is at the same time sufficiently thick to prevent unwanted resonances.

### The Circuit

The circuit is on more or less standard lines, and employs two screen-grid valves, detector and pentode, with a further valve acting as a full-wave rectifier. The first two stages are of the single circuit type tuned by a two-gang condenser, and the detector valve is aperiodically coupled to the second screen grid valve. Ordinary transformer coupling is employed between detector and output stage, and the primary is included direct in the anode circuit of the detector valve. The characteristics of the particular transformer which is used are such that no loss of bass occurs with this method of connection. The speaker is of the moving iron type and gives a very full response. The two gang condenser control is balanced on the cabinet front by the wave-change switch and the volume control. The actual wave ranges covered by the coils are very extensive, ranging from approximately 180 metres to 700 on the medium band, and from 800 to 2,000 on the long-wave band. This permits of the reception of Fécamp and Kaunas at the extremes of the tuning range without difficulty.

### Mains Adjustment

The method of adjusting the input for mains of varying voltages is very novel. An insulated plate is fitted at the rear of the chassis and this has a small window cut out through which may be seen voltage readings adjusted in steps. These cover a most exhaustive range of from 103 to 253 volts. Beneath the cover are eleven screws arranging in three rows, and four small metal bridges are permanently attached to the centre three screws. Covering the back of the ebonite plate is a small plate which has a window also cut in it. Rotating beneath this is a circular disc of paper upon which are printed the various voltage ranges above mentioned, and at the side of each range is a small diagram of the eleven screws and the arrangement of the metal bridges which must be carried out to obtain that range. To use this device, therefore, the insulated plate is removed, the disc rotated so that the voltage of your mains is visible through the window, and then on the back may be seen the arrangement of the shorting bridges which must be carried. The

*The Six-Sixty A.C. Super Five.*

screws are loosened and the small metal shorting strips swung about to occupy the correct position, and the screws tightened. The plate is replaced and the receiver is thus adapted for your mains. This probably sounds complicated, but is actually very simple to carry out and enables a very accurate adjustment to be made in place of the more usual idea of having a mains transformer with a winding suited for any voltage from 200 to 250 volts. Obviously a greater output will be obtained at the higher figure, and this sometimes results in overheating, or alternatively in the user of lower mains receiving a lower output.

### Results

On actual test the results obtained from this receiver were of a high order. The volume was ample, and although a moving-coil speaker is not employed the quality was very pleasing. Apparently circuit correction has been carried out, and in conjunction with the design of the loud-speaker the bass seems quite sufficient for the size of the cabinet, and the higher notes in the musical scale are well produced. The reproduction is of the forward variety, possessing none of the "boxed-in" tone common to so many self-contained receivers. Alternative aerial sockets are provided at the rear of the chassis, and the selectivity in the locality in which the receiver was used was sufficient on the loudest tapping, and there was no need to reduce signal-strength by using the selective socket. The actual loss incurred by the change is not sufficient to be of importance, and obviously if selectivity is required it must be at some little expense. A large number of stations was received on both wave-bands, and on the long-waves Radio-Paris was easily received without any background from Daventry, although Königs Wusterhausen was slightly interfered with on the evening the receiver was tested. On the medium band Athlone was received without trace of the Midland Regional, and Radio Toulouse was tuned in clear of the London station. At the lower end of the scale Trieste could be heard with no interference and gave sufficient volume on this station for domestic purposes. It is always misleading to give actual stations heard, as reception conditions in different parts of the country vary, and what may be easily tuned-in in one part of England may be unobtainable in another part. The degree of selectivity in London, however, is a very good judge of a receiver's capabilities, and the separation of Trieste from the National, and Toulouse from the London Regional set a fairly good standard upon which to base the performance of a receiver. We think this better than stating that forty or fifty stations could be heard, as they may easily be heard on the poorest receiver, but with a background to every station. When it is remembered that this receiver only costs £14 14s. complete, it will be realised that it represents very good value for money and is one of the best "cheap" receivers we have yet had the pleasure of meeting.

**RECEIVER:** A.C. Super Five.
**MAKERS:** Six-Sixty.
**SPECIFICATION:** Two S.G. stages, Detector and Pentode. All Mains operation, Full Wave rectification by means of valve rectifier. Voltage adjustments for any mains from 103 to 253 volts. Tuned circuits for Aerial and first H.F. stage, Aperiodic coupling for Detector. L.F. Transformer coupling for output stage. Tone compensation.
**RESULTS:** Splendid range and quality, large tuning range covered, with good reproduction on the moving iron loud-speaker.
**PRICE:** Fourteen Guineas.

# RADIO RAMBLINGS

By JACE

*Jottings from my Notebook*

### Fitting A.V.C.

AUTOMATIC volume control has come to stay. It has now advanced well beyond the experimental stage and is so much of a reality that I understand that it will be included in quite a number of medium-priced receivers to be shown at Olympia in August. It is generally considered that A.V.C. can only be employed with a powerful mains receiver, but this is not so. In fact I have recently been experimenting with a simple "2 V.-M." battery set fitted with automatic volume control and the results were very encouraging indeed. Whilst it is certainly impossible to obtain perfectly uniform volume on all stations when the set is of the low-power type, A.V.C. is extremely useful in preventing overloading due to a nearby Regional, and for this purpose alone it is well worth while.

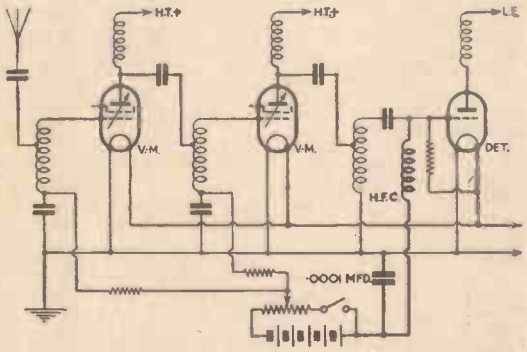



*Fig. 1.—Showing how automatic grid bias was added to an ordinary battery set having two V.-M. valves. The new components and connections are shown in heavy lines.*

The skeleton circuit in Fig. 1 shows a very simple arrangement and from this it can be seen that the only additional components required are a high-frequency choke and .0001 mfd. fixed condenser. The single alteration to the original wiring is in respect of the grid-bias battery; its positive terminal must be disconnected from H.T. negative and joined to one end of the choke. It is also necessary to include a switch in series with the G.B. potentiometer, if this is not already provided, to prevent the bias battery discharging while the set is out of use. When the V.-M. grid potential has previously been taken from the same G.B. battery as that used for the L.F. valve, a second battery will be required for the latter. This arrangement is well worth a trial in either a "straight" set or a super-het. After making the slight modification you simply adjust the variable-mu potentiometer to a position which gives the required volume on a signal of average strength, and the A.V.C. device does the rest.

### "Give and Take"

TALKING of A.V.C. I am reminded of a complaint made to me recently by an enthusiast who had gone to some expense to add an automatic volume control to his S.G.—det.—pen. all-mains set. To quote his own words, "the idea worked all right on the more powerful stations, but it was no use on the others." It transpired that this gentleman has read that A.V.C. tends to produce the same volume level on all stations and very largely prevents fading. Which, of course, is quite correct, *provided that the set is sufficiently powerful to bring in the stations at good volume.* But an automatic volume control does not increase the amplification in the slightest; it can do no more than reduce it on signals which come in at more than some pre-determined maximum strength. Neither can it entirely prevent fading unless the lowest volume of the signal (after fading) is equal to the maximum required. In other words, A.V.C. "takes," but does not "give."

*(Continued overleaf)*

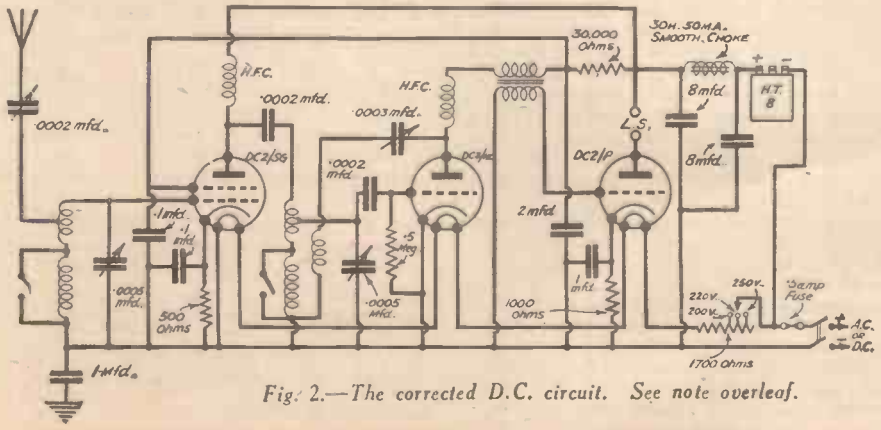



*Fig. 2.—The corrected D.C. circuit. See note overleaf.*

(Continued from previous page)

**Q.A.V.C.**

IF you have tried automatic volume control you will have observed its one defect; it brings in a good deal of "between station" noise. This is only to be expected, because the set is most sensitive on weak signals such as the various forms of "mush" constitute. And then besides, V.-M. valves produce a certain amount of "hiss" when they are working at "full throttle."

A cure for the trouble just mentioned is not difficult to find, but its application tends to add to the complication of receiver design. In America, where A.V.C. has been in common use for some time, they use in addition to the automatic volume control device, a "quiet" A.V.C. valve. This latter generally works on the L.F. amplifier which it renders inoperative on signals of less than a minimum strength. Thus, all between-station noise and any signal below a certain intensity cannot be heard, since it never gets as far as the loud-speaker. The additional valve (which is generally an ordinary pentode), is variously described as a "Q.A.V.C.," "noise suppressor" and "squelch." Despite the rather American sound of the last word, it is perfectly good English and, according to my dictionary, means "to crush or silence."

Even though the addition of a squelch valve does rather complicate matters, I am inclined to the belief that it will have to be made before automatic volume control becomes as popular as some of its sponsors would have it.

**Automatic Volume Control and Selectivity.**

WHEN first operating a set fitted with A.V.C. one is very liable to get the impression that selectivity is lacking, because the tuning seems comparatively "broad." That is, a station one would normally expect to "spread" over about one degree of the tuning dial extends over perhaps three or four. This does not indicate a fault, but merely shows that the A.V.C. action is taking place as it should. The point is, that with an ordinary selective receiver slight de-tuning causes the signal to be so much reduced in strength that it is practically inaudible. But when A.V.C. is used the H.F. amplifying valves become much more sensitive on slight de-tuning and therefore amplify the signal to a greater extent. As a result, the volume remains practically constant over a tuning range representing the maximum bandwidth of the tuner.

This effect is likely to lead to trouble because once the set has been tuned the least bit away from the actual wavelength of the signal a certain amount of distortion occurs due to uneven response to the two side-bands. Various ways of avoiding distortion from this source have been devised and these generally take the form of a "visible" means of tuning. Thus, instead of judging the exact resonance point by ear a milliammeter is fitted in the cathode circuit of the variable-mu valve. The meter gives the lowest reading when the set is exactly in tune, since the A.V.C. grid bias is then at its maximum.

Other methods include the fitting of a red light operated by the V.-M. anode current; the light does not go out until the set is tuned to exact resonance with the signal.

**Correction.**

ON page 264 of PRACTICAL WIRELESS dated May 6th, a circuit of a D.C. receiver was shown. Owing to a draughtsman's error a mistake occurred in this circuit, and it has therefore been corrected and is reproduced in Fig. 2 in its correct form.

**D.X. Reception**

CONTRARY to expectations recently expressed in these columns, long distance reception has not been affected so very adversely by the advent of summer time. It is still possible to receive a dozen or so Continental stations at good strength quite early in the evening. Among those which can be picked up very easily with a single S.G. set are Trieste (247.7 metres), Hilversum (296.1 metres), Bordeaux-Lafayette, P.T.T. (304 metres), Breslau (325 metres), Poste Parisien (328.2 metres), Brno (341.7 metres), Leipzig (389.6 metres), Rome (441.2 metres) and Prague (488.6 metres). The long waves, are, of course, unaffected by the lighter weather and Luxembourg, Moscow, Warsaw and Radio Paris continue to come in at full blast. Although rated at only 13 kilowatts, the French station Bordeaux-Lafayette has provided the best and most consistent reception of all European transmitters for the last few days; Fécamp, previously a very strong signal, is very poor at the moment. The U.S.A. medium-wavers are still coming over excellently, especially those working on wavelengths between 230 and 300 metres.

## BOOKS RECEIVED

**"Ray Controlled Mechanisms,"** by Major Raymond Phillips (Percival Marshall & Co., Ltd. Price 2s. 6d. net.).

Major Raymond Phillips is well known in connection with his wireless controlled airship, boats, trains and other apparatus and readers have no doubt seen his demonstrations on the Halls. This interesting little hundred-page book is devoted to the subject of the control of working models by means of wireless, sound and light, and devotes nine chapters to the subject. The author has spent many years developing such apparatus, and all the mechanism described in the book is guaranteed to give good results. Some of the interesting models described include a model electric train, which starts and stops at the word of command; a model airship which may be made to rise, turn and travel in any direction through the medium of a small wireless transmitter, and a chapter is finally devoted to a description of the faults, etc., which may be experienced in ray controlled mechanism. A most interesting book.

*The New Marconiphone Receiver, Model No. 272*

*(Continued from previous page)*

### NEW MARCONIPHONE RECEIVER

THE following information concerns the new Marconiphone Model "272" five-valve (including rectifier), super-het receiver, which constitutes the first big shot in the 1933-34 programme. Stocks will be available as from June 1st, and this early release clearly indicates that they are well ahead with the production programme, thus giving three months business between now and the Radio Exhibition.

TECHNICAL INFORMATION ON MARCONIPHONE MODEL "272."

*Circuit.*—Superheterodyne; 5 valves (including rectifier), A.C., 200-250 volt; 50-60 cycles.

*Circuit details.*—Constant-peak band-pass input, preceding screen-grid combined detector-oscillator, followed by transformer-coupled variable-mu intermediate-frequency amplifier and power grid second detector; output from this goes to triple compensated auto-transformer coupling to indirectly heated power pentode. Fifth valve: heavy duty rectifier.

*Controls.*—Four: tuning, volume, tone and wave-change.

*Tuning.*—Rectangular wide vision scale is illuminated and traversed by vertical knife edge moving horizontally over both station names and wavelengths.

*Speaker.*—Energized moving coil, fitted with hum neutralizers, improved response.

*Performance.*—9 k.c. selectivity; absence of second channel interference, splash, whistles, etc. Mains aerial; earth not essential, thus giving absolute portability.

*Refinements.*—Distortionless volume control, tone control, provision for permanent connection of pick-up; extra high or low resistance loud-speakers.

*Cabinet.*—Figured walnut; modern style; moulded speaker fret above scale and tuning knobs.

Undistorted output of last valve—2 watts and total power consumption—65 watts.

### USE FLUXITE

FLUXITE—a world-wide product and a household word. Every mechanic knows that Fluxite SIMPLIFIES all soldering, in fact, no mechanic would attempt a job of soldering without its aid.

There is always a job for Fluxite to do—in the house, workshop or garage—so no handy-man can afford to be without the Fluxite Soldering Set. It is simple in use and lasts for years. It contains a special "small-space" soldering iron with non-heating metal handle; pocket blow-lamp; Fluxite; solder, etc., etc.; and full instructions. It is sold complete for 7s. 6d., or you can purchase the blow-lamp only for 2s. 6d.

Wireless enthusiasts—especially constructors—will appreciate the value of this set. Just ask your hardware stores or ironmongery stores to show it to you.

Fluxite is also sold separately in tins—the smallest of which is intended as a "trial" tin and costs only 4d. So, if you have NEVER tried Fluxite—just take this opportunity of trying a small tin—and see what a difference it makes to that soldering job!

### SIX-SIXTY TYPE 3-32 CHASSISET

IN our issue, dated 6th May, we reviewed the above receiver. The panel giving a description of this set stated that a balanced-armature speaker was fitted. We should like to point out that this should have read Permanent Magnet Moving-Coil, as may be seen in the illustration on page 263 of the issue in question.

### NEW FERRANTI CLASS B VALVE

TO the interesting new range of Ferranti valves, a Class B pattern has now been added. This is of the 2-volt .4 amp. type, designed to work at a maximum anode voltage of 150 volts and with a maximum current swing of 50 mA. The maximum peak which should be applied to the two grids is 40 volts. The static anode current with 100 volts H.T. is 2.5 mA. The type no. is HP2, and it will work well in any of the receivers which have so far been designed for this type of valve, requiring the same output load with the same type of input, or driver transformer. The price is 14s.

### NEW COSSOR VALVE — DOUBLE DIODE PENTODE

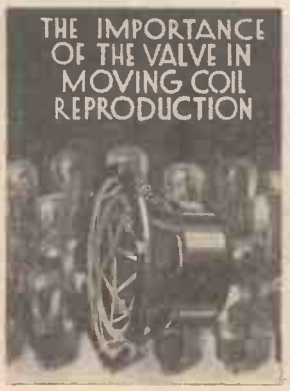
AN article has already been published describing the features of the Double-diode Triode, in which it was shown how each diode could be used to perform a separate function (*i.e.*, rectification and automatic volume control), whilst the triode portion of the same combination was employed as a straightforward L.F. amplifier. The drawbacks to this form of valve lie in the differences between weakest and strongest signal which are passed on by the L.F. portion. On the weakest signal which will be handled the output will be insufficient to fully load the output valve, but the maximum signal permitted by the automatic volume control action may be sufficient to easily overload an output valve, especially if transformer coupled. The laboratories of the Cossor factory have now produced a variation of the Double-diode Triode, in which the L.F. section of the valve takes the form of a pentode of the variable-mu type. It thus gives an output which is dependent upon the actual value of grid bias. The voltage used to control the H.F. valve may be used with this valve, also to control the L.F. side of the valve, in which case the amplification varies between about 1.5 and 15. The distortion has been measured, by means of oscillographs, etc., and found to be almost negligible.

*The new Ferranti Class B valve.*

*The New Cossor Double Diode Pentode Valve.*

### MATCHING THE LOUD-SPEAKER

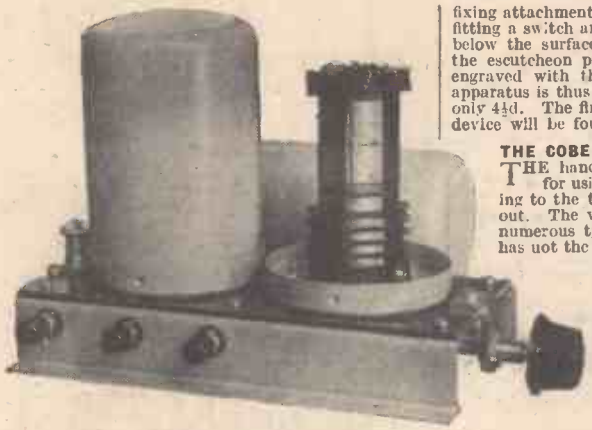
A RECEIVER may be designed to give the most faithful response, and then the reproduction completely spoiled by an incorrectly-matched speaker. Reproducers and Amplifiers, Ltd., makers of the well-known R. and A. speakers, are anxious that listeners shall get the very best from their R. and A. speakers, and to this end have produced an interesting leaflet which tabulates practically every output valve and gives the correct transformer ratio for the Bantam, Challenger and Victor speakers. This is a very useful leaflet, and is sufficiently small to be pinned over the work-bench or other convenient position for easy reference. The leaflet may be obtained free by our readers, on application to Messrs. Reproducers and Amplifiers, Ltd., Frederick Street, Wolverhampton, enclosing a 1½d. stamp for postage.



# Facts and Figures

## Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF



*New Hambling band-pass coils.*

### HAMBLING GANGED COILS

THE normal dual range coils usually fail to tune down low enough on the normal band to enable interference-free reception of Fécamp to be carried out, or fail to tune high enough to receive Budapest. Messrs. A. W. Hambling have, therefore, introduced the coils illustrated above, in which the usual two wave-bands have been divided into three. The ranges covered are 150 to 230 metres; 200 to 500 metres and 1,000 to 2,000 metres. This enables tuning to be carried out much more easily than with the ordinary two band tuners. The coils are of the band-pass type, requiring an additional .01 fixed condenser to complete the circuit. The switching mechanism is very robust and works very smoothly in changing from one band to another. The reaction winding is so adjusted that smooth control is obtainable on all bands, and a .0005 mfd. reaction condenser gives adequate control. The coil screens are finished in Post Office red, which makes them quite distinctive, and also prevents undue shocks due to touching uncovered metal. The coils may be thoroughly recommended, and the price is 17s. 6d.

### BULGIN SWITCH ESCUTCHEON

THE fitting of a simple toggle switch to a thick wooden cabinet or gramophone motor-board introduces difficulties which may be overcome by means of a long-throat switch. This method still, however, permits the operating dolly to project and so be inadvertently knocked one way or the other. Messrs. A. F. Bulgin have overcome this difficulty by introducing small oxydized escutcheons which are dish-shaped and require an inch hole to be drilled in the cabinet. The sunk escutcheon is then attached by means of two small wood screws and the ordinary type of toggle switch may be mounted in the centre of the escutcheon by means of the simple one-hole fixing attachment. The advantages of this method of fitting a switch are firstly, the operating dolly is sunk below the surface out of harm's way, and secondly, the escutcheon presents a neater appearance and is engraved with the words "On" and "Off" The apparatus is thus improved by this fitting which costs only 4½d. The finish is in Florentine Bronze, and the device will be found most useful.

### THE COBEE SAW

THE handyman repeatedly finds the necessity for using different types of saws according to the type of work which is being carried out. The well-equipped workshop is fitted with numerous types of saws, but the average man has not the room in which to keep a very large assortment. The Cobee saws illustrated on this page will be found of real service in such cases. As may be seen, interchangeable blades are employed, and these are retained in position in the wooden handle by bolts and wing-nuts. These compass saw are entirely British made and the three blades which are supplied will be found to cover most of the requirements of all but the very advanced cabinet-maker. The price is 5s. 3d.

*The Cobee compass saws*

### SALTER TELEVISION MOTOR

THE principal part of the televisor is the scanning disc, and the motor for rotating same. As the principal requirement of this part of the apparatus is accurate running at a very definite speed, the choice of a motor is rather limited. John Salter markets a very good model designed to run at the correct 750 r.p.m., and fitted with a double ended spindle which facilitates the fitting of synchronizing mechanism if required. The motor is of the ball-bearing type and loose wires (instead of terminals) are fitted for connection so as to enable easier fitment to be carried out. The base is drilled and tapped with ¼in. Whitworth threads, and may be conveniently attached to any form of mounting, although a special pedestal is also sold for the purpose if required. The motor puts up a very good performance, running constant and practically noiselessly. The cost of the motor alone is 45s., and the pedestal is 8s. 6d. All other television accessories are also obtainable from the same firm.

### BLUE SPOT SPEAKER MODEL 62 P.M.

FOR the listener who requires a better speaker than that illustrated on this page two weeks ago, the Model 62 P.M., which is illustrated on the right, will be found most suitable. This incorporates the famous 45 model permanent magnet movement which is housed in an attractive cabinet in walnut or mahogany. The design is similar to the model recently described, but naturally is slightly better finished. The speaker movement is larger than model 29, and is fitted with dust caps over the magnet to prevent the entry of dust and other foreign matter into the gap. This is a source of great trouble with some types of speaker, but the method used in this model to overcome the nuisance proves most effective. As usual a special input transformer is fitted and this enables accurate matching to be carried out. Reproduction is crisp and clear, and the higher notes in the scale are well reproduced without shrillness. In addition the bass is clear without being boomy. The complete model at 67s. 6d., represents good value for money and may be recommended.

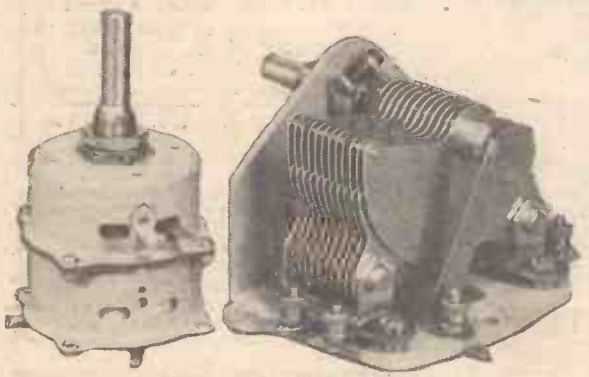
*Pressland Cop aerial device.*

### COP TERMINAL

THE series aerial condenser is well-known as an aid to selectivity, and as a general improver in radio reception, and many alternative forms of this condenser have been produced from time to time. The latest design to be submitted to us for test is the Pressland Cop, and this is illustrated herewith. It consists simply of a length of ebonite tubing lined with a piece of brass tubing inside which is a mica shell. Sliding, with a fairly comfortable fit into this mica cylinder is a solid brass rod fitted with an ebonite knob. The device is actually, therefore, a billi condenser, but the novelty lies in the finish of the instrument, that is to say, the provision of a one-hole fitting at one end, and a terminal and slotted metal piece at the opposite end. Most amateurs know how the series aerial condenser often requires adjustment for different conditions, and when a simple fixed condenser it fitted this change is not easy to carry out. The pre-set type of condenser also, is usually fitted to the baseboard, and when experiments are in progress it is not easy to get at. The Cop may be screwed on to the outside of the cabinet; attached to the baseboard with the control knob projecting through the panel; fitted on the window frame; in fact, in any convenient position. The tightness of the fitting enables it to be set and left alone if desired, yet, at the same time, adjustments may easily be carried out. The price is 2s.

### ROLA EXTENSION SPEAKERS

THE majority of good commercial receivers are fitted with special connection points for an additional loud-speaker, should one be required. The choice of this extra loud-speaker must be carefully made if the high quality of the receiver is to be maintained on both the original model and the addition reproducer. The British Rola Company have therefore produced a special Data Sheet upon which is listed the majority of the better-known makes of receivers and the type of Rola speaker which should be chosen for addition. The method of connection is also shown as it varies with different types of receiver. The tabulated list gives the set number, the type of additional speaker required, the method of connection and the price. It may be obtained free from the company mentioned.



*The British Radiophone control and condenser which were described on this page last week.*

*Blue Spot Model 62 P.M. speaker.*

# Practical Letters from Readers.

**The Editor does not necessarily agree with opinions expressed by his correspondents.**

## A South African Reader's Thanks

SIR,—I was very agreeably surprised on going to my post box last mail day to find my copy of "*THE*" Encyclopædia reposing therein, and must thank you very much for supplying me with such a lot of radio information in one volume.

Although I have been interested in wireless for the last ten years, my interest has never been so great as since I have been reading your very valuable weekly, PRACTICAL WIRELESS, and I eagerly look forward to obtaining my copy every mail day. PRACTICAL WIRELESS is *REALLY* practical, and, I think, the pictorial illustrations must be a boon to the novice who, when reading other magazines on radio, has to decipher what seem to him to be a lot of hieroglyphics.

I am particularly interested in the articles entitled "Holding the Foreigners," and am now about to incorporate A.V.C. in my receiver, which, incidentally, is of Yankee origin, consisting of three H.F. vari-mu stages, S.G. Detector, L.F. and two pentodes in push-pull—all this for broadcast. For the short-waves I am using an external superhet converter consisting of S.G. detector and oscillator, which gives me a range of wavelengths from 12½ to 110 metres, with four pairs of coils.

In your issue of March 18th I see that S. Carter of Lepton suggests that you lead the way by referring to all radio components by their correct names, and to transmissions in terms of kilocycles. I must say I am in complete agreement with his suggestion, and would point out that the American Radio journals invariably refer to "Radio Frequency Stages" and "Audio Frequency Stages" and "Kilocycles," and now we have "Megacycles"—not wavelengths.

A further suggestion I would like to make is that the British Valve Manufacturers' Association attempt to have some uniformity in valve nomenclature as our American friends have—*e.g.*, a 235 tube is a vari-mu R.F. tube, no matter who makes it, and its characteristics are the same in every case, whereas the members of the B.V.M.A. have an alarming variety of names for their valves, as witness the list shown in Data sheets Nos. 10 and 11.

Trusting your paper will continue to be practical in the future, and wishing it all the success it deserves.—W. G. BROOK (Johannesburg).

## Retaining the "Nationals"

SIR,—There have appeared lately in several of the wireless journals articles describing the B.B.C.'s regional scheme—its successes and failures. In nearly all cases opinion seems to indicate that with the advent of the Droitwich transmitter, the "Nationals" will no longer be necessary. Although it can be taken for granted that the new long-wave station will provide reliable reception (in terms of signal strength) throughout most of the British Isles; I doubt whether its programmes will be of much entertainment value during the summer months in places situated more than eighty miles away.

Static interference is exceedingly tiresome on the higher frequencies, and is sufficient to mar programmes, or at least make them very irritating to listen to, whereas on the lower wavelengths their effect is far less pronounced. An idea of the difference can easily be gained from the following summary of reception conditions during the month of August, 1932, a few miles north of Pickering in the East Yorkshire moors.

| | 5XX | N. Nat. | N. Reg. |
|---|---|---|---|
| Nights when static interference was bad .. | 16 | 4 | 2 |
| Nights when fading occurred .. .. .. | 3 | 25 | Nil. |

It will be observed that although N. Nat. is 200 or so metres below N. Reg., static interference was more pronounced. This is contrary to what one would expect, but can be explained by the fact that its signal strength is considerably less than N. Reg., but in comparison to 5XX radiating the same programme, it will be seen that for half the month the long-wave station was no good. In this respect the short-wave National scores.

(*Continued overleaf*)

**CUT THIS OUT EACH WEEK**

# DO YOU KNOW?

—THAT if a tapped output choke is used with a Pentode valve the advantages of the choke output as a decoupler are lost.
—THAT when working out the value of bias resistance for a Pentode or S.G. valve the screen current must be added to the anode current.
—THAT long leads may be added on the low-resistance side of an output transformer without high-note loss.
—THAT when trying a mains unit on a battery receiver instability may be caused owing to a tapping point being common to two valves.
—THAT an indirectly-heated valve requires more than the rated bias voltage.
—THAT the increase in the above case is half the filament voltage rating of the valve.
—THAT a short aerial running down from a roof to a lower room will often prove more effective than an ordinary type of aerial.
—THAT for short-wave reception the vertical aerial is superior to the horizontal type.

## NOTICE.

*The Editor will be pleased to consider articles of a practical nature suitable for publication in* PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

*Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.*

*(Continued from previous page)*

However, 5XX was practically free from fading, while N. Nat. suffered almost every night. This fading took place in periods occupying about fifteen minutes for a complete cycle, and there seemed to be no distortion.

In view of the tendency of modern set designers to fit some form of automatic volume control, the N. National scores the most points; and the same will apply to the other "Nationals." Of course, the new 5XX will have several times the power of the present long-wave station, and it follows that static interference will not be so great; even so, I think there is a good deal to be said in favour of retaining the "Nationals."—J. H. SLATER (Bradford).

### A "Mine of Information"

SIR,—I beg to thank you for the "Wireless Constructor's Encyclopædia" which I have just received, and would like to add my appreciation of this excellent gift. The first time of opening it I found the solution to a problem which had puzzled me for some time, and I am looking forward to many happy hours "digging in" to this mine of information. Wishing PRACTICAL WIRELESS increasing success.—W. J. BLACKWELL (Birmingham).

### Short-wave Working in Australia

SIR,—I would like to reply to a paragraph which appeared in the short-wave columns of No. 21 of PRACTICAL WIRELESS, where the writer was in doubt as to how power was obtained for working sets in out-of-the-way places in the Colonies since the heat affects batteries so much.

In Australia we have the Inland Mission, to which is attached a flying doctor. To enable messages to be sent to headquarters from the outback they make use of the short waves. The power for these stations is obtained from a small generator fitted with pedals and worked by the feet like a cycle. This idea is mainly due to the efforts of an Adelaide amateur who, I believe, is still experimenting with it. I think, possibly, that other short-wavers may use this idea, too.

Now I would like to say something about PRACTICAL WIRELESS. I get a copy every week, and I think it is about the best "weekly" in South Australia. Certainly no other paper deals with the practical side of radio as well as PRACTICAL WIRELESS.

Wishing you and your paper every success for the future.—G. W. JOHNSTON (Birkenhead, S. Australia).

### An Indian Reader's Appreciation

SIR,—It is no habit of mine writing to editors, but I feel I must, out of fairness, write and thank you and your staff for "filling in the big gap." I must say that from No. 1 every article that has appeared in PRACTICAL WIRELESS has been written so that they are understandable and useful to expert and novice alike.

The articles which appeal to us here in India most are those published in the short-wave section, and I hope that it will be given more space, as short waves are all we can really rely upon; medium and long waves being out of the question for roughly seven months out of the year, so you will understand why.

Wishing PRACTICAL WIRELESS and its staff the best of good luck.—J. W. R. BARKER (Lahore).

### "A Wonderful Volume"

SIR,—I safely received my copy of the Wireless Encyclopædia, and thank you for same. It is a wonderful volume and will be most useful to me in constructional work. I might mention that I have been a regular reader of PRACTICAL WIRELESS from No. 1, and will continue to be as long as it remains practical.—T. H. EVANS (Trealaw).

# RADIO CLUBS & SOCIETIES

*Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.*

### THE ANGLO-AMERICAN RADIO AND TELEVISION SOCIETY.

The first of a series of International Meetings, organized by the Anglo-American Radio and Television Society to promote goodwill between nations, took place at the society headquarters in Uxbridge on May 17th. New Zealand and the United States of America were represented by two DX enthusiasts upon a visit to this country. Australian and other New Zealand enthusiasts who are visiting England shortly will be similarly entertained. International meetings are also being organized, by the society, in many parts of the world.

### GOLDERS GREEN AND HENDON RADIO

An interesting paper entitled "Notes from an Experimenter's Note Book" was read before this Society by Mr. G. G. Blake at the Hampstead Central Library recently. The Radiometric condenser, developed by the lecturer, was described for the first time. In one experiment this condenser proved that a piece of casement cloth printed in various colours transmitted varying degrees of heat according to the printed colour. Various types of copper oxide cells were explained and also their methods of manufacture. One such cell was constructed before the audience and its photo-voltaic response to light demonstrated. The Gilbert-West method of measuring the pressure of light was described in detail. A very interesting discussion followed the reading of the paper. President, H. Ashley-Scarlett, 60, Pattison Road, London, N.W.2.

### SLADE RADIO.

"Mains transformers and power smoothing chokes for radio and industrial purposes" was the title of a lecture given by Mr. F. G. Sawyer at a recent meeting of this Society. A few words on Faraday and electro-magnetic induction led to current step up, also A.C. current and its effects. Flux density, eddy currents and hysterisis were followed by losses and regulation, after which came general points in design. A splendid set of slides was shown depicting the various processes of manufacture of both transformers and smoothing chokes. The apparatus which is used for testing was then described and this concluded the lecture which proved exceptionally interesting. An open invitation to attend the weekly meetings is extended to anyone interested. Details on application to the Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

*LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS*

# REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

*If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.*

## SPECIAL NOTE

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also, that all sketches and drawings which are sent to us, should bear the name and address of the sender.

### LONG-WAVE DIFFICULTIES

**"I have built a three-valve set using S.G., det. and L.F. valves, and the ordinary form of tuning, that is, not band-pass. The two coils are enclosed in screens, and I know they are not faulty as I have had them tested. When I push in the switch I get just the same stations as when it is out. I cannot alter this at all. Can you tell me what is wrong from my poor description?"—(S. H., Barnet.)**

There are many likely causes of such a difficulty, but the principal one, and the one which we should imagine is your particular difficulty, is the failure of the wave-change switch to operate. This may be due to incorrect wiring or faulty springs on the switch which prevent the contacts from touching. Examine this part of the circuit first. The other likely cause is simply what is known as "break-through," and is caused owing to the proximity of a powerful station. You are not far from Brookmans Park, and if this is the only medium-wave station you hear on the long waves, but can hear Radio-Paris, for instance, then it is only break-through. If, however, no long-wave stations at all are receivable, your switch must be the cause.

### INSTABILITY

**"I have had a shop-made four-valver for over two years now, and I have been following your various hints. I have several times made alterations to the circuit after reading some point in your paper, and have gradually got the set better and better, but now I have come across a snag. I recently read up all about the variable-mu valve and decided to fit one of these. The set won't go full on now, and I can only turn the potentiometer knob a little way before it oscillates, just like badly adjusted reaction. Can you help me to get this working, and so bring my set right up-to-date. I should be glad of your assistance."—(H. E. R., Cardiff.)**

Your receiver may be of the rather simple lay-out type which will require more carefully arranging, and perhaps screening, when used with a modern high-efficiency H.F. valve. On the other hand, you may have applied too much voltage to the screening grid. Make quite certain that the voltages applied to anode, screening grid and bias potentiometer are of the values recommended by the valve manufacturers, and then, if you cannot employ the potentiometer correctly, you must rearrange your H.F. stage, paying particular care to the wiring, and, if necessary, instal a metal screen between H.F. and detector stage. The modern valve is much more efficient than the one which was previously fitted, and this will show up the defects of the original lay-out.

### MAKING A TEST-METER

**"I notice that you recently gave a description of a test-meter for different ranges. This seems quite simple to build up, but on working out the cost I find that I can buy a similar meter just as cheap in the local wireless shop. Is there anything to be gained by making the instrument? I should like to have your definite assurance that it is worth while before undertaking the expensive work."—(H. T. R. G., Balham.)**

There are two ways of looking at this question. Firstly, is the meter which you have seen of the same high standard as the one which was described. Remember that this employed a moving-coil meter—and the majority of cheap multi-meters only use a moving iron meter which is not so accurate and takes more current. It will not, therefore, measure such low voltage values. It is possible, of course, to obtain obsolete or damaged models at quite cheap prices, but they are mostly boxed, and no alterations can be carried out. The multi-meter which you can make up will lend itself to modification, and may be arranged to suit your own particular needs, and thus may be made to cover a much more comprehensive range than the average commercial model. A good multi-meter is an expensive proposition.

## DATA SHEET No. 37

*Cut this out each week and paste it in a Note-book.*

### INTERNATIONAL ELECTRICAL SYMBOLS.

| | |
|---|---|
| Ampere | A |
| Capacity | C |
| Conductance | G |
| Coulomb | C |
| Current | I |
| Dielectric Constant and Electromotive Force | E |
| Farad | F |
| Flux density | D |
| Frequency | f |
| Henry | H |
| Impedance | Z |
| Joule | J |
| Ohm | O |
| Reactance | X |
| Reluctance | S |
| Resistance | R |
| Self-inductance | L |
| Volt | V |
| Watt | W |

### MODIFYING A LOUD-SPEAKER

**"My loud-speaker is of the moving-coil type, and is rather old, in fact, it is one of the first commercial models which was produced. It has a high-resistance speech coil—roughly 2,000 ohms. Could I re-wind this to a low resistance? If so, what value do you recommend?"—(C. A. B., Portsmouth.)**

There is nothing to prevent your undertaking the operation, providing you take great care in the dismantling process. Remove the cone by loosening the screw (or screws) which hold the centring spider. Carefully unwind the speech coil, and if necessary you will have to remove the small cylinder which is used as a former for this winding. A new former would then have to be made, and this should be stuck on with Durofix. Wind on a coil having a resistance of between 5 and 10 ohms, this being the most useful value. The actual number of turns will depend upon the air gap which is available, and you should not use too large a gauge of wire so as not to increase the weight. You must remember that when the alteration has been carried out you will require a step-down transformer to couple the speaker to your present receiver, and it cannot be connected direct as was the previous coil.

### BLUE LIGHT IN OUTPUT VALVE

**"When I switched my mains receiver on the other day the speaker gave forth a kind of faint pop, pop, pop. It was not too loud, but when I examined the set I noticed a blue light jumping up and down in the output valve. Is this the sign that anything has gone wrong? If so, what is the cure?"—(E. D. W., Golders Green.)**

The light is a fairly common feature with high-power output valves, and is of no importance provided it is only faint. If, however, it is a very bright blue, then you will probably find that the bias resistance has broken down, and the valve is receiving no bias—or a value which is too low. Alternatively, the H.T. supply to the valve has in some way increased, due to a short-circuit, perhaps, and the valve is under-biased from this reason. Measure the voltages, and keep the signal voltage down when you will probably find that the glow will disappear.

### ONLY IN ONE CORNER

**"I should like to know the answer to this simple question. A friend of mine has bought a three-valve battery-operated set. It is a wonderful set and can get practically any station in one corner of the room. It is it moved to another corner it does not get half the stations that are obtainable in the other corner. Why is this?"—(A. M., Leytonstone, E.)**

This seems rather a catch, and yet there may be a simple explanation. In the majority of houses water-pipes and gas-pipes are taken down behind the plaster-work of the walls, and there is a chance that the bad corner of your friend's room is well supplied with such pipes. When the set is stood in this corner there may be an effect produced on the coils or wiring by the earthed pipes which results in a leakage of signals. On the other hand, the explanation may be quite simple, and is due to nothing more than the lengthened lead which is necessitated from the aerial to the set when it is moved. A long lead-in wire is always a source of losses, and if this is trailed across a room or laid along a floor it may run parallel with pipes, etc., and so give a leakage in this manner.

### SCREENED AERIAL

**"I live in a very bad quarter of Liverpool, and the electrical interferences are almost too bad to describe. I have read about your tests of the metal screened down-lead and I wonder whether it is worth while using this for the entire aerial? Would it be more certain to reduce the trouble than just a lead-in alone? My aerial is nearly 60ft. long, and only 10ft. of lead-in, and I wondered if screening this 10ft. would be enough."—(R. J., Liverpool.)**

Screening the entire aerial would no doubt reduce the interference to a minimum. But it would probably also reduce all your signals to the same small value. You must employ a small amount of unscreened wire, if you wish to pick up the broadcast programmes, and our recommendation is that you reduce the length of your aerial to about 20 or 30ft. Simply lower the aerial and cut it about this distance from the house, and join it together through two or three insulators. Then use the screened down-lead and you will probably find that the interference is sufficiently reduced in strength to enable you to obtain some enjoyable programmes. Do not, however, screen the entire aerial.

### DRESSING FOR EBONITE

**"I am the proud possessor of a rather old set, but it gives such good results that I do not want to part with it. The point I am writing about is the panel. This has been fitted now for about three years and it is not a nice black as it was at first, but has acquired a greenish tinge. Can this be blackened again? What is the best polishing medium for it?"—(L. M. Y., Brondesbury.)**

If the green hue is due to the action of the light, it is not removable. If, however, it is simply an accumulation of dust, etc., it may be improved by rubbing over with an oily rag. If the appearance after this treatment is not good enough, we would suggest that you buy a new panel, and use the old one as a drilling template.

## FREE ADVICE BUREAU COUPON

This coupon is available until June 10th, 1933, and must be attached to all letters containing queries.

[PRACTICAL WIRELESS, 3/6/33.


*To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogues," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.*

**WHARFEDALE SPEAKERS.**

A USEFUL range of moving coil speakers is shown in a booklet recently issued by Wharfedale Wireless Works. A new model, priced at 32/6, embodies the latest type of permanent magnet and has a frequency response of from 50 to 8,000 cycles. A popular model is the Bronze Wharfedale at 39/6, which is capable of handling up to 4 watts undistorted input. Among the other speakers listed are two D.C. mains energized models with field windings of either 2,500 or 6,500 ohms. A special feature of Wharfedale speakers is a device for excluding dust and grit from the magnetic gap. A copy of the booklet can be obtained from the above firm—at 62, Leeds Road, Bradford.

**PRESSLAND COMPONENTS.**

TWO folders are to hand from Clifford Pressland (Sales), Ltd., giving particulars of two new components marketed by this firm. The first is an ingenious device, known as the Pressland Terminal Cop, for controlling selectivity and is designed for fitting directly to the aerial terminal of a set. The second component takes the place of an ordinary aerial lead-in tube and acts as a volume and selectivity control, lightning arrester and aerial cut-out when desired. The address is 84, Eden Street, Kingston-on-Thames.

**WEARITE CHOKES.**

PARTICULARS of a new range of their high-frequency chokes is given in a leaflet recently issued by Wright and Weaire, Ltd. There are nine different types altogether, and all the characteristics and data concerning each is given, together with some circuit diagrams. Messrs. Wright and Weaire are well known for the care given to detail in the manufacture of their components, and the stringent tests to which they are put. Each choke listed is tested for resistance, inductance, and self capacity, etc. Readers interested can obtain a copy of this leaflet (H.F. 3133), on application to 740, High Road, Tottenham, London, N.10.

## Broadcast Query Corner

When sending queries to the Editor the following rules should be followed:—

1. Write *legibly* in ink. Give your full name and address.
2. State type of receiver used, and whether transmission was heard on headphones or on loud-speaker.
3. State approximate wavelength or frequency to which receiver was tuned, or, alternatively, state *between* which two stations (of which you have the condenser readings) the transmission was picked up.
4. Give date and time when broadcast was heard. Do not forget to add whether *a.m.* or *p.m.*
5. Give details of programme received, and, if you can, some indication regarding the language, if heard.
6. State whether and what call was given and/or kind of interval signal (metronome, musical box bells, etc.) between items.
7. To facilitate publication of replies, append a *nom-de-plume* to your inquiry.

### Replies to Broadcast Queries

SPARKS (Winchester): FLE, Eiffel Tower, Paris; GFK, Croydon Airport, London; FNB, Le Bourget Aerodrome, Paris; GLO, Ongar, Essex; CUE, Lisbon, Portugal; GIZ, Oxford, England; ESA, cannot trace but Estonian transmitter; all commercial transmitters. Q8L, Szekesfehervar (Hungary) works on various wavelengths. BRS958 (Oxford). Many thanks for information. E. C. BEDFERD (Seven Kings): The identity of the call sign, G2CD has been traced as belonging to W. H. Matthews, 132, Halnault Road, Romford, Essex.



## IMPRESSIONS ON WAX

(*Continued from page* 399)

**Miscellaneous Recordings**

Yodelling records have an attractiveness for odd moments. One of the best for some time is by Harry Wulson on *Sterno* 1160. He has an attractive voice, too. The titles are *Yodelling Lovers* and *The Cobblers.* A highly entertaining record (for grown-ups only!) is *She Hit Him on the Head with a Hammer*, and a fable and recitation *The Queen and the Porter.* These form a very characteristic turn by Ronald Frankau on *Parlophone R*1450. Entertainers at the piano must, of course, include Norman Long. His *You Can't Make a Vule Out of Oi!*" is very amusing—one of his best in fact. *The Five Year Plan* backs it on *Columbia DB*1090. There is an extremely funny skit on the two O.B.'s on *H.M.V. B*4375. Max Kester's *Pancake Tuesday Throughout the Empire* and *Crazy Commentaries* both show an uncommonly rare talent for satire and the laughs will come heartily and regularly for a long time to come if you have this record.

***Viktoria and Her Hussar*—A Number To Keep**

This is the very good song, *Good Night.* It was *played* on April 18th, but did you hear Tauber *sing* it? This was one of the best records he has made, and was tremendously popular. *Pardon, Madame* is on the other side. The record is *Parlophone RO*20156.

**A Strauss Masterpiece**

*A Thousand and One Nights* waltz, played on April 22nd, is a worthy second to the good old *Blue Danube.* It has rather more shape and continuity than its better-known relation, and lends itself better to more advanced treatment. I commend the performance of the British Symphony Orchestra (under Weingartner) on *Columbia LX*133, as a very delightful rendering indeed.

## ADVERTISEMENT INDEX



## PRACTICAL WIRELESS BLUEPRINT SERVICE

**In order to meet the requirements of readers who prefer to work from a full-size blueprint when building up any of the "Practical Wireless" Receivers, we can now supply full-size Blueprint Wiring Diagrams of all the "Practical Wireless" receivers for 1s. each, post free. When ordering, quote the number. Copies of the paper containing descriptions of the particular receiver cost 4d. each. Address orders to: The Publisher, George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.**

| Blueprint No. | Receiver. | Described In Issues dated 1932. |
|---|---|---|
| 1. | Dolphin Straight Three | Sept. 24th<br>Oct. 1st. |
| 2. | Long Range Express Three | Sept. 24th<br>Oct. 1st |
| 3. | Mains Express Three | Oct. 8th |
| 4. | Sonotone Four | Oct. 8th<br>Oct. 15th |
| 5. | Bijou Three | Oct. 29th |
| 6. | Argus Three | Nov. 5th<br>Nov. 12th |
| 7. | Empire Short-Wave Three | Nov. 26th<br>Dec. 3rd |
| 8. | Solo Knob Three | Dec. 10th<br>Dec. 17th |
| 9. | Midget Two (6d. only) | Dec. 17th<br>1933. |
| 10. | Selectone Battery Three | Jan. 7th<br>Jan. 14th<br>Jan. 21st |
| 11. | Fury Four | Jan. 21st<br>Jan. 28th<br>Feb. 4th<br>Feb. 11th<br>Feb. 18th<br>Feb. 25th |
| 12. | Featherweight Class B Four valver | Apr. 29th<br>May 6th |
| 13. | Q.P.P. Three-Four | Feb. 25th<br>Mar. 4th<br>Mar. 11th<br>Mar. 18th |
| 14. | Alpha Q.P.-P. Three | Mar. 25th<br>Apr. 1st |
| 15. | Ferrocart Q.P.-P. Hi-Mag Three | Mar. 25th<br>Apr. 1st |
| 16. | Supersonic Six | Apr. 1st<br>Apr. 8th<br>Apr. 15th |
| 17. | Beta Universal Four | Apr. 8th<br>Apr. 15th<br>Apr. 22nd |
| 18. | A.C. Twin | Apr. 15th<br>Apr. 22nd<br>Apr. 29th |
| 19. | Selectone A.C. Radio-Gram Two | Apr. 22nd<br>Apr. 29th |
| 20. | A.C. Fury Four | Feb. 25th<br>Mar. 4th<br>Mar 11th |
| 21. | Radiopax Class B Four | May 20th<br>May 27th<br>June 3rd |
| 22. | Three Valve Push-Pull Detector (6d. only) | Mar. 4th |

# Splendid June Number


## Special

## HOW THE MOUNT EVEREST PICTURES WERE TAKEN

*Principal Contents for June.*

HOW THE MOUNT EVEREST PICTURES WERE TAKEN, with special pictures of the summit, by arrangement with "The Times."
A SIMPLE GUIDE TO USING PLATES, with two pages of instruction by photographs.
SHUTTER SPEEDS AND HOW TO USE THEM, the third article in the "Secrets of Exposure" series.
PRIZE WINNING NAMES from THE APRIL COMPETITION.
PRIZE WINNING PHOTOGRAPHS IN THE "WATER" COMPETITION, reproduced in photogravure.
NEW COMPETITION WITH VALUABLE MONEY PRIZES.
FREE CAMERAS FOR YOUNG PHOTOGRAPHERS.
FREE PRINT CRITICISM FOR READERS.
PRACTICAL HINTS AND TIPS.
EXPOSURE TABLE for JUNE

**THE HOME PHOTOGRAPHER AND SNAP-SHOTS is written in language you can easily understand, and is fascinating as well as informative. Packed with beautiful pictures, it tells you how to get the finest pictures with the apparatus you have, and how to save money by doing your own developing and printing. Its remarkable photogravure supplement—in colours obtainable IN YOUR OWN prints—is universally admired, while monthly competitions with VALUABLE MONEY PRIZES are a special feature.**

*Ask your Newsagent to deliver it regularly every month*

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*Obtainable at all Newsagents, Bookstalls and Dealers, or post free 7½d. (Subscription rates: Inland and Abroad 7/6 per annum; Canada 7/- per annum) from Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.*

# Some Invaluable Practical Handbooks

This series covers a wide field and will prove of the greatest value to everyone interested in models and how to make them; woodwork and other crafts. Each book is clearly written and fully illustrated.

**Accumulators**
An up-to-date handbook dealing with every type of accumulator, methods of charging them at home, care and maintenance. This little handbook also explains how to erect a charging station.

**Motor Car Upkeep and Overhaul**
In this handbook will be found information on the engine, decarbonising, valve grinding, the lighting system, the carburetter, cooling system, lubrication, springs and shock absorbers, steering gear, brakes, wheels, axles, tracing noises, etc., etc.

**Toy Making for Amateurs**
Tells how to make clockwork toys, model aeroplanes, model locomotives, model boats, ingenious toys operated by sand, wooden models and toys, electrical toys, steam toys, guns, kaleidoscopes, acrobats, etc.

**Twenty-Five Tested Wireless Circuits**
All the sets described have been designed to meet modern needs. They range from simple crystal receivers to a seven-valve super-heterodyne, and all the sets have been made and tested before inclusion.

**Simple Electrical Apparatus**
An excellent little book for those who wish to make simple and useful electrical appliances, such as galvanometers, electric motors, dynamos and Leyden jars.

**Model Boat Building**
In this book there are designs for a battleship, a speed boat, a paddle steamer and yachts, from which excellent models may be built with the help of the simple directions and diagrams that are given.

**The Home Woodworker**
A fascinating book for the handyman. Clear instructions on how to make a large variety of articles in wood, together with many useful hints on wood-working.

**Model Aeroplanes and Airships**
Contains full descriptions of easy-to-make models of every description that will fly.

**The Handyman's Enquire Within**
Everyone should possess this book. Hundreds of practical ideas and hints of value to the man who is clever with his hands.

**25 Simple Working Models**
Ingenious and practical designs for electric, steam and clock-work models.

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P. W. Gift Stamp No. 36

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## MORE ABOUT THE CATKINS—By F. J. CAMM

# Practical Wireless

3D

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## BUILDING THE "DOUBLE DIODE TRIODE" 3

*Also in this issue:*

AUTOMATIC VOLUME CONTROL.

CHOOSING A CHOKE.

A SHORT-WAVE TWO-VALVER.

WIRING EFFICIENCY.

THE AMATEUR TRANSMITTER'S LICENCE, Etc., Etc.

*Use these lighter evenings to*

# BUILD WITH YOUR OWN HANDS THIS BETTER RADIO SET

GREAT LISSEN

# CHARTS FREE

# The NEW ALL-ELECTRIC "SKYSCRAPER"

## THE FIRST COMPLETELY SAFE - COMPLETELY PRACTICAL ALL-ELECTRIC RECEIVER FOR THE HOME CONSTRUCTOR!

Now the lighter evenings are testing your old radio set. In these summer evenings signal strength is reduced and foreign stations fade when you are using an ordinary set. Now is the time you need the power of "Skyscraper" radio—and now you have the longer, lighter evenings in which to build it.

If you want to build yourself all-mains radio, go to your radio dealer and ask to see the new All-Electric Safety "Skyscraper." Get the FREE CHART from which you will see that Lissen have made it easy for you to build this All-Electric Receiver and have also made it SAFE. This is the most powerful, most sensitive, most modern All-Electric Set ever put into the hands of the home constructor. To make SUCCESS and SAFETY CERTAIN, unique features and right-up-to-the-minute developments are incorporated in the All-Electric "Skyscraper" which you could not get even in very expensive factory-built Mains sets.

COMPLETE WITH FOUR VALVES £7·19·6

Self-contained Safety Power Unit—Special Universal Safety Fuse Plug—Four matched Valves with Variable-Mu Screened Grid H.F. Stage and brilliant Power Pentode Output—One Dial Tuning with Single Knob Volume and Reaction Control — Triple Aerial Selectivity Tapping and alternative Mains Aerial—All-metal Chassis and Under-baseplate wiring—beautiful Walnut Cabinet which you put together yourself, and complete full-power Moving-coil Loud-speaker.

Chassis Kit, complete with four valves .. .. .. £7 19s. 6d.
Kit, complete with Table Model Cabinet .. .. .. £8 15s. 0d.
With Consolette Cabinet and Moving-coil Loud-speaker, as illustrated above .. .. .. £10 12s. 6d.

## The FAMOUS BATTERY "SKYSCRAPER"

### MOST POWERFUL 3 VALVE BATTERY SET YOU CAN BUILD YOURSELF

The Battery-driven "Skyscraper" is the most powerful battery set ever put into the hands of the home constructor. It is the ONLY battery set kit employing Metallised S.G. High-Mu Detector and Economy Power Pentode Valves, and is sold complete to the last nut and screw, including these three valves. Yet the current consumption of these three powerful valves is less than that of an ordinary three-valve set—less than 9 m/A.—and makes the "Skyscraper" economical to work off ordinary H.T. batteries.

Lissen have published a Constructional Chart which enables everybody, without any technical knowledge or skill, to build this most powerful battery receiver with COMPLETE CERTAINTY OF SUCCESS. Why be satisfied with whispering, fading foreign stations when you can build with your own hands this "Skyscraper" that will bring in loudly and clearly distant stations that will add largely to your enjoyment of radio?

COMPLETE WITH VALVES 89/6

Chassis Kit, complete with three valves .. .. .. £4 9s. 6d.
Kit complete with Table Model Cabinet .. .. .. £5 5s. 0d.
Kit complete with Consolette Cabinet and Pentode Matched Balanced Armature Loud-speaker £6 5s. 0d.

POST THIS COUPON

To LISSEN LTD., Publicity Dept., Isleworth.

Please send me FREE CHART of the "SKYSCRAPER" (All Mains) (Battery). Strike out whichever not required.

NAME .....

ADDRESS .....

.....

..... (P.R.47)

LISSEN "SKYSCRAPER"

BATTERY DRIVEN OR ALL-ELECTRIC

Lissen have published two fascinating Charts—one of the Battery "Skyscraper" and one of the All-Electric "Skyscraper." So clear and so detailed are the instructions and photographs that SUCCESS is CERTAIN. Ask your radio dealer for the Chart of the "Skyscraper" in which you are interested—or post coupon below.


# ROUND *the* WORLD *of* WIRELESS

### The Record Multi-lingual Broadcast

WHEN the Vatican transmitter on June 4th concluded its broadcast of a Pontifical Ceremony relayed from St. Peter's, Rome, it secured the record for the greatest number of languages comprised in one transmission. The Acts of the Apostles on the occasion of the Whitsun Holydays were read in *thirty-five* different languages. The broadcast was carried out on 19.84 m. between 11.0 a.m. and midday.

### Italy's Most Up-to-date School

THE Industrial School at Cremona possesses one of the most modern receiving stations with which any similar institution has been equipped. From his private office the "Head" is able to lecture to seven hundred scholars throughout the establishment, speech being broadcast through forty-eight loud-speakers in the class rooms. All educational courses from the Italian studios are relayed during the day; according to their subjects they are taken by different class rooms. It is perhaps the most up-to-date educational establishment in Europe.

### Eiffel Tower Remains Conservative

NOTWITHSTANDING the fact that so many European broadcasting stations have adopted distinctive opening and interval signals, the Eiffel Tower, one of the earliest to broadcast, retains its original custom. Shortly before a transmission is due the announcer puts out the official call and with a view to facilitating the tuning-in of the broadcast, verbally gives out a succession of numbers such as *trois cents, trois-cent-et-un, trois-cent-deux* and so on. This preliminary warning may last from one to two minutes, when the call is repeated.

### World-wide Broadcast

WHEN the King opens the Economic Conference on June 12th his speech will be relayed to almost every country in the world, barring, perhaps, Japan and China. The transmission will be carried out by the Post Office authorities working in co-operation with foreign administrations from the Geological Museum, where the address is delivered. His Majesty's voice will be conveyed through the new International Telephone Exchange at Faraday House to a number of lines, feeding in turn the B.B.C. network, including the Empire broadcasting stations, the Post Office system at Rugby for relay to the Empire and ships at sea, and the international submarine cables for the benefit of continental capitals.



### New Russian Transmitter

IN the intervals of North Regional broadcasts owners of multi-valve receivers may hear from time to time strains of music or foreign speech; these emanate from the new high-power transmitter which the Soviet Union has erected at Ivano Vosnesensk, and which has been carrying out tests on 483 m. (621.1 kilocycles) with a power of some 40 kilowatts (aerial).

### The Watch on the Rhine

THE new interval signal adopted by Frankfurt-am-Main and its relays, Cassel and Treves, comprises a few notes of the famous *Wacht am Rhein*, a song which, during the Great War, was no less popular with the Germans than the *Hymn of Hate!*

### To Replace Paris PTT

WITH a view to carrying out the Ferrié plan in its entirety the French State has decided, notwithstanding the purchase of Radio Paris, to erect a 120 kilowatt PTT transmitter at Villebon-sur-Yvette, some 13 miles distant from the French capital. The building of this new station has been entrusted to French manufacturers, and work is to be started without delay, as it is desired to bring the station into operation at the beginning of next year. The present station worked by the *Ecôle Supérieure* has had its power raised to 7 kilowatts, and will continue to broadcast until the new transmitter is finished on 447.1 metres.

### Broadcast to South Africa

THE KING will perform the opening ceremony at South Africa House, Trafalgar Square, London, on June 25th. His speech will be broadcast to the South African Zone through one of the Daventry Empire stations, and may also, it is hoped, be heard by British listeners to the National or Regional programmes.

### European Statistics

ACCORDING to the International Broadcasting Union the increase in the number of registered wireless receivers in Europe amounted in 1932 to nearly two millions, or approximately eight million individual listeners. This increase, taking place as it did at a period of crisis, surpassed by nearly two and a quarter millions that of 1929, the last year of prosperity since the war. We have by no means reached anywhere near saturation point.

### The New Lucerne Plan

ALTHOUGH at this juncture it is impossible to forecast the wavelength plan which may be elaborated at Lucerne, it is possible to state that the allocation of channels will be made accord-

# ROUND *the* WORLD *of* WIRELESS *(Continued)*

ing to the stations concerned, in four separate categories. Exclusive wavelengths will only be allotted to National high power transmitters. Smaller National stations in groups of two or more may be compelled to share a wavelength. The common wavelengths (*ondes communes*) will be classified under two headings, namely, International (1) on which several stations of a power not more than 2 kilowatts will operate, and, providing there is but a small deviation during working hours from the allotted nominal channel; International (2) a series of international common wavelengths destined to transmitters of which the power does not exceed 200 watts.

### Make a Note of It

AFTER June 1st last, in the interval of the Heilsberg programmes listeners nó longer heard the two bell signal to which they have hitherto been accustomed; it was replaced by something more elaborate. An abbreviated version of an old East Prussian song (*Wild flutet der See*) is now used to identify the transmitter to its home and foreign audiences.

### Radio Tessin

THE wavelength of the new Swiss transmitter has not yet been fixed. Tests made on 678.7 m. have been suspended as interference was caused with the shipping band. Experiments are now being carried out on 720 and 750 metres, but it is quite possible that a totally different channel may be allotted to this station.

### For the Short-wavers

FOR the broadcast of its National and other programmes the German *Reichsfunk* now disposes of four short-wave transmitters which work according to the following time schedule. From B.S.T. 13.55 until 22.30 the Königswusterhausen entertainments are also taken by DJB on 19.73 m.; from 16.00 to midnight (24.00) DJD on 25.51 m. is brought into operation. DJA, the station with which we have been so familiar on 31.38 m., comes into action at 23.00 and stays on the air until about 0.300. DJC on 49.83 m. possesses an aerial directional to America and transmits special programmes from 01.00-03.00 daily.

### Dutch Short-wave Transmitter

PCJ, Hilversum, which closed down in October, 1931, has not resumed its broadcasts, but in its place PHI, a neighbouring station at Huizen on the borders of the Zuider Zee, is working on 16.88 m. (17,775 kc/s), on Mondays and Thursdays between B.S.T. 13.00 and 15.00, and on Saturdays and Sundays with an extended transmission. An alternative channel is that of 25.57 metres (11,730 kc/s) which may be used during the winter months. The broadcasts, which are strictly of a non-political character, are mainly destined to the Dutch East and West Indies, but are being well received in most quarters of the world. The announcer is one of the most versatile linguists on the air, as he speaks Dutch, English, German, French, Italian, Spanish and Portuguese fluently. Many of these languages are used in the broadcasts.

## INTERESTING and TOPICAL PARAGRAPHS

### A LESSON *via* RADIO

*A demonstration for teachers and University students of a broadcast lesson in geography being given at Cookridge Street Baths, Leeds. The radio apparatus is seen on the left.*

### Radio Galicia

FRENCH listeners report the reception of broadcasts from an apparently new transmitter installed at Santiago on the North-western corner of the Iberic peninsula. Its call letters are EAJ4. The transmissions have only been heard in the later evening hours, as it works on a wavelength of 368.1 metres common to Bolzano (Italy) and Helsinki (Finland). Moreover, its signals are not strong, the power being given as 200 watts (aerial). It would appear to be run by a local association of wireless amateurs.

### Radio and Mount Everest

THE work of the Mount Everest Expedition has been considerably assisted by the fact that two of the camps have been in direct radio communication with the base at Darjeeling. One of the stations is situated at the foot of the Rongbuk Glacier from which the ascent to the summit of Mount Everest is to be attempted. All equipment for the installation of a combined transmitter and receiver had to be conveyed by carriers from Darjeeling, and the convoy was greatly hampered by storms. Unfavourable weather conditions at the outset made radio messages almost impossible, but when they improved, three-way communication was established and greatly assisted towards the success of the undertaking.

### Lille and London National

THE French station which is heard immediately above the tuning of London National is Lille PTT. This transmitter, situated in the North of France, is approximately only 150 miles from the English capital and, although its power is less than 1½ kilowatts the signals are well heard in many parts of Great Britain. Lille announces itself as "*Radio PTT du Nord à Lille*," as the station is in the French State broadcasting system. Its opening and closing call is usually followed by a gramophone record. Most French studios now close down with the playing of the *Marseillaise*; the National Anthem is not curtailed but given in its entirety.

### Latinizing Foreign Words

ALTHOUGH the French are doing their utmost to find equivalents for English radio words, they have succeeded in doing so in very few instances, and the French fans' radio jargon contains most of the terms—curiously mispronounced it is true—familiar to our ears. In their radio talks such words as *midget, fading, lay-out, buzzer, shunt, bandpass*, and so on can be frequently heard. Some, on the other hand, have been adapted; a loud-speaker is a *haut parleur*, a literal translation. On the other hand, *un coquetel* is a poor adaptation of cocktail; in programmes *un coquetel musical* is an *olla podrida* of popular melodies.

### Hungarian Railway Radio Service

WITH a view to popularizing the new listening equipments on Hungarian trains, the Budapest transmitter broadcasts a special concert daily at 9.15 a.m. G.M.T. for the benefit of passengers travelling by the Budapest-Vienna express.

## SOLVE THIS!

### Problem No. 38

Jackson's set had suddenly taken leave of its senses. The London transmission was proceeding when suddenly, with a faint click, the music ceased. He walked across to the set and found the valves still burning, and upon rotating the tuning dial the station was again heard, only this time it was eight or nine degrees higher up the scale. The condenser was left at this point, and the programme continued uninterrupted for an hour or so, when with another click it vanished, to be found once more at the correct point on the scale. This occurred for several days, and then Jackson found the cause. What do you think it was? Three books will be awarded for the first three correct solutions opened. Address your solutions to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and mark your envelopes Problem No. 38. Do not enclose any other correspondence with your solution.

### SOLUTION TO PROBLEM No. 37

Robinson overlooked the fact that the inductance was increased by using the iron core, and consequently the particular coil he used tuned to a wavelength of between 600 and 1,000 metres, with the result that none of the ordinary stations were audible.

The following three readers received books in connection with Problem No. 36.

S. Dover, 37, N.W. Terrace, Netherfield, Nottingham; H. S. Francis, 179, Nelson Street, Norwich, Norfolk; J. Lowder, Forest, Pontardulais, Swansea, Glam.

# A SHORT-WAVE TWO VALVER

It is Explained in this Article how an Efficient, though Simple, Two-Valve Short-Wave Receiver can Easily be Made.

A Special Set for the DX Enthusiast

By FRANK PRESTON, F.R.A.

THE summer months are notorious for presenting innumerable difficulties to the normal reception of long-distance stations. As a result, the DX enthusiast is debarred from getting the maximum enjoyment from his hobby during the light weather. Conditions are such that the signals from medium and long wave stations do not travel nearly so well as they do in winter time and thus if they are to be well received over distances of more than 200 miles or so a rather specially sensitive receiver is required. But even the best set that can be designed, with little regard to cost, cannot entirely overcome the difficulty because the more sensitive it is made, the more readily does it respond to atmospherics, which are, of course, of frequent occurrence during the warmer months of the year.

It is a happy coincidence, however, that short waves, below 50 metres or so, behave in an entirely opposite manner to those within the so-called "broadcasting bands." Not only do they travel over greater distances during daylight hours, but they are affected to a much lesser extent by atmospheric disturbances. In fact, it is often found that when the "grinding" and "crashing" noises are intolerable on, say, 400 metres, they can scarcely be heard on 40 metres.

All this points clearly to the conclusion that if DX work is to be carried on at this time of year, it must be done through the medium of short waves. Very fortunately, the simplest and least expensive kind of apparatus is all that is necessary for world-wide short-wave reception. Anyone who has not spent half an hour at the controls of a good short-waver cannot possibly imagine the thrills which the set can give. No matter what hour of the day it happens to be, the listener can be assured of picking up signals from two or three continents, and with a bit of luck it is by no means impossible to log every continent of the world in the space of twenty-four hours. There are stations galore working on the wavelengths between 15 and 50 metres and these are so far-flung as Tokio, Wellington (N.Z.), Kuala Lumpur (Malay States), Calcutta, Nairobi, Bucharest, Rabat (Morocco), Rio de Janeiro, Tegucigalpa (Honduras), Pittsburgh (U.S.A.) and Vancouver—without question they span the whole world.

(Continued overleaf)

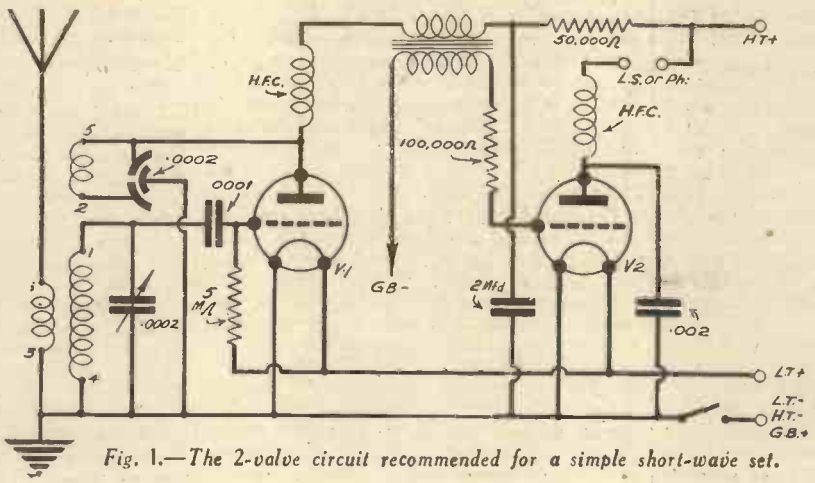



*Fig. 1.—The 2-valve circuit recommended for a simple short-wave set.*

**Simplicity of wiring is the keynote!**

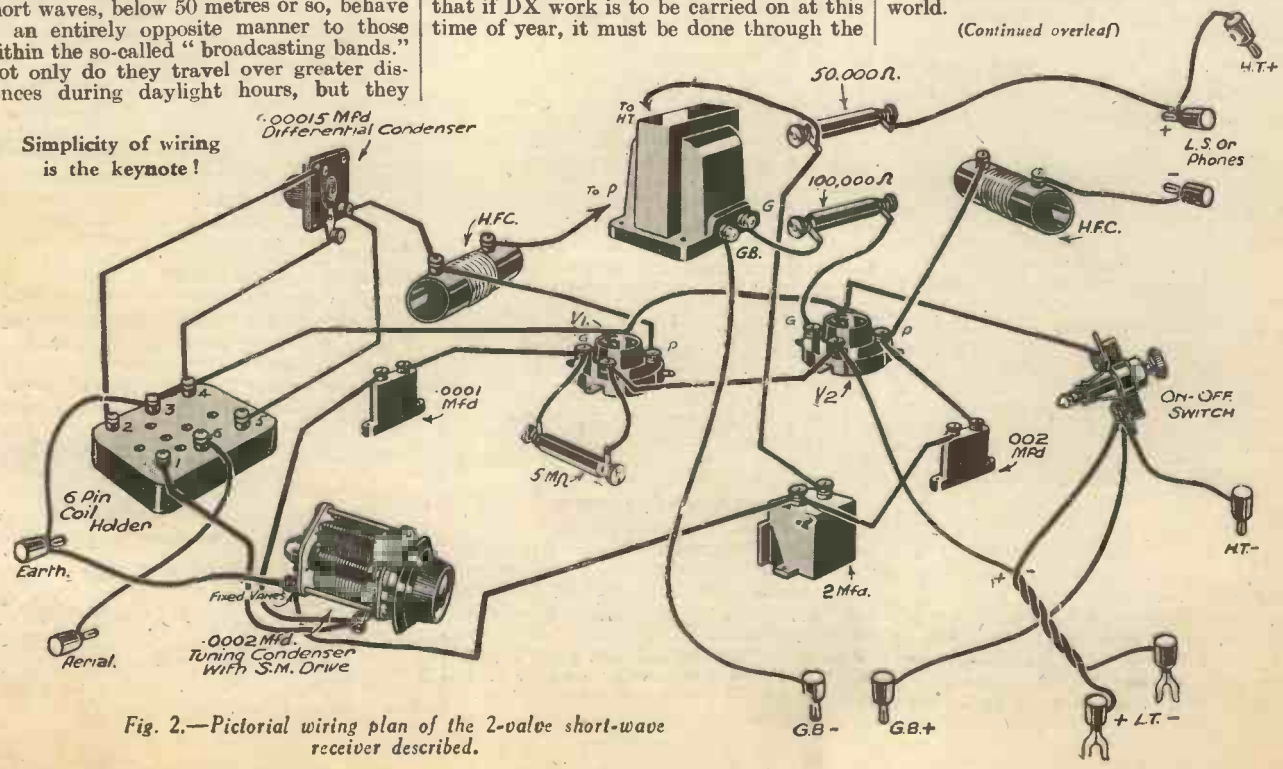
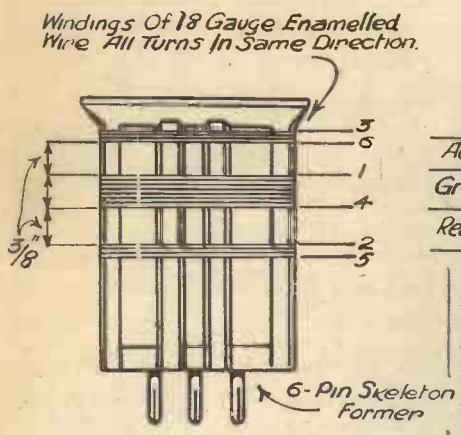


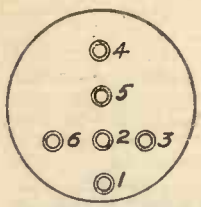

*Fig. 2.—Pictorial wiring plan of the 2-valve short-wave receiver described.*




| | 15-30 | 25-60 | W/L METRES. |
|---|---|---|---|
| Aerial | 3 | 4 | TURNS |
| Grid | 4 | 6 | " " |
| Reaction | 4 | 5 | " " |

*Fig. 3.—Details of the 6-pin tuning coils*

(*Continued from previous page*)




*Arrangement Of Pins.*

### Short Waves Are For The Enthusiast

I am not going to say that round-the-world short-wave reception is the thing for the listener who is merely intent upon hearing a good programme of music, or a talk, but for the real enthusiast who enjoys DX reception for its own sake there is nothing like a short-wave set. There is ever a spice of adventure and a little uncertainty as to whether New Zealand, India or Ecuador will be heard at best strength, or whether one will receive the transmissions of an amateur in the wilds of Africa or broadcasting station in New York.

A few years ago the number of powerful stations regularly working on short-waves was small, but at the present time there are at least seventy transmitters sending out more or less regular programmes on wavelengths between 18 and 50 metres. In addition to these, however, there are literally thousands of amateurs who make constant use of short-waves in "working" with their brethren at the ends of the earth.

### What Is The Best Type of S.W. Receiver?

The question which now arises is, how can the amateur of limited means take part in the great game of short-wave reception? There are two distinct ways; one is to make an adaptor or converter which can be used with the existing broadcast receiver, and another is to build an entirely new set specially for the job. It might be that the former method is rather less costly, but the self-contained short-wave set has much in its favour. There is no need to connect and disconnect it every time a change is to be made from one waveband to another, it is more adaptable for experimental purposes, and it can be used at the same time as the normal receiver in supplying entertainment to the non-technical members of the household. For these reasons I shall direct my remarks principally toward an outfit of the latter type. In passing, however, I would mention than an excellent adaptor will shortly be published in PRACTICAL WIRELESS.

### Available Circuits

There are many circuits available to the constructor of a short-wave set, from a simple single-valver to a multi-valve superheterodyne, and all of them can be depended upon to provide endless entertainment. When only one valve is employed the user is necessarily tied down to the use of 'phones, whilst a superheterodyne, though being extraordinarily efficient, is a comparatively costly instrument. I suggest a compromise between the two extremes in the form of a two-valver having a detector and low-frequency amplifying stage. Such a set in the hands of a keen amateur will bring in the whole world on 'phones, and will make possible loudspeaker reception of more powerful signals.

### A Good Two-valve Circuit

A circuit diagram of the type of set recommended is shown in Fig. 1, where it can be seen that the arrangement is almost identical with that of a similar type of broadcast receiver. The chief difference lies in the component values, but there are one or two "extras" which are included to simplify the operation; these latter are shown in heavy lines so that they will be more readily noticed.

On glancing over the circuit we see that the tuner has a separate aerial winding which makes the set suitable for use on any kind of aerial. The detector valve operates on the leaky grid principle, the grid condenser and leak being of .0001 mfd. and 5 megohms respectively. Reaction is applied through a winding on the tuner and a differential condenser. Coupling between detector and L.F. valves is by means of a transformer, and the anode circuit of the first valve includes a decoupling resistance and condenser. Notice that a 100,000 ohm fixed resistance is joined between the grid of the second valve and the transformer secondary; this, in conjunction with the H.F. choke, prevents the leakage of high frequency currents into the second valve. To prevent hand-capacity effects which might be caused by H.F. currents picked up in the 'phone or speaker leads a second choke is wired between the anode of the power valve and one "L.S." terminal. Still further to help in this respect a .002 mfd. by-pass condenser is connected from the anode to earth.

### Making the Set

Rather than give full constructional details for a particular instrument using this circuit I shall merely offer suggestions for its "interpretation" so that you may experiment yourself and probably make use of a number of parts which happen to be in the "junk box."

A pictorial wiring plan is given in Fig. 2 and this will help you to follow the connections. In practice the components will be laid out on a panel and baseboard in the same order as you would arrange the corresponding ones of a broadcast set. Care should be taken that the six-pin coil-holder is placed near to the first valve-holder and tuning condenser, so that the wires between these three components may be kept as short as possible. Both H.F. chokes should be near to the anode terminals of the valve holders to which they are connected, and should be at right angles to each other. It is also advisable to keep the L.F. transformer fairly well away from the tuning circuit components and from the chokes.

### Choice of Components

What about the choice of components? For best results, all those except the transformer, fixed condensers and fixed resistances should be special ones designed essentially for short-wave use, but for a start you can try ordinary ones which are on hand, changing them later as your experiments progress. This remark does not apply to the coils and H.F. chokes, but it will be explained later how these can easily be made at home. The .0002 mfd. tuning condenser *must* be of the air dielectric type—a bakelite one is useless for short waves—and should be fitted with a good slow-motion drive. A bakelite condenser can be used for reaction, but if an air-dielectric one is available it will be better. Although definite values are assigned to all fixed condensers and resistances there is no reason why these should rigidly be adhered to; the figures given will serve as a guide.

### The Coils

The coil connections shown are correct for the "Eddystone" 6-pin coils, which may be bought ready-made if required. On the other hand a pair of coils can easily be made as shown in the sketch of Fig. 3. Skeleton 6-pin formers are used, and these are wound with 18 gauge enamelled wire; the turns are slightly spaced in the aerial and grid windings, but those for the reaction winding are placed side by side. The ends of the windings can be secured by passing them through small holes made in a rib of the coil former. Connection to the hollow pins is made by passing the ends of wire through them and applying a spot of solder at the tips.

To cover the full range of wavelengths from 15 to 60 metres two coils are required, one of which will tune up to about 30 metres and the other from 25 to 60 metres. Both are identical except in regard to their numbers of turns.

### Making the H.F. Chokes

The two short-wave chokes can be made as shown in Fig. 4, by putting 80 turns of 30 gauge double cotton covered wire on a ¾in. diameter tube of paxolin or ebonite. The tube is fitted with two small terminals to which the ends of the winding can be attached, preferably by means of soldering tags. Of course, suitable chokes can be bought ready-made from any radio store, but remember that ordinary chokes intended for the longer waves are useless for the present purpose.

### Connecting Up and Testing

Having made the set, it can be tried out by putting a "210 H.F." or similar valve in the detector holder (V.1) and a

(*Continued on page 420.*)

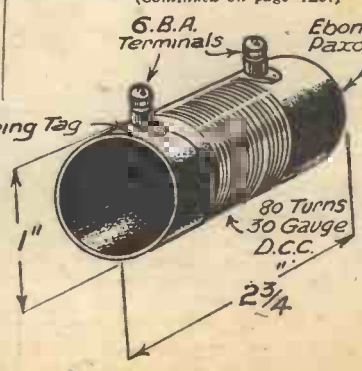



*Fig. 4.—Showing how the H.F. chokes are made.*

# AUTOMATIC Volume Control & your Set

FIRST ARTICLE

A Few of the Simpler Methods of Providing A.V.C. are Here Described

ONE of the most far-reaching radio developments of recent times has been the evolution and perfection of automatic volume control. Although the system is not as yet very widely employed in receivers on sale in this country it has become almost standardized in America and I do not think it is a very wild prophecy to predict that A.V.C. will be a strong feature of all the better-class receivers during 1934.

For the benefit of those readers who are not quite in touch with the progress that has been made during the last few months it should be explained that it is the object of automatic volume control to bring in every station, which is normally well received, at the same volume level. An incidental, though by no means insignificant, advantage of A.V.C., however, is that it goes a long way towards the elimination of fading.

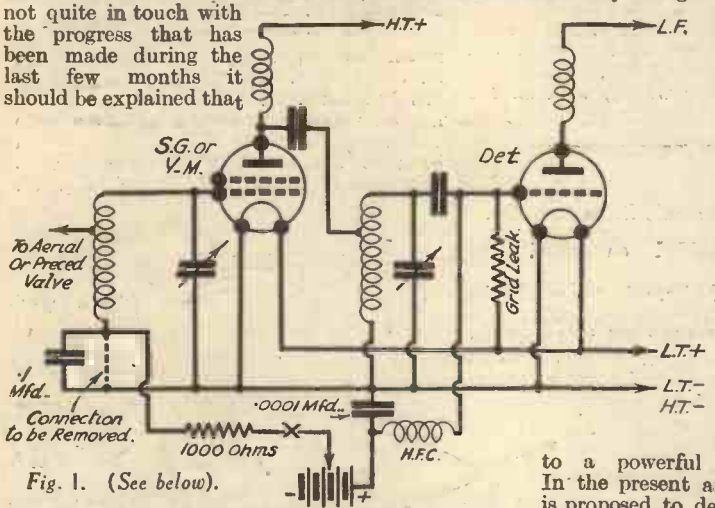



*Fig. 1. (See below).*

Only a short time ago this latest development would have appeared incredible, and, even fantastic, but it has been tested and proved so thoroughly that it is quickly being relegated to the commonplace. It is, nevertheless, highly interesting and well worthy of trial, so I will try to explain how it can easily be added to existing receivers. Perhaps I ought to say that A.V.C. can never be of value in a comparatively insensitive set because it *does not increase* the strength of distant transmissions, but acts only by virtue of its ability to *reduce* the volume from the nearer and more powerful ones.

### How it Works.

This will more easily be understood by considering how the system functions. The primary idea is that strong signals are made automatically to reduce the amount of amplification afforded by the high frequency amplifying valve or valves. We know that the amplification of a variable-mu, or even an ordinary screened grid valve can be reduced by applying more negative bias to its grid. We also know that the signal voltage passed on to the grid of the detector valve is proportional to the strength of the signal tuned in. Putting two and two together, as it were, it is not difficult to imagine that the extra voltage applied to the detector by a powerful signal might be fed back to the high frequency valves as additional bias, which would reduce the amount of amplification that they can give. The net result would be that the H.F. amplification would be reduced in proportion to the strength of the signal. This is, of course, precisely the action that is required and it forms the basis of automatic volume control. There are many ways of obtaining the desired effect, but, unfortunately, most of them are rather complicated and can only be satisfactorily applied to a powerful mains receiver. In the present article, however, it is proposed to deal only with the simpler systems which can be tried in practically any receiver of standard type having one or more S.G. or V.-M. valves.

### The Simplest Method of A.V.C.

The first and most straightforward of these is shown diagrammatically in Figs. 1 & 2. Only a portion of the complete receiver is represented and the additional components and wiring are clearly indicated in the sketch. Fig. 1 applies to a battery receiver and Fig. 2 to a mains one. When a signal is tuned in a certain amount of current flows through the detector grid leak and causes a voltage drop to occur across it, making the detector grid negative. The more powerful the signal is the heavier is the current flowing through the leak, and thus the greater is the voltage developed. As you are no doubt aware, this is the principle underlying the operation of a grid-leak detector. Well, then, it only remains to feed back the voltage drop produced by the grid leak to the grid of a preceding H.F. valve. This is done by taking a connection from the "grid" end of the leak to the "bottom" of the tuning coil connected in the grid circuit of an H.F. valve. To prevent instability, an H.F. choke, .0001 mfd. by-pass condenser, decoupling resistance and .1 mfd. condenser are inserted in the "return" lead. In the case of a battery variable-mu valve it is also better to include a grid-bias battery so that a suitable minimum value of bias can be applied to the high-frequency valve.

As mentioned before, the methods illustrated in Figure 1 can be used even with a set having only a single high frequency stage, but they are much more effective when two amplifying valves come before the detector. The control may then be applied to the first valve only, or to both; grid bias for the second is taken from the point marked X, through another 1,000 ohm decoupling resistance. Precisely the same idea holds good when the set is a superheterodyne, and in that case the A.V.C. will be applied to the intermediate frequency amplifying stages. Actually, this particularly simple arrangement is very effective with a superhet, since the signal voltage handed on to the detector is fairly great in this type of receiver.

In using this method in an existing set the only very important point to watch is that the extra H.F. choke should be mounted as near as possible to the detector valve-holder and should be arranged at right angles to any other unshielded chokes or coils that happen to be within six inches or so.

*(To be continued)*

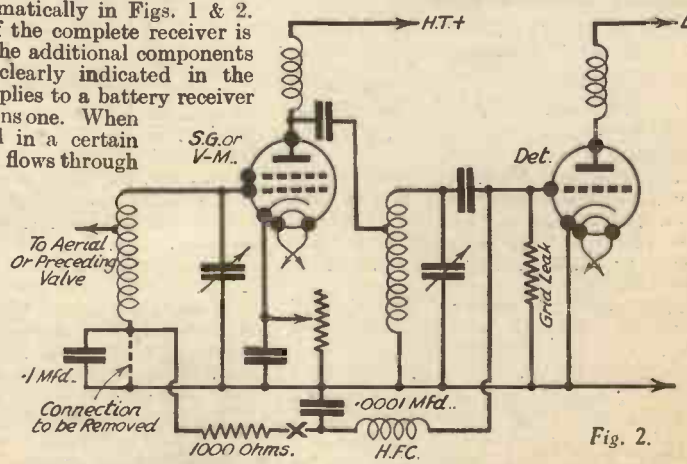



*Fig. 2.*

*Figs. 1 and 2.—These two diagrams show the easiest, though not always best, method of providing automatic volume control. Circuit (1) applies to a battery set, and (2) to a mains set.*

# WIRING EFFICIENCY

## How to Make the Connections in a Wireless Receiver in a Workmanlike Manner.

By A. V. D. HORT

THE arrangement of the wiring connections of a receiver and the method of securing them in position are second only in importance to the disposition of the component parts. If you build from a published design, the lay-out of the components is done for you, and all that you need to do is to follow the drawings and instructions in order to make an exact replica of the original.

Then comes the wiring. The drawings and photographs show how the wires go, and very nice and neat they look. There is more in it than mere neatness, too. The wires are so arranged that they take the shortest route from point to point, while, at the same time, they are well spaced apart. Though there may be several bends in a long wire, the straight parts are like ruled lines, and the bends are true right-angles, as a result, the receiver practically provides its own circuit diagram, which it would not do if the wires followed kinked and erratic paths. More than this, the connections being rigid and spaced well apart, no unsuspected interactions are likely to be set up between them. This is a trouble which is prone to appear in the H.F. portions of a circuit in particular, if the wires are placed haphazard. The capacity between adjacent wires makes them in effect tiny condensers, so that the H.F. currents can take paths which should not be open to them at all.

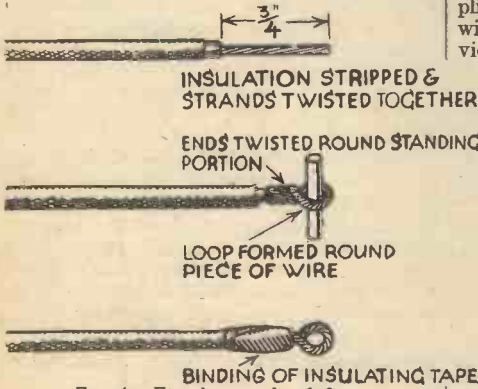



*Fig. 4—Finishing ends of flex.*

### Tools to Use

In a well-wired receiver, if you want to vary the circuit arrangement, or if a fault arises, you will be able to get at the right wires at once, without needing to trace your way through a tangled skein of connections.

It is quite easy to make a "professional" job of the wiring. You will need a pair of pliers. Ordinary side-cutting wireman's pliers will do for the whole job. If you are doubtful of your skill with a soldering iron, and prefer to put loops at the ends of the wires to fit on the terminals, you cannot do better than equip yourself with a pair of round-nosed pliers as well. There is a special type made for the job, with stepped jaws to bend loops of various sizes, but the ordinary plain pattern will serve quite well.

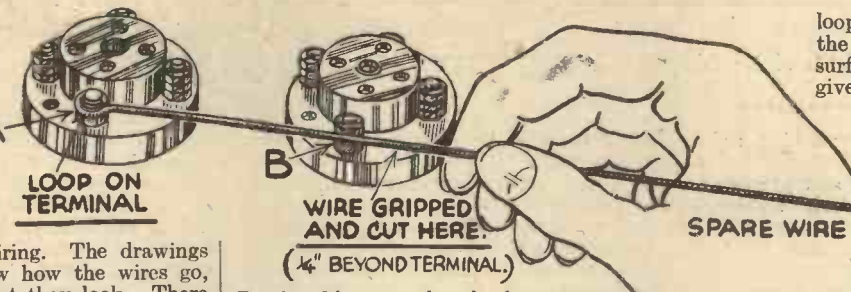



*Fig. 1.—Measuring length of connecting wire.*

For the wire itself, soft tinned copper, 16 s.w.g., is the best. Glazite fills the bill here. Let us assume that you have a bundle of 2ft. lengths by you, and that the receiver is ready for wiring, with all the components assembled on panel and baseboard.

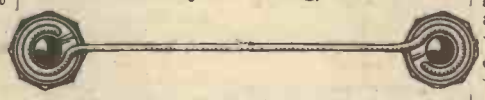


*Fig. 2.—How loops should lie on terminals.*

Take a length of wire, grip one end in the vice, take hold of the other end with your pliers, and pull steadily till you feel the wire "give" just a trifle. If you have no vice, twist the far end of the wire round some object which is really secure. You will waste a bit of wire this way, so choose a nail or a hook, or something equally small, so that you waste as little as possible. In any case, you must straighten the wire before you start work.

Now your wire really is straight. Handle it with care. No bends can be permitted in it now except the right-angled ones which you are going to make.

### Procedure in Wiring

Start on the wires which come closest to the baseboard of the receiver. These will include the L.T. circuit to the valve filaments. Fig. 1 shows two valveholders of a receiver, to illustrate the procedure in wiring. Bare ¼in. of one end of a straightened length of wire by unwinding the insulation and cutting it off close to the wire with a pair of scissors. Form a loop on this wire and slip it over terminal A, laying the wire along beside terminal B. The loop should be of such a size that it just drops easily on to the terminal. Grip the wire with your finger and thumb about ¼in. beyond terminal B, lift it away, and cut it close to your fingers. Strip the insulation for ¼in. at this end of the piece, and form your second loop, in the opposite direction to the first. Twist one or other of the loops if necessary, till they lie in the same plane. The link should now fit exactly over the two terminals. Lay each loop in turn on the anvil of the vice, or on any smooth-surfaced block of metal, and give it one blow with a hammer. This will flatten the loops, allowing the terminal heads to hold them firmly, with the largest area of contact. Note that the loops are put on the terminals in such a way that screwing down the terminal head tends to tighten the loop round the shank (Fig. 2).

### Sub-baseboard Connections

If there are any wires which pass underneath the baseboard, put in these also at an early stage. Now look at the photographs of the receiver which you are making, and see which wires come next above those which you have completed. Take as an example the wire from the anode of a valve-holder to a H.F. choke (Fig. 3).

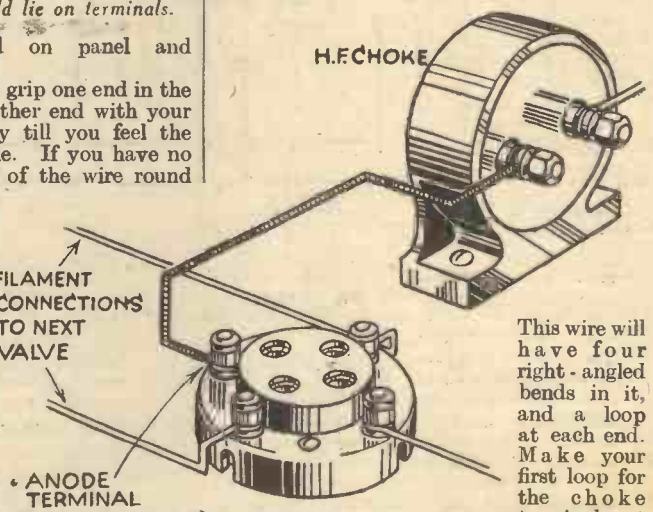



*Fig. 3—Wiring a choke to the anode terminal of a valveholder.*

This wire will have four right-angled bends in it, and a loop at each end. Make your first loop for the choke terminal, put the wire in place on the terminal, and see where your first bend will come to pass the wire clear of the corner of the choke. Grip it here with finger and thumb, lift it off, and make the bend. Put it back, and note the point for the next bend, this time ¼in. beyond the anode terminal of the valve. Again in position, to mark the bend bringing the wire down to the level of the terminal. Next, the bend directly underneath the last one, to bring the end level again, and, finally, leave ¼in. for the loop, cut the wire, and form the loop. Before putting the wire in place, true up the bends; the wire should then fit exactly on the terminals.

This process takes longer to describe than to carry out in practice. It does need patience, but the result is a job which is

(Continued on page 432.)

HOW TO OBTAIN AN—

# Amateur Transmitter's Licence

## An Informative Article Dealing with the Necessary Formalities

By G. H. WRAY, F.C.S.

PROBABLY the majority of readers find that wireless reception, with its associated problems, provides sufficient interest to satisfy them without investigating the possibilities of experimentation in the field of wireless transmitting, but there are also, no doubt, many advanced readers who have felt the desire to extend their activities beyond the confines of ordinary reception by taking up the sending or transmitting side of wireless, with a view to obtaining a Post Office licence to install and work an amateur transmitting station.

Under the Wireless Telegraph Act of 1904–1926, the Postmaster-General's authority must be obtained before any apparatus for wireless, either for transmission or reception, may be installed or worked. In order to obtain the necessary licence, a form of application must first be obtained from the Engineer-in-Chief, General Post Office, London. The more important of the questions contained in the application form are: Particulars of any previous experience in working transmitting apparatus, and of any certificates of proficiency in wireless which the applicant may hold. Speed at which the morse code can be sent or received by the applicant. General outline of the nature and object of the experiments which it is desired to carry out with the transmitting apparatus. Particulars of the apparatus to be used, together with circuit diagrams. Source of power to be used for transmission purposes. Frequency and character of waves to be transmitted, and type and dimensions of the aerial to be employed.

If the applicant is under twenty-one years of age, the application must be countersigned by his parent or guardian, in whose name the licence, if granted, will be issued. Each application for a licence is judged upon its merits, and care should, therefore, be taken to provide answers as definite and comprehensive as possible to the questions asked, especially in the case of that calling for a general outline of the nature and object of the experiments which it is desired to conduct. It is not sufficient to answer this question by stating that it is intended to conduct experiments with wireless transmitting apparatus. Some definite line of research or investigation must be indicated.

If the form of application is completed in a sufficiently explicit and convincing manner, there is little doubt that the licence will be issued to the applicant, irrespective of whether he has any knowledge of the morse code. A licence to use transmitting apparatus with a radiating aerial is not usually granted to beginners, and if the applicant comes within this category he will probably receive a reply to his application to the effect that the Postmaster-General is advised that the use of a radiating aerial is not necessary for the experiments which the applicant has in view. It would probably be pointed out that the use of such apparatus with an "artificial" aerial, in conjunction with suitable detecting or measuring instruments, should prove sufficient, and that accordingly the Postmaster-General authorizes the applicant to use sending apparatus with an "artificial" aerial, with the stipulation that the apparatus shall not be connected with a radiating aerial. A call sign is also allotted for the use of the station, and a licence fee of 10s. is payable yearly.

An "artificial" aerial is defined as a closed, non-earthed oscillatory circuit possessing inductance, capacity and resistance, and functioning in the place of the usual aerial-earth system. It must be as nearly non-radiating as possible. The inductance should be in one piece and of small dimensions, as distinct from an inductance of large dimensions such as a frame aerial, and the maximum area formed by the turns of the inductance must not exceed 3 sq. ft.

The circuit arrangement of a continuous wave transmitter in its most simple form is shown, connected with a "radiating" aerial, in the diagram Fig. 1, from which it will be seen that the general layout bears a close resemblance to that of an ordinary one-valve receiving set.

When the amateur has served what might be termed his probationary period with sending apparatus connected with an "artificial" aerial, during which time he has acquired adequate knowledge of the operation of his apparatus, and an operating speed in the morse code of at least twelve words per minute, he may probably consider that the progress of his experimental work would be assisted by the use of a radiating aerial. With an artificial aerial the range of reception of the transmitter is approximately the four walls of one's house, but connection to a radiating aerial makes it possible to communicate and work experimentally with other amateur transmitters, both at home and abroad.

Application for authority to use a radiating aerial should be made to the Engineer-in-Chief, G.P.O., together with the reason why, in the opinion of the applicant, the use of a radiating aerial is necessary for the further progress of his experiments. If a sufficiently good case is made out, the desired permission will usually be granted. Before such permission becomes effective, however, it will be necessary for the applicant to satisfy the Postmaster-General, by undergoing an examination, as to his qualifications in morse working. Morse qualifications are necessary even where wireless telephony only is proposed, in order that the amateur working the station may be able to understand instructions addressed to him in the morse code by Government or Commercial Stations. An amateur who does not possess the necessary knowledge of morse may, however, under certain circumstances be permitted to employ a qualified wireless operator to take charge of the transmitting apparatus. If the issuing of a permit conditional to passing an examination in morse working is agreeable to the applicant, arrangements will be made by the Inspector of Wireless Telephony for the examination, for which a fee of 5s. is payable.

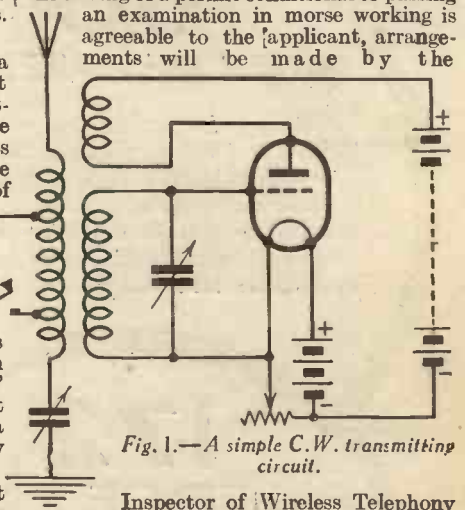


*Fig. 1.—A simple C.W. transmitting circuit.*

If a licence to use a radiating aerial is granted, the fees payable are 30s. for the first year, and 20s. for each subsequent year. These fees apply only to stations where the power for transmission purposes does not exceed 10 watts. For more powerful stations higher fees are charged. Ten watts is the usual power for amateur stations. The character of the waves transmitted is confined to continuous wave and telephony, spark transmission being prohibited.

Transmitting is ordinarily limited to the following wavelength bands: 173.4 to 151.1 metres, 42.7 to 41.24 metres, and 21.38 to 20.88 metres, and the amateur must ensure that the apparatus is as accurately tuned as possible to the particular frequency within these authorized wavelength bands.

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A.C.G.I., D.I.C., A.M.I.E.E.

PART II.

# CHOOSING A CHOKE

## Points to Note Concerning the Selection and Use of L.F. and H.F. Chokes

THERE are at least five uses to which low-frequency chokes may be put in radio receiving apparatus. The most familiar, and that for which there is no substitute whatsoever, is in the smoothing circuit of a high-tension supply unit—"battery eliminator" or "power-pack," as it is variously termed. In a power unit operating on alternating current mains, the rectifier, whether of the valve or metal type, gives an output which is certainly a direct current, so far as being uni-directional is concerned, but which is, in its present form, totally unfit for use as the high-tension supply because it is fluctuating in value, carrying a ripple corresponding to twice the frequency of the A.C. supply, and also ripples of higher frequency.

Similarly, a supply drawn from direct current mains is far from steady as regards voltage, for it suffers from ripple also, and in many districts where direct current mains are available, it is more difficult to eliminate the ripple than to smooth the output of the average A.C. rectifier.

### Smoothing Circuits

The method of removing ripple is the same in either case—the use of a smoothing circuit, as indicated in Fig. 1. Here, the two terminals marked "input" are those connected either to the output of the rectifier, or the direct current mains (when the condenser $C_1$ is really unnecessary), so that a "ripply" voltage exists across these two points, and any current flowing in a circuit attached thereto will be subject to similar fluctuations. But a low-frequency choke is connected in series with the circuit, and, by virtue of the impedance it offers to current fluctuations, shunts a very large proportion of the ripple current into the alternative path provided by the large-capacity condenser $C_1$. A further condenser, $C_2$, is also shunted across the supply at the other end of the choke, and has the effect of still further smoothing.

A single smoothing choke of suitable design, with two reservoir condensers—usually of 4 mfd. capacity—is in most cases sufficient for smoothing the output from a full-wave rectifier valve operated on normal commercial A.C. systems, and also for smoothing a supply taken from some D.C. mains. In many instances, however, it is found necessary to add another choke and condenser to obtain satisfactory smoothing on D.C. mains.

### The Output Stage

The next application of low-frequency chokes is in the output stage of a receiver. The anode current of the output valve consists of a steady direct current component, and also an alternating current component corresponding to the audio-frequency power which will ultimately operate the loud-speaker. It is, of course, possible to pass the whole anode current through the speaker winding, and in many cases the loud-speaker will operate quite satisfactorily, providing its impedance is correctly matched to that of the output valve. But then the direct current portion of the anode current will pass through the winding as well as the alternating current component, and will have the effect of heating it up. This may not be of importance in the case of a small output valve, but the mean anode current of many large output valves is fairly heavy—a matter of 30 milliamperes or more, and may be greater than the speech coil can carry continuously without overheating or even the risk of burning out.

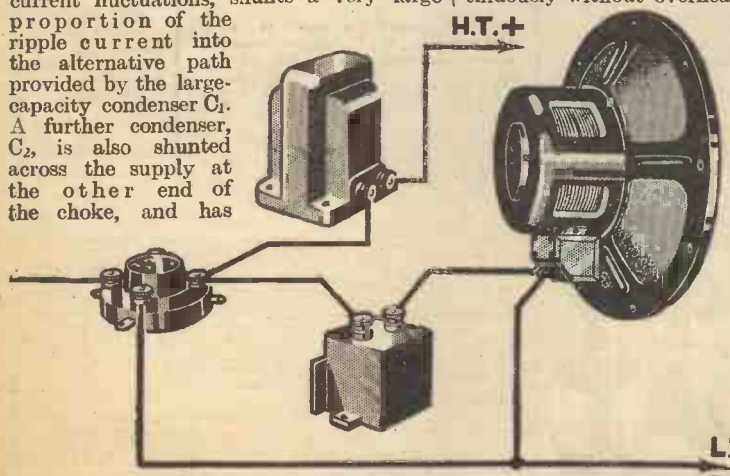


*Fig. 2.—Connections for a choke-capacity output-filter.*

One way of avoiding this is to employ a choke-capacity output-filter, as shown in Fig. 2. A choke, having a suitable inductance value, is inserted in the anode circuit of the output valve, between the anode and H.T. positive terminal. The choke has a comparatively low resistance to the direct current portion of the anode current, but the audio-frequency portion is choked back and takes the easier path through the condenser C to the loud-speaker, and thence to the H.T. — terminal. An additional advantage of this system is that, as the speaker winding is entirely isolated by the condenser C from the high-tension voltage, there is no risk of shock or disastrous shorts if the loud-speaker or extension leads are accidentally earthed.

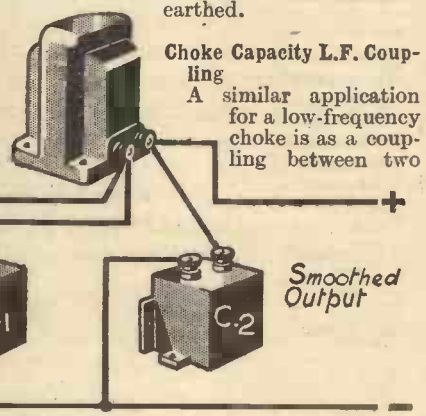


*Fig. 1.—A smoothing circuit.*

### Choke Capacity L.F. Coupling

A similar application for a low-frequency choke is as a coupling between two audio-frequency valves. The connections are shown in Fig. 3, and are identical with the somewhat better-known resistance-capacity coupling. It has an advantage over R.C.C., however, in that as the choke is of comparatively low resistance, the drop in anode voltage in the coupling device is comparatively small.

It is perhaps not so well known as it should be, that a low-frequency choke can be employed in place of a decoupling resistance in situations where it is desired to keep the voltage drop in the decoupling arrangements as low as possible. The action of a decoupling choke is exactly the same as that of the smoothing choke in a high-tension supply unit and it can, in effect, be considered as an extension of the smoothing system. Another use for a choke is in place of a grid-leak in resistance-capacity couplings where, for any reason, it is desired to keep the resistance of the grid circuit low.

### H.F. and L.F. Choke Differences

The design of low-frequency chokes differs from that of radio-frequency chokes in several particulars. In the first place, in order to achieve the necessary high impedance at the comparatively low (audio) frequencies, a much higher inductance is necessary. Inductances of 15 to 30 henries are usually specified for output chokes, and somewhat larger values, up to 50 henries, for smoothing. In order to achieve the necessary high inductance, low-frequency chokes are wound on iron cores built up from a number of laminated sheets, similar

(Continued on page 420)

## CHOOSING A CHOKE (contd. from p. 418)

to those forming the cores of low-frequency transformers.

Such a construction is not applicable to high-frequency chokes because, at the enormous radio frequencies, the losses due to eddy currents induced in iron cores and other magnetic losses would be very serious.

Another point of difference is that low-frequency chokes usually have to carry much heavier currents than radio-frequency chokes, and are therefore wound with wire of much heavier gauge. Refer, as in the case of H.F. chokes, to PRACTICAL WIRELESS Data Sheet No. 6 for certain particulars, but to help readers the practical values are reproduced here :—

| *Purpose.* | *Inductance.* | *D.C. Res.* | *Current.* |
|---|---|---|---|
| L.F. Coupling | 15/20 henries | 500/800 | 15/30 m.A. |
| Power Grid Coupling | 100/300 ,, | 1000/2000 | 5/10 m.A. |
| General Purpose | 20/30 ,, | 300/500 | 30/60 m.A. |
| Output Filter | 20/60 ,, | 200/500 | 20/60 m.A. |
| Pentode Output | 30/60 ,, | 500/1000 | 20/60 m.A. |
| Mains Smoothing | 30/60 ,, | 200/500 | 20/30 m.A. |

### Selection

We must now consider what points affect the selection of a low-frequency choke. Obviously, the first consideration must be to see that the choke has the correct inductance—the figure specified by the designer of the set. Next, it is important to ascertain that the rated inductance is obtained when the choke is carrying the full load current of the circuit. This is, of course, a matter of design. The inductance of the choke depends upon the number of turns, the size of the coil, the size of the core, and the current carried. If the core is not of sufficient section, the iron may become magnetically saturated at, or even before, full load. If the steady, direct current component is sufficient to saturate the core, the alternating current component will not be able to produce the alterations in magnetic strength required, and the effective inductance will drop. The correct specification for a low-frequency choke, therefore, is that it shall be of a given inductance at a given current. All good makes of choke are rated in this way by the manufacturers.

The resistance of the choke is the next point to receive attention, especially in the case of smoothing chokes. If such a choke has a somewhat high resistance, a fairly big voltage drop will develop across it, and this voltage drop will be high when the current passing is high, and less when the current passing is reduced.

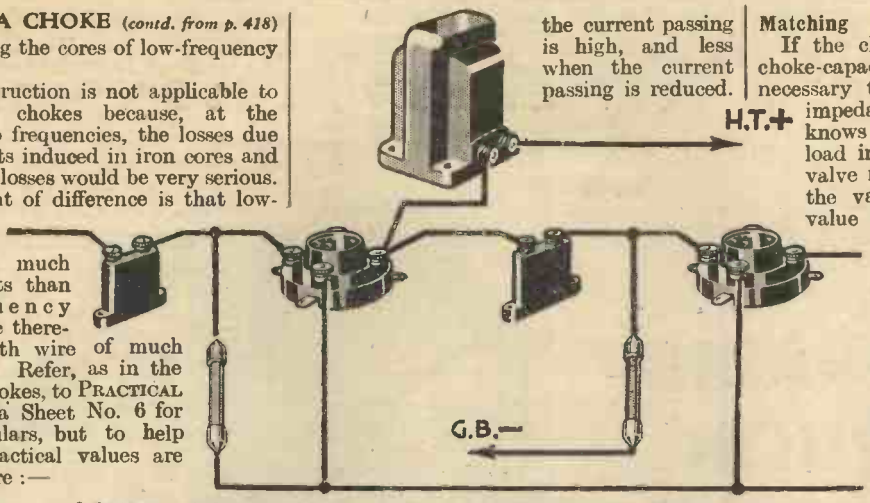


*Fig. 3.—Showing the connections for choke-capacity L.F. coupling.*

Three effects will follow : first, the drop in voltage due to the choke's resistance will reduce the anode voltage available for the various valves ; second, the voltage regulation of the supply unit will be poor ; and third, the receiver will be more prone to low-frequency oscillation, hum, and motor-boating because the resistance of the smoothing choke will be common to the anode circuits of all the valves.

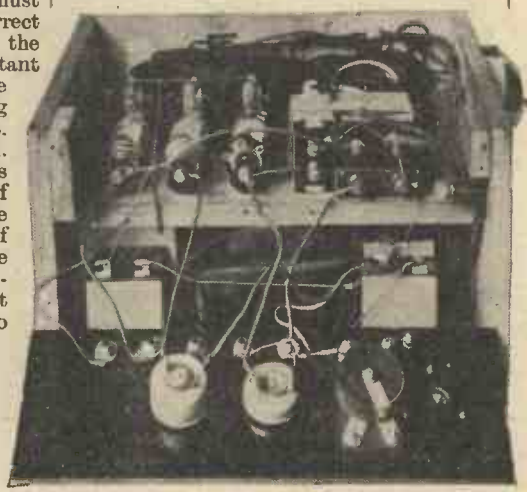

*Fig. 4.—An example of a home-made H.T. eliminator in which the choice of correct L.F. chokes plays an important part. Note the three large open ones.*

### Matching

If the choke is intended for use in a choke-capacity output filter, it may be necessary to obtain a tapped choke for impedance matching. Every listener knows that the impedance of the load in the anode circuit of an output valve must bear a certain relation to the valve impedance, and the best value of load impedance is usually quoted by valve manufacturers for each type of output valve. If the impedance of your loud-speaker is not the correct value to form the optimum load for your output valve, you must adjust matters by employing either an output transformer of appropriate ratio, or a tapped choke. A tapped choke may be considered as a kind of transformer (auto-transformer is the technical name) in which the whole or a part of the choke winding acts as the transformer primary, while a part or the whole of the winding functions as the secondary. Tapped chokes giving a variety of different ratios can be obtained, as well as centre-tapped chokes for push-pull, quiescent push-pull, and class "B" circuits.

Concerning the mechanical design of low-frequency chokes there is really not much to be said. The purchaser will naturally see that the general finish is good, and will attend to such matters as convenient and accessible fixing lugs or feet, and solid terminals or soldering tags. Insulation is an important matter, particularly in smoothing and output chokes, and must be designed to withstand the full voltage to which the component is likely to be subjected.

It is sometimes necessary, especially in the case of chokes which are to be incorporated in the receiver proper, to shield the component magnetically, in order to prevent stray magnetic fields from the choke inducing hum in other parts of the circuit. Shrouded chokes are encased in a metal case, and this case should be connected to earth by the terminal provided. Shrouding is not so important in smoothing chokes embodied in supply units installed some little distance from the receiver proper.

Loose laminations often produce a very annoying form of hum—or even buzzing—due to magnetic stresses, and I have known cases when this hum was so bad as to be audible as a most unpleasant background to even fairly big volume reproduction, and was often mistaken for actual circuit hum.

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## SHORT-WAVE TWO-VALVER

(Continued from page 412)

high amplification power valve, such as a "220 P.A.," "P.M. 2A" or "L.P.2" in holder V.2. A high tension voltage of 100 or more will give best results, and the grid-bias plug should be given a voltage appropriate to the power-valve and H.T. voltage in use.

The method of manipulation will be almost the same as that which applies to any Det.-L.F. broadcast receiver, except that the tuning and reaction controls must be adjusted *much more slowly*. You should attach great importance to the last three words, for otherwise you will be disappointed in the results—or lack of them—obtained. If it is remembered that a station can be tuned in *and out again* in about a quarter of a degree of the tuning dial, you will at once appreciate the need for careful operation of the tuning condenser. Reaction adjustment is nearly as critical, and whilst "searching" the set should be kept just "off" the oscillation point. All except the most powerful signals will be missed entirely if the reaction condenser is set either too far "in" or too far "out" ; the correct setting is that which produces a faint "rushing" sound in the speaker or phones.

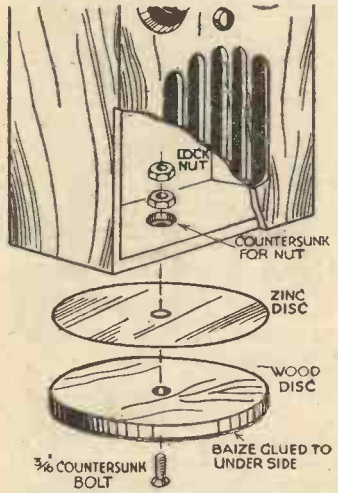
In all cases it will be found better to do the preliminary tuning with 'phones, switching over to the loud-speaker only after a loud signal has been tuned in.

Just one final word. If you do not succeed in tuning in any stations on one wavelength range, try the other. Reception conditions on various wavelengths change from hour to hour, and whilst the 20-metre band might not be productive of strong signals at one time, conditions will probably be just the reverse on the 31 metre range. Perhaps the best time for a preliminary trial is between 1 and 5 p.m., when Zeesen is to be heard on 19.73 metres. After 2 p.m. you will probably also pick up Pittsburgh (W8XK) on 19.72 metres and Bound Brook (W3XAL) on 16.87 metres. Once the set has been "got going" you will find that signals from somewhere or other are to be heard practically all day long. A list, with times of working, power, etc., of all the principal short-wave stations in regular operation was given in an excellent "Data Sheet," presented with PRACTICAL WIRELESS dated April 8th, 1933.

# READERS' WRINKLES
## The HALF-GUINEA Page

### A Cheap Turn-table

HAVING made a self-contained transportable set from a circuit given in No. 19 of PRACTICAL WIRELESS, I needed a turntable so as to obtain the full advantage of

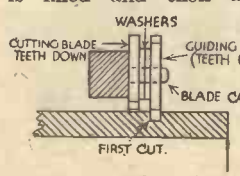



*Showing the parts for making a cheap turn-table.*

directional properties of the frame aerial. The total cost of the one I made was about twopence! For a penny I obtained a circular piece of wood cut out of a baffle-board, and having its diameter about ¼in. more than the depth of my cabinet. For another penny I purchased a 3-16in. bolt and two nuts. I then bored a hole to take the bolt, without binding, through both the bottom of the cabinet and through the centre of the wooden disc, and between the two rubbing surfaces of wood I put a sheet of zinc to reduce friction. The first nut I let into the bottom of the cabinet—on the inside, of course—the second nut acting as a lock-nut. A piece of baize, glued underneath the turn-table removes all risk of scratching the furniture.—M. D. G. (Hampstead).

### Slotting Ribbed Coil-formers

WHEN winding bare wire short-wave coils on 6 or 8 ribbed formers, difficulty is found in equally spacing the turns if the ribs are not slotted. This somewhat tedious operation can be simplified as follows. First mark and cut with a hack-saw the first groove right round the former. Then slack off the saw frame and leaving the first blade in the frame, slip two small washers over the studs on which the blade is fixed and then another blade, but reversed, *i.e.*, toothless side towards the work, as shown in the sketch. Tighten up the frame, rest the reversed blade in the cut already




*A simple method of slotting coil-formers.*

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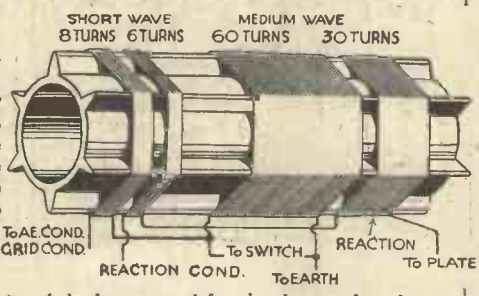
made and proceed with the work—the washers between the blades ensuring even spacing and the blade even depth of cut. —W. ANDERSON (Wolverhampton).

### Making a Dual-range Coil

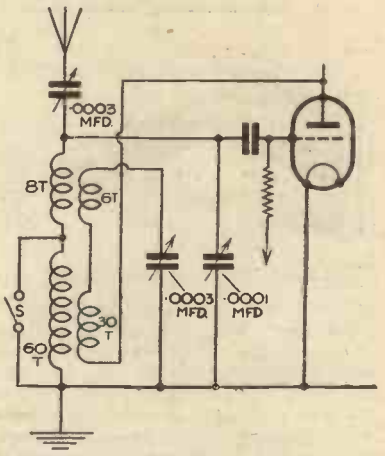
A COIL covering the most interesting portion of the short-wave band as well as quite a large range on the medium waves can easily be constructed at little cost. The one here described was wound to tune from about 400-300 metres and 34 to 18 metres with a .0001 mfd. condenser in parallel. If a larger variable condenser is used, say, .00025 mfd. a greater range can be obtained, but tuning becomes more




*A dual-range coil for the short and medium waveband.*

critical on the short waves. As the coil was primarily intended for short-wave work with provision for receiving the local or regionals the rather narrow medium-wave range did not greatly matter. This can, of course, be varied to suit individual requirements. On the short-wave band many interesting transmissions will be found in the 34–18 m. range including most of the commercial telephone transmitters, and better received broadcast stations.

The construction of the coil is very simple, a ribbed ebonite former 6in. long being used. It is desirable to have this of small diameter as in this way the fields of the coils are kept small and interaction between the medium and short-wave windings prevented. In the original, the wire used was enamelled, but d.c.c. may also be employed. Particulars of windings are given in the diagram, but these may be altered to suit individual needs. An ordinary 2-pole switch is used for wave changing, and should be mounted as close to the coil as possible. In nearly all cases it will be found that a short-wave choke will give smooth reaction on the medium waves, but if this is not the case a 10,000




*Circuit for the dual-range coil.*

ohm spaghetti in series with it, or alternatively, an all-wave choke may be employed.—R. T. WARD (Exmouth).

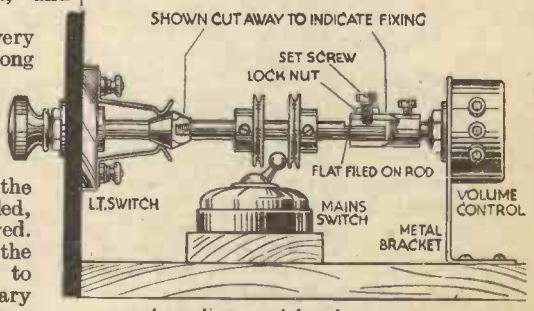
### Single-knob Control

IN keeping with the modern tendency of reducing control knobs on a wireless receiver to a minimum, I have devised the switching arrangement shown in the accompanying illustration. It will be noticed that one knob controls three separate components. First obtain a suitable length of metal-rod; thread one end to fit the bulb of the L.T. switch, and then fit two toy pulley wheels to engage with the "dolly" of the mains switch, as shown.

A flat must be filed at the other end of the rod, about 1in. long. This flat part operates the adaptor fixed on the volume control spindle.

A grub screw on the adaptor is screwed down until the rod will slide freely but not turn round in the adaptor. The screw is then locked in that position by the locknut. The assembly completed, a few adjustments may be necessary according to the design of the components used. When knob is pushed in both the L.T. switch and the

(*Continued overleaf*)




*A single control for three components.*

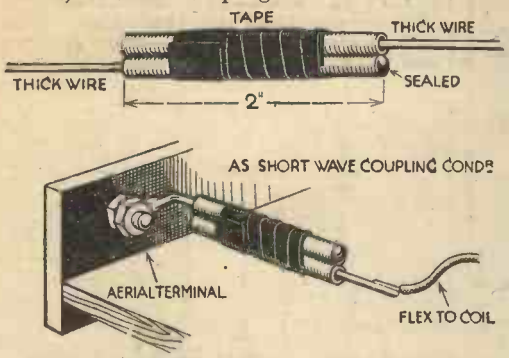
## RADIO WRINKLES

(Continued from previous page.)

mains switch will be in the "off" position; when pulled out they are both "on." Turning the knob round works the volume control.—R. G. MARSHALL (Oakengates, Shropshire).

### Midget Neutralizing Condensers

MIDGET adjustable condensers of small capacity—extremely useful for balancing circuits, neutralizing output valves, antenna coupling in short-wave

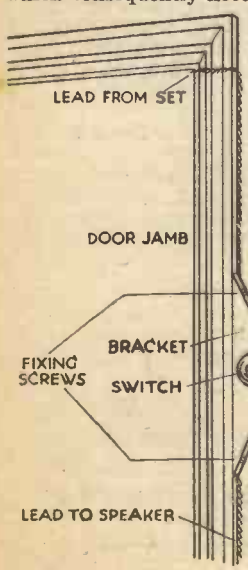



*Method of making small neutralizing condensers.*

receivers, etc.—can be made for next to nothing from odd lengths of systoflex and copper wire. The condensers consist of two 2in. lengths of systoflex, into which are inserted 3in. lengths of stiff copper wire One end of each tube is sealed with sealing-wax or Chatterton's compound. The two tubes are laid parallel (as shown in the diagram) and wrapped firmly together with insulating tape. Variation of capacity is effected by sliding the wires in or out of their respective sheaths. For connecting purposes a loop may be formed, on one wire, and a length of flex soldered to the other, or short lengths of flex soldered to both. If desired, the condensers may be made in 3in. or 4in. lengths to give a higher capacity.—F. GOUGH (Ellesmere).

### A Handy Switch Bracket

WHEN an additional loud-speaker is used in a separate room it is not always desirable that it should function simultaneously with the main speaker, which consequently necessitates some form of switching arrangement being installed in the vicinity of the extra loud-speaker. There is very often a difficulty in finding a suitable position to place a switch for this purpose. A very simple method of mounting same is to cut a small piece of wood—about ⅜in. or ½in. in thickness—to the shape shown in the accompanying sketch. After staining or painting the wood the switch can be mounted on it and the necessary leads connected through holes behind the switch. The bracket can then be secured by means of two screws to the edge of the beading around the door jamb, as shown. In the majority of cases, the beading stands out about 1in. away from the wall, leaving ample room for the leads behind the bracket.—H. WEARING (Plymouth).

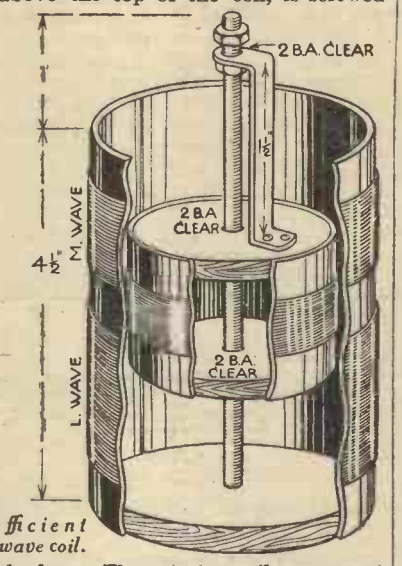



*Mounting a switch for an extra loud-speaker.*

### An Efficient Dual-wave Coil

PROBABLY the majority of amateurs have found that whereas reaction is freely obtained on the medium-wave section of a dual-wave coil, the coupling has to be considerably increased to reach the oscillation point on the long-wave band. The result, in the case of the majority of receivers, commercial sets included, is that on switching over from long to medium waves the set bursts into oscillation.

The following arrangement will be found to overcome this difficulty and, as can be seen from the accompanying sketch, the construction is perfectly simple. The coil is a single layer wound on a 3in. diameter paxolin former, with forty turns of 24 S.W.G., d.s.c. wire for the medium-wave band and 150 turns of 31 S.W.G. d.s.c. wire for the long-wave band. A wood disc is cut to fit inside one end to form a base, so that the coil can be mounted vertically, and a length of 2 B.A. studding, sufficient to project about 1in. above the top of the coil, is screwed

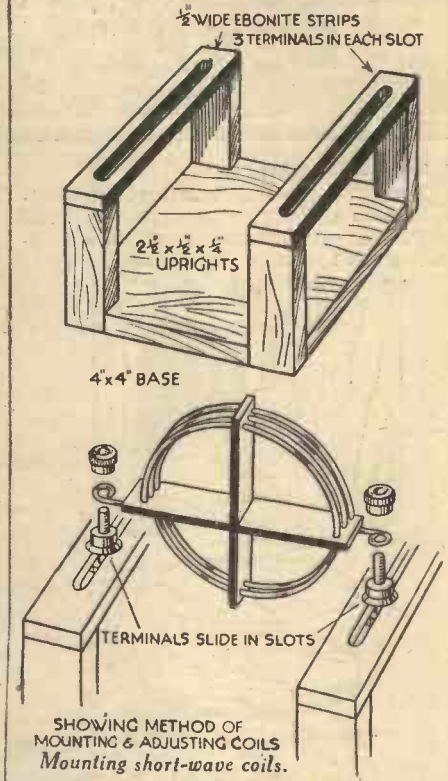



*An efficient dual-wave coil.*

into the base. The reaction coil consists of fifty turns of 24 S.W.G. d.s.c. wire on a 2½in. diameter former, the ends of which have a wood disc fitted inside, a 2 B.A. clearance hole being drilled through the centre of each. A piece of brass strip is bent to shape and drilled as shown, and screwed to one of these discs so that the three 2 B.A. clearance holes are in alignment. The reaction coil assembly is slipped over the studding, a nut being screwed on before the brass bracket so that the coil is suspended by the nut, a second nut following after the bracket to lock its position. It will be seen that by adjusting the nuts the coil is raised or lowered, and a reaction setting will remain constant over the entire scale of both wave bands.—E. L. NIMMO (Merton Park).

### Short-wave Coil Unit

A SHORT-WAVE coil unit, as shown in the accompanying sketches, can be made up in a few minutes from scrap




*Mounting short-wave coils.*

material. It possesses advantages, especially for the experimenter, in that each individual coil is easily interchangeable, and all are adjustable. The diagram is self-explanatory, and the materials required are: one piece of hardwood, 4in. by 4in.; four wooden uprights, 2½in. by ½in. by ¼in.; two pieces of ebonite, 4in. by ¼in.; six terminals, and a quantity of 16 S.W.G. bare wire. The terminals are mounted three in each slot, one pair for each coil.—F. C. TREND (Upper Norwood).

### A Short-wave H.F. Choke

A NEAT short-wave choke that can be suspended in the wiring of a set can be made as follows: Cut the former out of three pieces of 3-16in. ebonite to the dimensions given in Fig. 1. Assemble the three pieces, as in Fig. 2, and tie them together with thread. Fix a 6 B.A. terminal in each hole, with a soldering tag, solder some 36 d.s.c. to one tag and begin the winding. When the winding is well advanced, the thread can be removed, the turns of wire holding the former together. Finish the winding and solder the end of the wire to the second tag.—J. R. JONES (Cambridge).

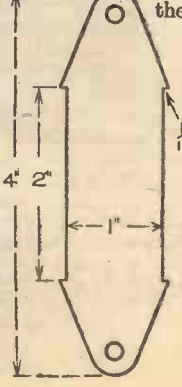



*Fig. 1.*

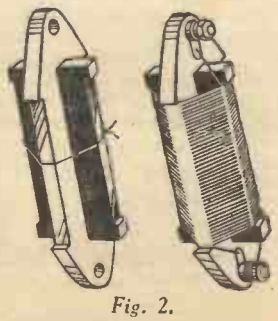
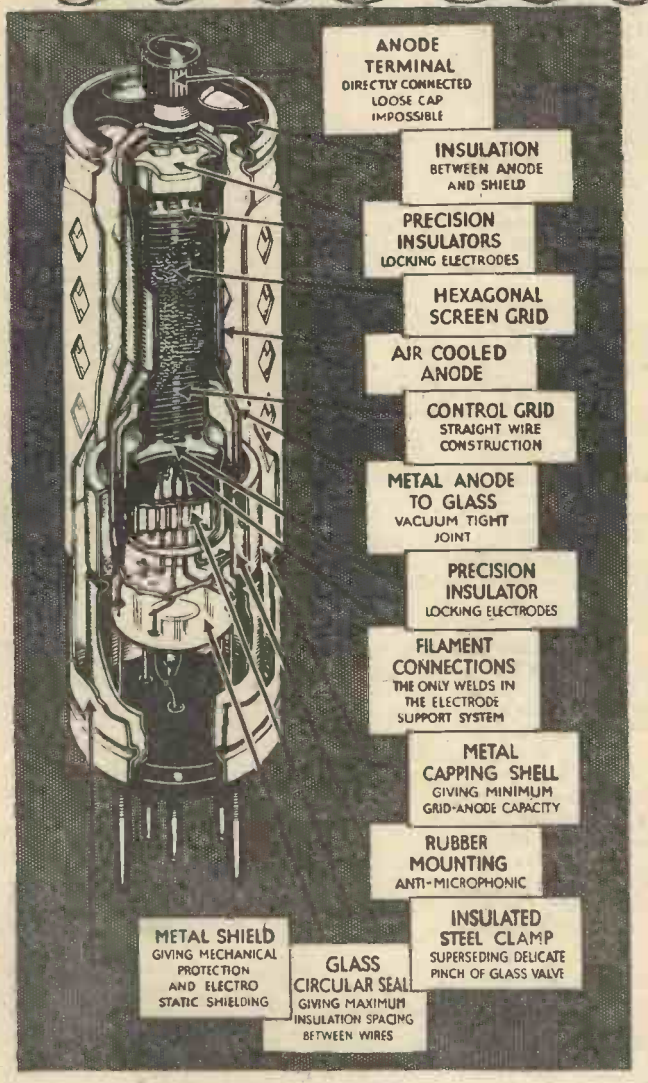


*Fig. 2.*

*Making short-wave chokes.*

# Metal INSTEAD OF GLASS

## a present reality




A study of the diagram reveals at once the advantages of the OSRAM "CATKIN" VALVE assembly over the previous method. The increasing accuracy in the use of valves demands an increasing accuracy in performance, and therefore increasing precision in construction. The "Catkin" construction permits a greater uniformity in production than was possible with the equivalent glass types, and so allows for a greatly improved performance in the set.

*By using OSRAM "CATKIN" VALVES you are definitely assured of—*

1. FREEDOM FROM BREAKAGE.
2. HIGHEST UNIFORM PERFORMANCE.
3. NO BACKGROUND NOISES.
4. SMALLER SIZE.
5. PERFECT SHIELDING.
6. ABSOLUTE RELIABILITY.

(METALLIZED TYPE)

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| | |
|---|---|
| **MS4B** High Efficiency Screen-Grid A.C. Mains Valve | **19/-** |
| **VMS4** Improved Variable Mu Screen-Grid A.C. Mains Valve | **19/-** |
| **MH4** High Magnification Detector A.C. Mains Valve | **13/6** |
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# Osram (CATKIN) Valves

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**FOR A.C. MAINS RECEIVERS**

**THE VALVE WITH THE IRON CONSTITUTION**

*Advt. of The General Electric Co., Ltd., Magnet House, London, W.C.2.*

# BUILDING DOUBLE-D THREE

IT will be noticed from the photographs reproduced this week that the baseboard of this receiver has been covered with metallized paper. There are two reasons for this. First, earth return leads are simplified by its use, and secondly, it helps to prevent instability which might arise due to coupling between certain parts of the circuit. The actual material used in the original receiver was Konductite, a material which consists of paper upon which aluminium foil is deposited. It is extremely simple to work, a pair of scissors cutting it as easily as ordinary paper. In commencing the construction, the first part of the work is the baseboard preparation. This is cut from five-ply 16in. by 10in. The side runners are 10in. by 3in. Smooth up the baseboard, and arrange the components as shown in the wiring diagram, and make quite certain that sufficient room is left at the rear edge of the baseboard to accommodate the metal bracket which holds the two electrolytic condensers. When every component is correctly placed, make a pencil mark round each one, and also, using the four-pin Clix valve-holder, make a mark in the centre of each valve position. This may easily be done through the centre hole in this particular valve-holder, and it should be placed in each valve-holder position in turn, and the centre marked. Now remove all the components and place them on one side for the time being. Drill out each valve-holder clearance hole, a 1in.-bit being used for the purpose. The hole for the seven-pin holder will then have to be slightly enlarged, an ordinary half-round file being easily employed for this purpose. Smooth the edges of the holes, and then place the side-runners in position and drill the holes for the fixing screws for these, but do not attach them yet.

### Covering the Baseboard

The next part of the work should be carried out very carefully. Cut out a piece of Konductite exactly 16in. by 10in., and thoroughly coat the paper side with some adhesive. When well covered, place it on top of the baseboard and smooth it out so as to leave no wrinkles or blisters. Allow it to dry thoroughly, watching that it does not curl up at the edges. A good plan is to clamp strips of wood along the edges whilst it is drying. When perfectly dry cut through the holes made for the valve-holders with a sharp pen-knife and trim the foil to the edges of the holes. In order to make quite certain that there is no risk of short-circuits on the seven-pin valve-holder, the foil round this one should be cut back for about ⅛in. beyond the edge of the hole. With a sharp instrument find the holes at the edges of the foil and pierce these, afterwards screwing on the side runners. To avoid the screws cutting through the foil a fairly large washer should be inserted under the screw head. When the runners are firmly attached the valve-holders may be fitted, and then the baseboard turned over so that the sub-baseboard components may be attached. The thickness of the valve-holders will prevent the foil from coming into contact with the surface of the work-bench and the foil will not, therefore, get torn. All the components may be mounted on the back of the baseboard, and when firmly attached, the wiring may be commenced.

### The Wiring

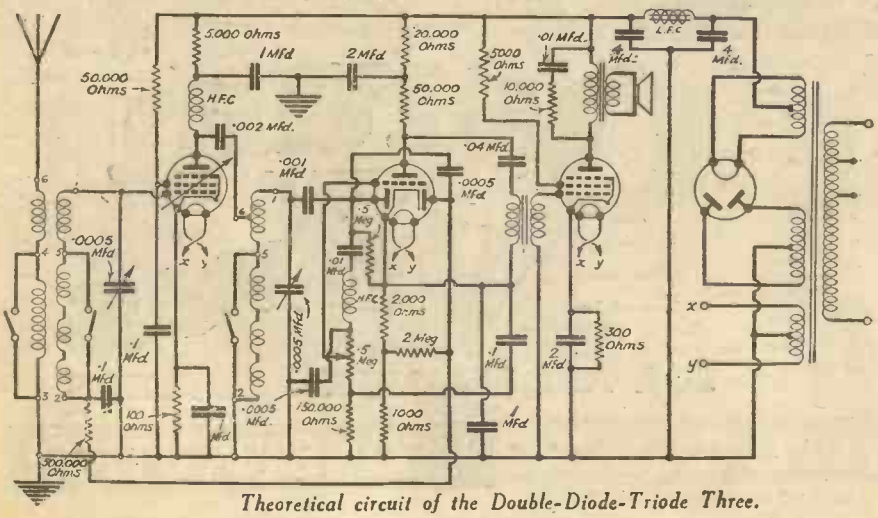
It will be noticed that the majority of the wiring is carried out on this side of the baseboard, and this greatly simplifies the construction. Only very few wires go through the board, and this saves a lot of time and trouble which usually occurs when the base has to be continually turned one way and then the other. The Ohmite resistances are held in place with the ordinary Glazite which is used for wiring-up, and they should be left until last in order to avoid untidiness which will occur if they are put in here and there, and have to be continually moved. The flexible leads for the heater windings should be inserted first of all, and the two leads from the valve-holder V3 to the mains transformer will, of course, be left until last. When all the main wiring is finished the positions of the holes through which leads pass must be marked and drilled from the bottom. In order to keep the appearance of the finished receiver nice and clean it is preferable to drill these holes only half-way, and then to use a fine pointed tool to continue the hole to the metal foil. The baseboard may then be turned over, and the hole finished from the top. This will save splitting and tearing the paper.

### Mounting the Coils, etc.

Now turn the baseboard up the correct way and position the coils, variable condenser assembly, mains transformer, etc. When these are accurately aligned, pierce through the screw holes and attach them in position. The two 4-mfd. electrolytic condensers must be mounted on a small metal bridge, or the baseboard must be recessed to accommodate them. It will be noticed that the length of thread which is provided on these condensers is only about ⅛in., and, consequently, if you drill through the baseboard there will be insuffi-

*An attractive look*

**A FULL-SIZE BLUEPRINT MAY BE OBTAINED F**




*Theoretical circuit of the Double-Diode-Triode Three.*

*The sub-baseboard*

# THE DIODE-TRIODE

## The First Steps in the Construction of this New Three-valve Set which Employs Automatic Volume Control.

By the "Practical Wireless" Technical Staff.

FOR LIST OF COMPONENTS SEE PAGE 440.

*ng set!*

cient thread projecting to permit of the attachment of the locking nut. To overcome this, the mounting bridge is used, but if you do not feel competent to carry out this little bit of metal work, the baseboard may be drilled with two §in. holes to take the fixing thread, and then the underside of the baseboard should be recessed by cutting away two or three layers of the plywood. In addition it will be necessary to drill two small holes to take the leads

**T OF THIS RECEIVER OR 1/-, POST FREE.**

*components.*

from the mains smoothing choke for subsequent connections to the positive tag of the condenser. The negative connection will automatically be made to the casing through contact with the metal foil. The bridge upon which the condensers are mounted is cut from a strip of aluminium or brass 6⅜in. long by 1½in. wide. The central horizontal portion is 2⅜in. long, and the upright portions are 1¼in. The small turn-over for attachment to the baseboard is §in. The two holes for the condensers are 1½in. apart, and the condensers should be attached to this mounting before screwing to the baseboard. Attach two short Glazite wires to the small terminals underneath the condensers and cut these long enough to reach the terminals on the Smoothing Choke. Bend the necessary loops in the ends of these leads, and then screw down the mount, as shown in the wiring diagram.

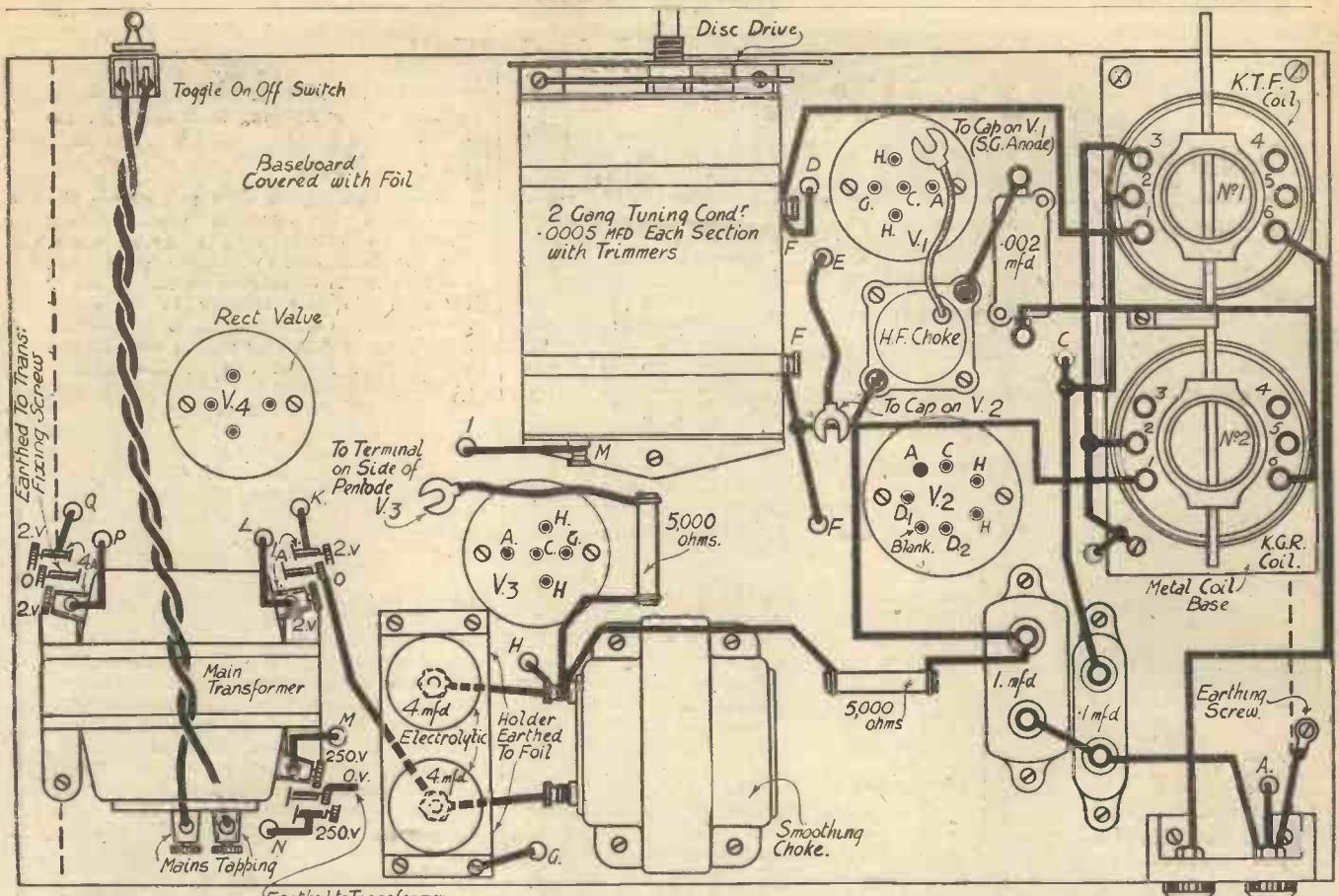
### Completing the Wiring

Now bring through the various leads from the underside of the baseboard, noting that in one or two cases earth returns are made to fixing screws. One lead is attached to the fixing screw for the electrolytic condenser mounting just made, whilst another lead is brought from a 2-mfd. condenser on the underside to the terminal on the rear of the condenser chassis. The coil base is attached with four screws, one of them being used as a combined earthing terminal for the coils and is then joined to the .0005-mfd. fixed condenser underneath. Two further components have now to be wired into position, and these are the on-off switch and the volume control potentiometer. These are attached to the front of the cabinet, and as it is awkward (in fact, almost impossible) to attach these first and then complete the wiring, they must be connected up and then inserted into the holes in the cabinet with the wires already attached. They should therefore be put into their approximate position, and the requisite lengths of wire cut off. In the case of the switch, two lengths of flex of approximately the right length will be sufficient as the flex may sag in this part of the receiver without any ill-effects. The volume control, however, must be more accurately adjusted, and it will be found that the Glazite is almost strong enough to enable this to remain in position without any mounting. When the wiring is finished it is preferable to try out the receiver before inserting it in its cabinet, and the instructions for this part of the work will be best held over until next week, when they can be dealt with more fully. Until these appear, carefully check over all wires, as a short-circuit in a mains receiver is not easily rectified, and may result in serious damage. No fuses are used as there should be no need for them, but as prevention is always better than cure, it is preferable to utilize the time between completion and the appearance of operating instructions in carefully checking connections, joints, etc., and making quite certain that everything is in order for the first test.

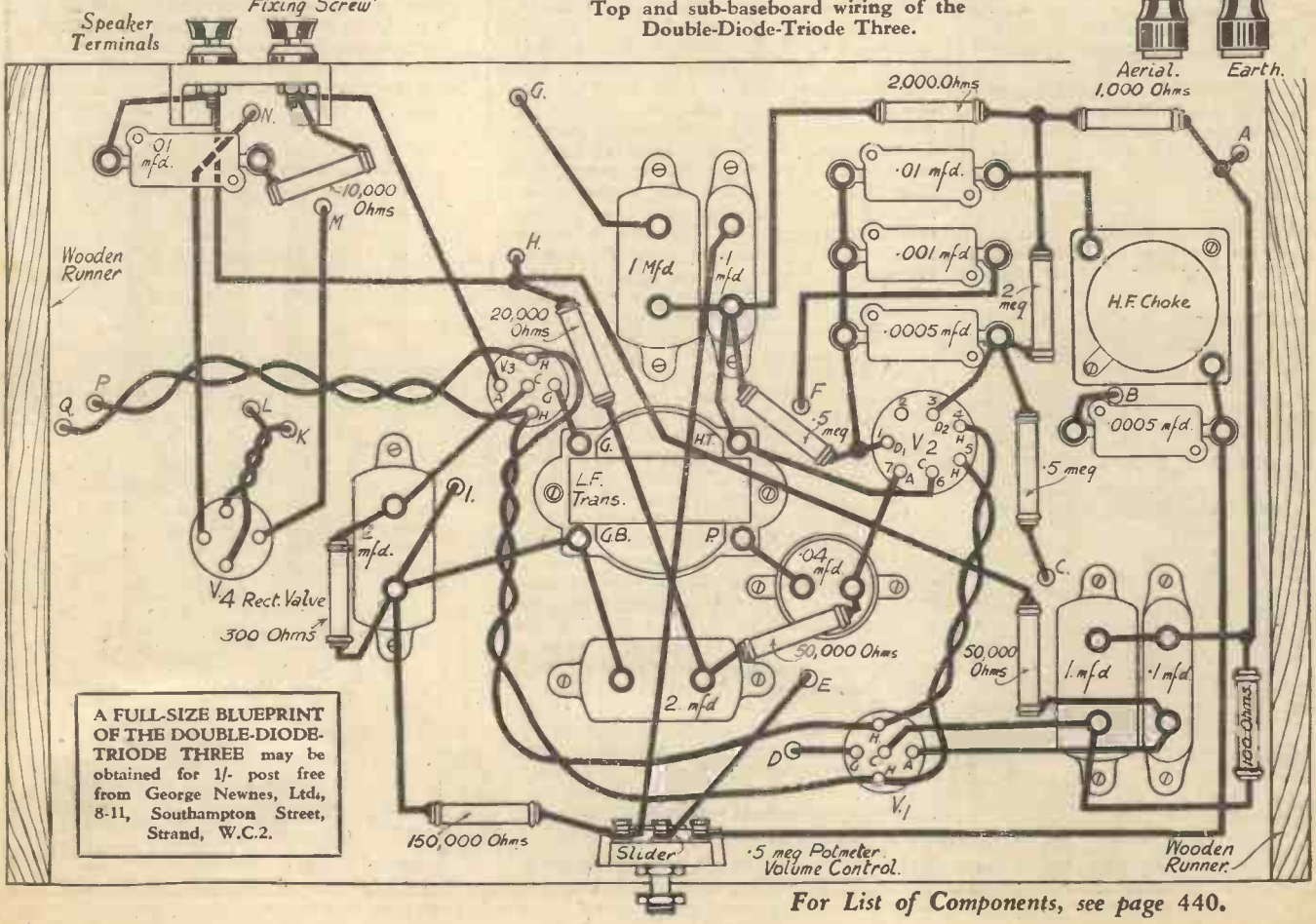
### Spacing the Wiring

A wiring diagram does not enable the constructor to ascertain what spacing should be left between adjacent wires, and the photographs which are taken when the receiver is completed do not in many cases enable this spacing to be easily ascertained. Consequently, it is possible sometimes to correctly wire a set and yet obtain poor results due to the manner in which the wiring has been carried out. The illustrations given on this page show the receiver after the wiring has been commenced, and it will be seen just what leads should be fitted first. (For the sake of avoiding confusion the heater leads, which are of twisted flex, have been omitted, but as mentioned above, they should be put in place before any of the Glazite is fitted. The subsequent wires should be put in by the aid of the wiring diagram, but at all points where wires cross try and arrange that the angle is as acute as possible. Where convenient, this should be a right-angle, but if this is not possible, bend it so that it takes a path nearly so, and also leave as wide a space between the adjacent wires as possible. Although there is only the one high-frequency stage in this receiver, it is possible to upset its performance by interaction between the wiring, but if the above points are borne in mind when the construction is being carried out there will be little likelihood of trouble being experienced. There are certain modifications which may be made in the value of some of the resistances on the automatic volume control side of this circuit, but they will be dealt with fully when describing the operation of the receiver next week.

*The method of mounting the electrolytic condensers.*




**Top and sub-baseboard wiring of the Double-Diode-Triode Three.**




**A FULL-SIZE BLUEPRINT OF THE DOUBLE-DIODE-TRIODE THREE** may be obtained for 1/- post free from George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

*For List of Components, see page 440.*

THE EASY ROAD TO RADIO

# The BEGINNER'S SUPPLEMENT

*Conducted by F.J. CAMM*

**Ebonite**

An insulating substance made by heating together a mixture of rubber and sulphur. It is a hard, black material, but capable of being pressed or rolled into various shapes at the high temperatures used in its manufacture. It will take a very high polish.

The most familiar form of ebonite to the radio enthusiast is the sheet ebonite used for panels. It is also used for making coil-formers, coil-holders, etc., but to nothing like the extent to which it was formally, it having in recent years been gradually replaced by the cheaper and more easily moulded bakelite.

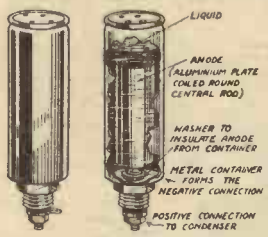



*Fig. 1.—Electrolytic condenser and (right) cut away to show construction.*

**Electrode**

Generally speaking this term refers to any of the component parts of a valve, battery, vacuum tube, or similar apparatus by which the electric current enters or leaves. For instance, in a wireless valve all the various "business" parts such as the anode, grid, or filament are called electrodes. In a primary cell or in an accumulator the plates are the electrodes. A positive electrode is also called an *anode* and a negative electrode a *cathode*.

**Electrolyte**

The liquid in a primary cell or accumulator. The liquid in an electrolytic condenser, and in the cells used for electroplating is also called the electrolyte. Although we say "liquid" it is possible to have electrolytes in the form of paste or jelly as in the familiar "dry" cells of H.T. and grid-bias batteries or in some unspillable accumulators. However, the fact remains that it is the aqueous content of the paste or jelly which enables it to work. To produce a really dry electrolyte is impossible since it is the combination of water with certain salts or acids on which the action of the cell depends.

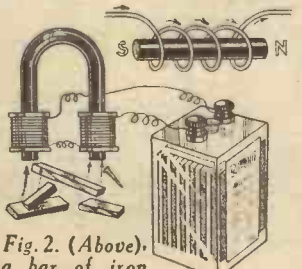



*Fig. 2. (Above), a bar of iron can be magnetized by passing an electric current round it. (Below), a simple horseshoe electro-magnet.*

## THE BEGINNER'S A B C OF WIRELESS TERMS (*Continued*)

**Electrolytic Condenser**

A type of condenser which is of relatively large capacity for small bulk. It is entirely different from the usual type of fixed condenser. A typical example is shown in Fig. 1. It is something like a small primary cell. It has an outer metal case containing a liquid (the electrolyte) and a centre metal plate coiled round a metal rod. This central electrode is insulated from the case. The condenser does not work as such until an electric current is passed through it in one direction only. A very thin film of insulating substance is then formed over the centre plate or anode. This film acts as the dielectric of the condenser while the anode and the liquid form the two plates. Since the film is very thin so the capacity of the condenser is comparitively large. The type illustrated is of the "wet" variety. There are also so-called dry or unspillable versions.

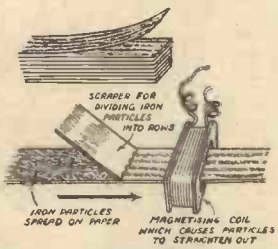



*Fig. 3.—Diagram illustrating how Ferrocart is made.*

**Electro-magnet**

If a coil of wire is passed round an iron rod as in the upper illustration, Fig. 2, and an electric current passed through the wire the iron becomes magnetized and will pick up small pieces or filings of iron. This principle is used in countless electrical devices such as electro-magnets for lifting iron and steel, relays, cut-outs, and some kinds of electric motors. One of the greatest advantages of an electro-magnet are that it loses its magnetism as soon as the current is switched off. An easily made electro-magnet in a practical form is also shown in Fig. 2. It consists of a soft iron staple wound with two coils of insulated copper wire mounted on bobbins. On passing an electric current through the coils as shown the iron becomes temporarily magnetized and will attract iron, steel, or nickel objects very strongly.

**Electron**

A particle of negative electricity. It is the flow of electrons which constitutes an electric current. In the ordinary way some conducting path such as a metal wire is needed for the movement of electrons but under suitable conditions it is possible to make them fly off into space. Such conditions exist in a valve. Here the heat of the filament or cathode causes electrons to be driven off into space until they strike the anode (See also *VALVE.*)

**Eliminator**

See *MAINS UNIT*

**E.M.F.**

Electro-motive-force, that is to say the pressure or *voltage* of an electric current.

**Ether**

Wireless power like heat and light is considered to be transmitted in the form of waves. Naturally they must be waves of *something* and, since they do not seem to be composed of any material substance such as air or water (wireless waves will travel through a vacuum), they are assumed to be wave motions in a subtle medium which scientists call the *ether*. This is supposed to pervade everything and to be present everywhere.

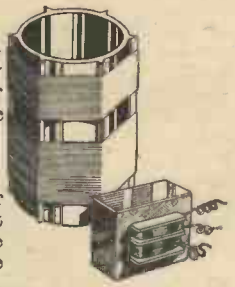


*Fig. 4.—A Ferrocart coil is as efficient as an ordinary type of coil many times its size.*

**Farad**

The unit of capacity. In wireless this unit is too large for practical purposes so we use the *micro-farad* which is a millionth of a farad. See also *CAPACITY.*

**Ferrocart**

The name of a recently introduced material which is used in the place of air as the core of tuning coils. It is a well known fact that the inductance of a tuning coil can be increased by using an iron bobbin or "core" as it is called on which to wind the wire. In fact, this principle is extensively used in the

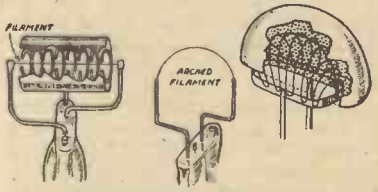



*Fig. 5.—Early straight valve filaments and the later arched filament. Note peculiarly shaped grid and anode used with the latter.*

construction of chokes, transformers, etc., used in low-frequency circuits. Unfortunately however, in the high-frequency circuits of a receiver (of which the tuning coils are part), iron cores introduce certain losses which entirely nullify their advantages. Chief amongst the losses are those caused by little currents of electricity which circle round inside the iron itself and so waste power. These are called *eddy currents*. In the Ferrocart core this is overcome by using small filings of iron instead of a solid rod or bar and sticking them on to strips of specially prepared paper. These strips

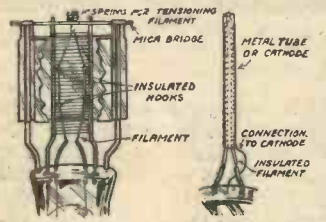



*Fig. 6.—Two examples of modern filaments. (Left), as used in a battery valve. (Right), in a mains valve.*

are built up to form the core in the manner shown in the upper illustration in Fig. 3. To reduce eddy currents to the very minimum the filings are not simply spread on the paper strip but are scraped into rows as shown in the same illustration. Again each particle in the rows is made to point in the same direction. This is accomplished by passing the strip through a strong magnetic field produced by an energized coil.

**Filament**

The filament in a valve is very similar to that used in an ordinary electric lamp. There is one important difference, however. The valve filament is coated with a

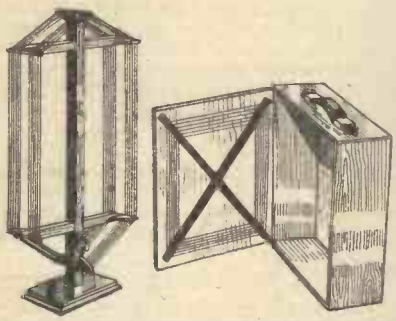


*Fig. 7.—Two forms of frame aerial. That shown on the right is wound on the inside of the door of a portable receiver.*

special substance which enables it to give off a large number of electrons at a temperature far below that needed to give the same emission from an uncoated one. Modern valve filaments are heated only sufficiently to make them glow a very dull red. Figs. 5 and 6 show some of the changes which have been made in the design of filaments during the past ten or twelve years. The early form shown in Fig. 5 was liable to sag when in use and alter the characteristics of the valve. In extreme cases it drooped on to the grid and caused a short circuit. The arched filament shown on the right was developed by the Cossor people to overcome this. The specially shaped grid and anode necessitated by this somewhat unorthodox filament are shown on the right.

Fig. 6 shows on the left a sectioned view of a modern Cossor valve for battery use. The filament is here supported at no less than seven different points, thus assuring perfect alignment and freedom from microphonic troubles. The peculiar looking thing on the right is the filament arrangement used in a mains valve. In this case the filament is designated a *heater*, since it heats a narrow surrounding tube known as the *cathode*. Any slight variations in the heat of the filament caused by fluctuations in the mains current are not passed on to the cathode since this is much heavier than the filament and therefore retains the heat better. In this way mains hum (which is caused by fluctuations in the mains current) is avoided.

**Frame Aerial**

A small aerial usually wound round some form of wooden frame. It is not connected up in quite the same way as an ordinary aerial, since it takes the place of both aerial and aerial tuning coil. In fact, it may be looked upon as a large tuning coil, which, by virtue of its size, is able to pick up sufficient energy without using any other form of pick-up. A frame aerial is very rarely as efficient as the more orthodox type, but it is, of course, the only type which can be employed in a portable set. Most frame aerials have strongly directional properties, that is to say, they are most efficient when pointing towards the station being received. They are least sensitive when at right-angles to the direction from which the signals are coming. See also *Aerial*.

**Frequency**

THE frequency of an alternating current is the number of complete cycles it passes through in a second. An alternating current travels first in one direction and then in the other, that is to say, from zero it rises to its maximum value in one direction, then falls to zero again and finally rises to its maximum in the opposite direction. On returning once more to zero it is said to have passed through one cycle. It is the number of such cycles which are completed in one second which is called the frequency. With low-frequency currents this may be anything up to 20,000, while in the case of high-frequency currents, as are set up in the aerial circuit of a receiver, the alternations backwards and forwards take place millions of times per second.

**Fuse**

A protective device included in electrical circuits. It usually takes the form of a thin piece of wire which is made of such metal that it will melt, and so break the circuit if more than a predetermined amount of current passes. Fuses are used to a considerable extent in wireless for such purposes as protecting valve filaments from an accidental increase in current due to a short circuit or some mishap within the receiver, and for protecting receivers operated from the mains. With the fuses used for these purposes the fuse wire is usually enclosed in a glass bulb or tube. Both these types are shown in Fig. 8, as also are the holders employed. It will be noticed that in both cases the fuse itself is readily detachable either by lifting it from a pair of clips or unscrewing it like an electric torch bulb. In this way replacements can be made in a minimum of time.

**Galvanometer**

A sensitive instrument for detecting the presence of an electric current and also for determining its direction. One well-known type, the d'Arsonval, is illustrated in Fig. 9. The diagram on the left shows the principle on which it works. A small rectangular shaped coil of wire is suspended by a thin phosphor bronze wire between the poles of a permanent magnet. The coil is able to swing round as it hangs from the wire, and is connected to two terminals on the base of the instrument through the wire itself and through a hair-spring at the bottom. On passing a small electric current through the coil it tends to turn round at right angles to the position in which it is shown on the diagram. The stronger the current is the further will it turn. Attached to the suspension wire

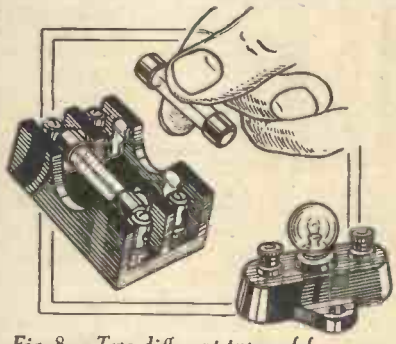


*Fig. 8.—Two different types of fuses; on the left is a double fuse.*

is a small mirror, and as the wire twists so the mirror moves round as well. To use the instrument a beam of light is shone on the mirror and reflects back on to a scale. When a current is passed through the instrument the coil turns, at the same time turning the mirror and causing the beam of light to be deflected. The amount of the deflection is shown on the scale. The advantage of the mirror is that it enables a beam of light to be used as a pointer which, of course, has no weight, and thus overcomes the chief drawback of the ordinary type of pointer or needle.

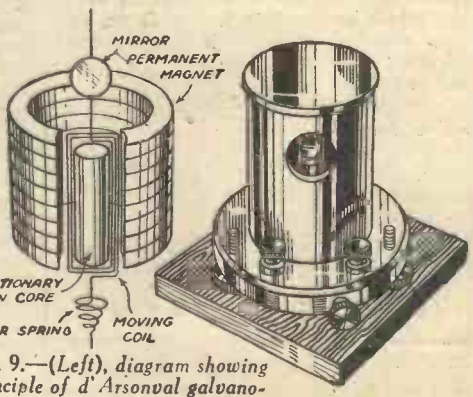



*Fig. 9.—(Left), diagram showing principle of d'Arsonval galvanometer. (Right), the complete instrument.*

# A Review of RECENT RADIO DEVELOPMENTS

In this Article the Author Summarizes the Developments which Have Taken Place in Receiver Design During the Past Few Months. Among These are Automatic Volume Control, Quiet A.V.C., Q.P.-P., Class "B" Amplification, Introduction of "Cold" and Other New Valves, and Iron-Core Tuning Coils.

## By FRANK PRESTON, F.R.A.

(Concluded from p. 320, May 20th issue.)

TO prevent interaction a screen is placed between the main and auxiliary anodes. The method of connecting this new valve is shown in Fig. 5.

Automatic grid bias for A.V.C. is obtained across the potentiometer grid leak R.1, and is applied to the V.-M. valves through the decoupling resistance R.2. The audio-frequency output from the rectifier is also taken from R.1 and passed on to the grid of the L.F. amplifying portion through the grid condenser C. Resistance R.3 provides automatic grid bias, and R.4 is the grid leak, for the L.F. amplifier. So as to make the circuit a little easier to follow I have re-drawn it in Fig. 6. as it would appear if two separate valves were used in place of the more complicated, but more convenient, double-diode-triode.

**Q.P.-P.**

For the past few years the attention of set designers (and manufacturers) has been directed towards all-mains receivers to the great detriment of the battery user. That this has been a mistake is clearly shown by the large numbers of mains receivers which have recently been thrown on the market at "cut" prices—the result of over-production. It is now realised that the call for more efficient and powerful battery sets is louder than ever before, and there is little doubt that the demand will be even greater in the near future. Until very recently the great objection to battery sets has been in respect to their inability to provide more than a relatively small volume of reproduction in return for an economical supply of high tension current. This has been effectively swept away with the development of quiescent push-pull amplification by which it is possible to obtain as much *undistorted* volume from a battery set as from a mains-operated receiver, and for the expenditure of a very modest amount of high tension current. We are often asked, "Is Q.P.-P. worth while?"; "Will it last, or is it merely a passing fancy?"; "Does it do all that is claimed for it?" Frankly, I have answered all these questions in the affirmative, but with certain provisions. For example, the advantages of Q.P.-P. would be wasted if it were used with an antiquated or badly-designed set; similarly, they could not be appreciated if the speaker was not a good moving-coil capable of handling up to, say, 2,000 milliwatts of signal energy. There is no doubt that Q.P.-P., or some development of it, will last for a long time provided it is not "boosted" to such an extent that constructors begin to expect it to do the impossible. The fact is that a pair of valves connected in quiescent push-pull will give as much amplification as two transformer-coupled power valves, *but with about one quarter as much H.T. current.*

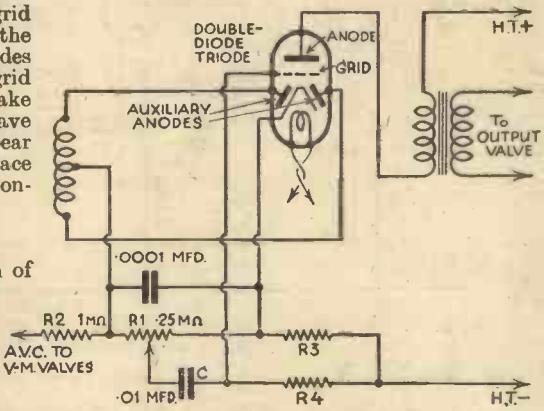



*Fig. 5.—A double-diode-triode used as detector, A.V.C. and L.F. amplifier.*

The circuit of a typical Q.P.-P. amplifier using two high-amplification small power valves is shown in Fig. 7. Actually, this diagram reveals very little, because it is the way it is operated that is all-important. The input transformer is of high step-up ratio (about 9-1) and thus supplies a large signal voltage to the grids of the valves used in Q.P.-P. These valves receive a heavy negative grid bias so that they normally pass a very small amount of H.T. current. But when a signal is tuned-in the positive halves of the rectified signal voltages reduce the steady negative bias and so cause the valves to pass more anode current, the increase in current being proportional to the strength of the received signal. Since one end of the transformer is always negative whilst the other is positive, the valves work "in turns," so that at any instant one valve might be passing as much as 10 milliamps whilst the other takes only 2 milliamps. The average current consumption is consequently small and depends entirely on the volume required. Thus one has the satisfaction of getting value for money—if volume is reduced, current consumption is also cut down. A fairly average current consumption over a period of "full-volume" listening works out at something like 6 milliamps.

**"Class B"**

Another method of L.F. amplification which is developing alongside Q.P.-P. and which has similar aims is known as "Class B." The name is American, but the system is in reality a modified form of push-pull. Instead of two separate valves, however, only one is used, but this is a "twin," having a single filament, two grids, and two anodes enclosed in the same glass bulb. The essential difference between a "Class B" valve and ordinary ones is that the former is of high impedance so that, although it is worked at a zero G.B. voltage, it passes only a very low anode current. Since the normal grid voltage is zero it becomes *positive* on the application of a signal and thus there is a flow of current in the grid circuit. It is well-known that in the ordinary course of events grid current

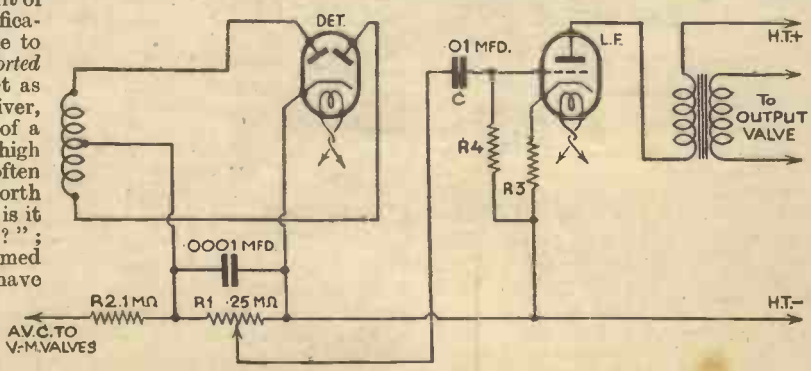



*Fig. 6.—The equivalent circuit of Fig. 5, where separate valves are used for detection and L.F. amplification.*

(Continued overleaf)

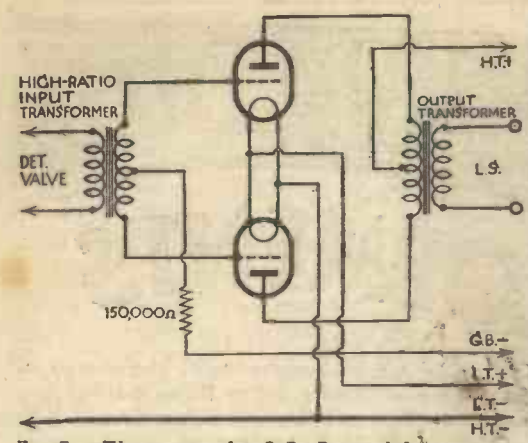



*Fig. 7.—The circuit of a Q.P.-P. amplifier using two high-amplification triodes.*

(*Continued from previous page*)

produces distortion due to the voltage drop across the transformer secondary; in "Class B," however, this difficulty is overcome by using a special *step-down* input transformer having a very low resistance secondary. Thus, although grid current does flow, it produces a negligible voltage drop. To compensate for the step-down effect of the transformer an extra valve, called a "driver," must be included between the detector and output stages. The usual circuit arrangement for a "Class B" amplifier is shown in Fig. 8. Special valves and transformers for this form of amplification are already on the market and the system can be adopted with every satisfaction.

### Ferrocart Coils

Perhaps one of the greatest advances which has been made during the last few months has been in respect to tuning coil design. It has been known for a long time that our coils were not so efficient as they might be, but no better method of construction could be found. The coils had to contain a comparatively great length of wire to enable them to tune over the necessary wavelength ranges, and unless the wire were of heavy gauge it must necessarily introduce resistance losses—and the complementary condition of inselectivity. It was obvious that the only way to reduce the amount of wire without lowering the inductance was to employ iron instead of the "air" core. But iron in solid or laminated form introduces eddy current and other losses which are even greater than those caused by the windings. It remained for Hans Vogt to produce a core material, which he called Ferrocart, and which consists of very fine particles of iron contained in solid insulating substance. This was found to have the combined advantages of both air and iron, for it had practically no eddy current losses and increased the inductance to such an extent that only a fraction of the number of turns were required for any given coil size.

The net result is that Ferrocart coils are definitely more selective than any hitherto produced. In addition, they are of smaller dimensions than other coils, and thus assist in reducing the overall size of the receiver and, in consequence, the lengths of the connecting wires.

### Permeability Tuning

In spite of their essentially rather high price there is little doubt that "iron-core" coils will eventually become standardized in some form or other. I think that in time they will revolutionize our tuning circuits since, by so arranging the core that it can be withdrawn from the winding, it will be possible to tune more efficiently without the aid of variable condensers. But that is for the future; permeability tuning (as it would be called) is not yet an accomplished fact, although it might be by the time these words are in print. Who knows?

**"PRACTICAL WIRELESS" still leads the way as you will see from next week's issue!**

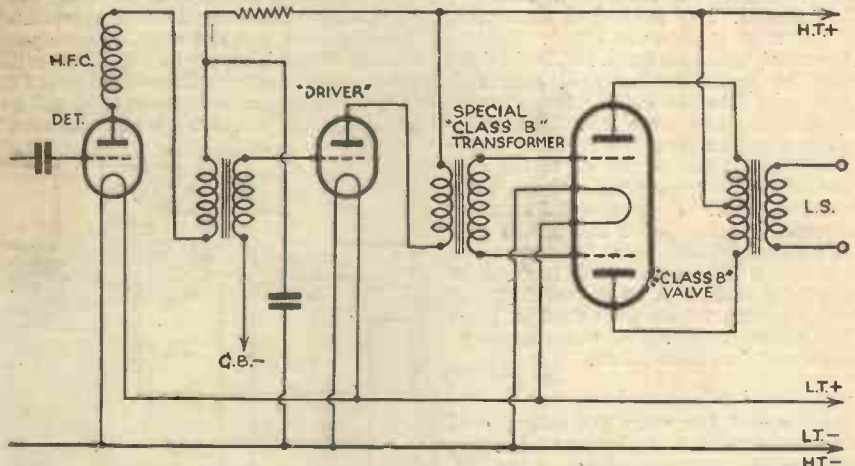



*Fig. 8.—The arrangement of a "Class B" amplifier. Note the special valve and input transformer.*

## WIRING EFFICIENCY

(*Continued from page 414.*)

neat and precise. You could measure the distances required and mark them off on the wire. The method described, however, is simpler, in that the receiver itself is used as the measuring instrument to adjust each wire to its exact position. Follow the same procedure with every wire which you put in, finishing up with the long ones from the baseboard to the panel.

### A Hint

One word of warning. You need not have the valves and coils in place all the time while you are doing the wiring. When you come to the wires which run close past them, put them in their sockets. Otherwise you may find later on that you have placed a wire just where a detachable component fits in. Leave enough space to enable you to remove valves or coils without disturbing the wiring.

### Flex Leads

A final word about flexible wires. You would be very ill-advised to use flex for the general wiring of the receiver. The positions of the lengths, especially the longer ones, would not be sufficiently controllable to make a sound job. You will, however, have some flex connections to make, such as battery leads. Make a neat job of the ends of the leads, and they will be less likely to come adrift from the terminals.

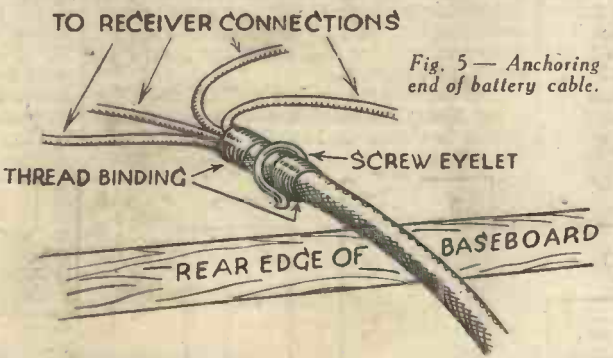



*Fig. 5 — Anchoring end of battery cable.*

### Securing the Ends

Fig. 4 shows a satisfactory way of securing the ends. Remove the insulation carefully for ½in., twist the strands together with your fingers, taking care not to omit any strands, and form a loop round a piece of wire of the size of the terminal shank, twisting the free end round the standing part of the wire. A scrap of adhesive insulating tape wrapped tightly over the neck of the loop, sealing the end of the insulation, will complete a workmanlike job.

If you use a battery cable, from which leads radiate to various parts of the receiver, do not rely on the individual terminals to hold the whole cable secure. Pass the main cable through a screw eyelet (Fig. 5) at the point where it enters the receiver, and tie it to the eyelet with a turn or two of stout thread. An accidental pull on the cable will then neither break the connections nor damage the components.

### Use Soldering Tags

Should you prefer to solder your connections instead of making loops as described, see first that every component and terminal is fitted with well-tinned soldering tags. Then go round the receiver, bending the wires as already described, omitting the loops, of course, and the extra bit of wire necessary to form them, merely stripping ¼in. of insulation at each end of each connecting wire. Make all the necessary bends in a wire before soldering either end in position. It is far simpler to make neat bends when you have the whole wire in your hands.

# More About Catkin Valves—2

*(Continued from page 383, June 3rd issue).*

## By F. J. CAMM

LAST week we gave preliminary details of the new unbreakable metal-mains valves which have been produced jointly by The General Electric Co., Ltd., and the Marconi Osram Valve Co., Ltd. I have under test a receiver with these new valves incorporated, and as soon as my tests are completed the information will be passed along to my readers. The following is a brief summary of its advantages:

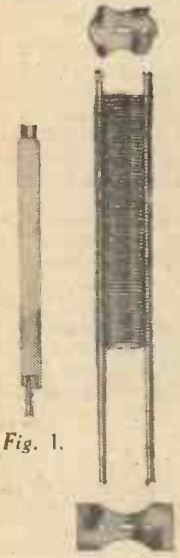


*Fig. 1.*

*Fig. 3.*



*Fig. 2.*

1. Almost unbreakable, owing to metal construction and interlocked electrodes.

2. Great uniformity, due to extreme accuracy of electrode alignment, steel and mica pinch, straight support wires, few welds.

3. Increased reliability, as anode in direct contact with air promotes cooler running, thus less chance of gases or water vapour being set free.

4. Less microphonic, owing to rigidity and rubber mounting.

5. Solid metal shield gives better screening than metallising on glass bulb.

6. Smaller size, hence more compact sets, great saving in storage space.

7. Base cannot work loose or come off.

8. Easy transit. Carton one quarter to one-sixth size of present types, can be sent by post with no special packing.

The perfection of the copper-glass joint for mass production has made it possible to place the anode in direct contact with air.

By promoting this more efficient radiation of heat the whole electrode system operates at a lower temperature than in a glass valve, and any tendency for occluded gases or water vapour to be set free in the vacuum is greatly lessened.

The cathode, heater and grid or grids are built up as a unit in an entirely new manner. In the normal valve the electrode supports are held by a glass "Pinch" which forms the foundation of the whole electrode system. This pinch, although in most respects quite satisfactory, is liable to distortion and inaccuracy, as well as introducing a number of welds and bends into the supporting wires. The Marconi "Catkin" pinch consists of a pressed steel clip with mica insulation, which cannot distort or shift; it is proportioned in such a manner as to eliminate all bends in the electrode supports, and so contributes again to greater accuracy and strength.

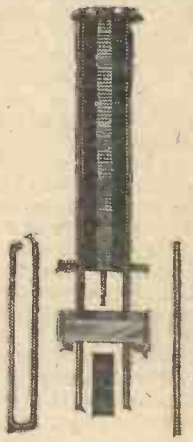


*Fig. 4.*

*Fig. 5.*



*Fig. 6.*

*(To be concluded next week.—Ed.)*

*Fig. 7.*

*Fig. 8.*

*Fig. 9.*

*Fig. 10.*

*Fig. 11.*

*Fig. 12.*

*These illustrations show twelve progressive operations in the assembly of the new Catkin valve.*

# RADIO RAMBLINGS

*By JACE*

*Jottings from my Notebook*

### Wired Wireless

I SEE that a British firm of cable makers have become the first in the field with a special cable and cable-connecting device for use in radio relay systems. This "wired wireless," as it is called, is proving very popular for people who do not care to be bothered with a set of their own, and the imaginary troubles that they believe to follow in the wake, but I am afraid readers of PRACTICAL WIRELESS would find little appeal in such a system in their own homes. Of course, wireless on tap for the people in the house who want to listen to something would leave the set free for the radio fan to experiment with, and the fact that the radio receiver could be regularly dismantled without affecting the other members of the household is a commendation in itself. Seriously, though, wired wireless is becoming a boon to large numbers of people, and the advent of a new system of wiring, both convenient and cheap, will do much to popularize this form of listening. The disadvantage of being able to listen to only the station that the organizers decide is, however, a real one, and those responsible are finding out, like the B.B.C. before them, that there are very few houses in which two people will agree as to what constitutes an ideal programme. Still, if we had a set capable of receiving a thousand stations I do not suppose we would find an ideal programme.

### Freak Radio

A MAN in a hospital in the Antipodes put a pair of headphones on his head and stuck the wires into the earth. He immediately received a broadcasting programme, although he had no set of any sort. Now he is hard at work trying to tempt the gods further by getting the programme on the loud-speaker so that his fellow patients will have the benefit of more or less free wireless. I make no attempt to give an explanation of this, even though I believe I can remember reports of similar phenomenon in this country, but there are just two questions I should like to ask. Firstly, how on earth did he come to stick 'phone tags in the earth ?—and is he liable to a licence fee for setting up a receiving "station"?

### Faulty Resistances

IN common with other electrical apparatus, wireless components have a nasty habit of wearing out or breaking down. If the constructor responsible is worthy of the name he can generally make up a makeshift job so as to keep the programme running (this is following the general assumption that wireless sets fail suddenly only when special programmes are being broadcast), and a common breakdown often occurs in the various resistances to be found in the set. Sometimes, in certain positions, the resistance can be short-circuited, and any subsequent instability cured by lowering the H.T. voltage or similar palliatives, but this is only to be recommended when the resistances that are faulty are those placed in the H.T. leads. In the case of bias-resistances, from which automatic grid-bias is obtained in all-mains sets, a faulty resistance can be eliminated by substituting an ordinary grid-bias battery, and thus reverting to battery bias. In this case it is usually enough to connect up the battery in the same way as the resistance was, so long as this was in the cathode circuit originally. The cathode, you will know, is equivalent to the filament in a battery valve, and the grid-bias positive should be connected to it. The correct valve of grid-bias negative should be connected to earth, and this can be accomplished by attaching the G.B.— lead to the chassis or metal panel, or other convenient earthed point.

### Kelvin Lecture

THE annual Kelvin lecture has just been delivered, and the subject dealt with wireless waves and how they travel through the ether. The lecturer, Sir Frank Smith, succeeded in interesting his audience to a man, which in itself was a difficult task, for although all of them were electricians many of them knew less about the mysteries of radio than many amateurs. You may have found out yourselves that many practising electricians, although capable enough in their own sphere, have a very elementary knowledge of the rudiments of radio. Even so, Sir Frank, intrigued all his hearers with the simple and concise lecture he delivered, and he referred to the way in which the theorists believed that two-way working with the other side of the world was practically impossible, even if all the power generated by the Niagara Falls could be radiated from the aerial. He related, what is now common knowledge, how the amateur transmitters, working on short waves, were able to circuit the globe with barely sufficient power to light an electric lamp, and from that point he discussed the way in which wireless waves travel, the Heaviside layer, and the cause of fading. Incidentally, I have seen fading attributed to sun spots, the phase of the moon and the weather, and who shall say which is right or wrong ? The peculiar part of it seems to be that until somebody invented the various causes of fading this complaint was not half so bad as it is now.

### Searching for Short-wavers

AS one would expect at this time of the year, the short-wave stations all over the world are coming in very well indeed. On the 19-metre band (which seems to be best of all at the time of writing) W2XAD, Schenectady ; W8XK, Pittsburgh and W2XE, New Jersey can be brought in at good speaker strength on a Det.-2L.F. receiver between about 4 o'clock in the afternoon and midnight. Radio Coloniale and Zeesen are, of course, easily received whenever they are working. Another station on the 19-metre band which is worth trying for is (never mind the name) Kemikawod-Cho-Chiba-Ken, Tokio. The time of working is from 10 a.m. to noon, and it can be received under fairly good conditions.

On the 31-metre band W3XAU. Philadelphia ; W1XAZ, Springfield ; W3XAF, Schenectady ; and PRBA, Rio de Janeiro are not difficult to find between about 9 p.m. and 2 a.m. Another good station on the same waveband is VK2ME, Sydney, which can generally be brought in fairly well between 6 and 8 a.m., and also from 6 to 9 p.m.

The 49-metre stations, although perhaps rather "steadier" than the others, have not been coming over with quite so much punch. Nevertheless, W3XAL, Bound Brook; W3XAU, Philadelphia ; W4XB, Miami and W9XF, Chicago, have all been heard after 11 p.m., whilst ZL2ZX, Wellington (N.Z.) ; ZTJ, Johannesburg and VQ7LO, Nairobi are fairly reliable stations between about 3 and 6 p.m.

### An S.-W. Tip

BY the way, here is a good tip for improving the sensitiveness of any short-wave set ; use an A.C. valve of the "HL" or "L" type as detector. Its heater can be supplied with current from an ordinary 4-volt accumulator, and although it will take about 1 ampere, the extra L.T. consumption will be more than compensated for by the improvement in reception. Very little alteration will be required to the set. If it is a single valver all that need be done is to replace the present valve-holder by one of the 5-pin type and join together the cathode and negative filament terminals. The same modification is also suitable in a multi-valve set if ordinary 4-volt valves can be used in the amplifying stages. Otherwise the wiring must be altered as shown in Fig. 1 so that 4 volts are applied to detector valve and only 2 volts to the others.

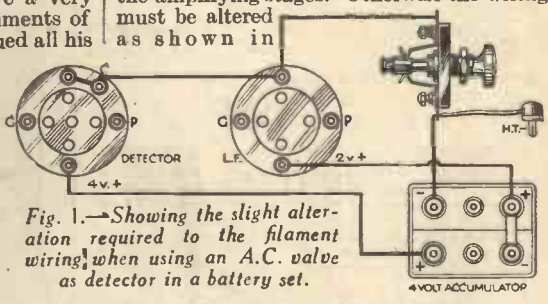



*Fig. 1.—Showing the slight alteration required to the filament wiring when using an A.C. valve as detector in a battery set.*

Just try this idea if you can ; you will find it well worth while, since the A.C. valve makes an efficient regenerative detector.

# The Radiopax Class "B" Four

## Some Further Notes Regarding the Correct Adjustment of this Receiver

SOME little doubt seems to have arisen regarding the correct connections for the loud-speaker in the Radiopax Four described in these pages recently. The Varley Output Transchoke is provided with six output terminals, and these are clearly shown in the photograph reproduced below (Fig. 1). On the top of the choke will be found three different ratio markings, 1.5 to 1; 2 to 1; and 2.5 to 1.

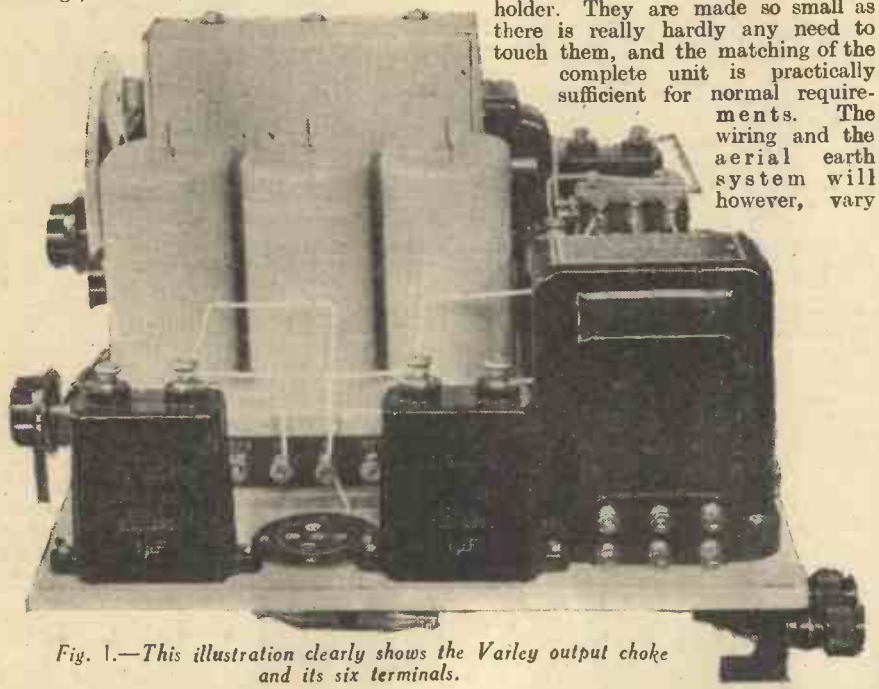


*Fig. 1.—This illustration clearly shows the Varley output choke and its six terminals.*

The loud-speaker which was specified should be joined to the terminals marked 1.5 to 1, and these are the two left-hand terminals shown in the illustration. The central pair are for the 2 to 1 ratio, and those on the right are for the 2.5 to 1 ratio.

**Trimming.**

Owing to the smallness of the trimming adjusting nuts some readers have appeared uncertain just which were the trimmers. Fig. 2 is a plan view of the receiver and the three small circles running down the centre of the print are the trimmers. They are almost above, and just to the right of the fixed condenser which is screwed at the side of the seven-pin valve-holder. They are made so small as there is really hardly any need to touch them, and the matching of the complete unit is practically sufficient for normal requirements. The wiring and the aerial earth system will however, vary on the different makes of receiver and the little extra which is obtainable when correctly matched is naturally worth while. There is no necessity in this receiver to alter the adjustment for long waves, as the matching holds over the entire range.

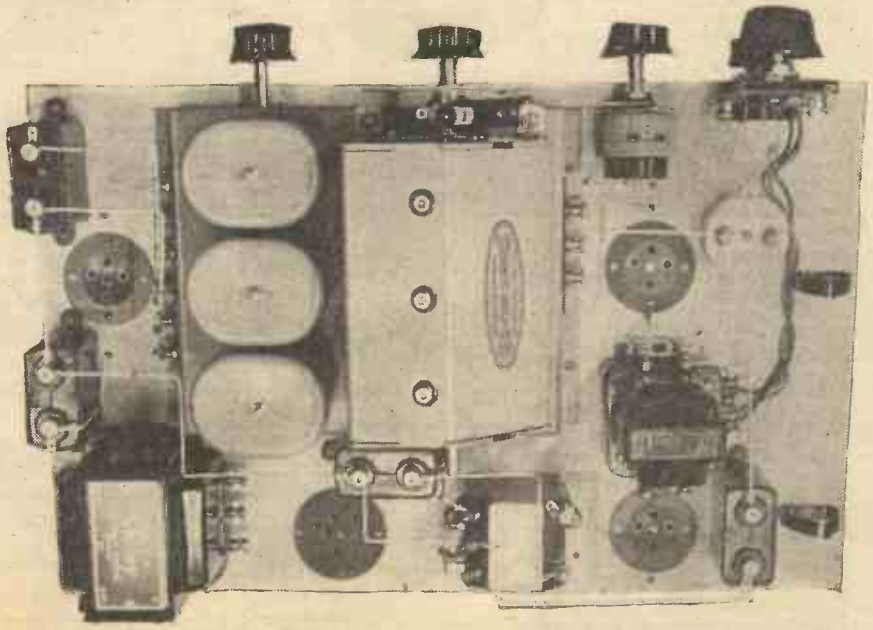
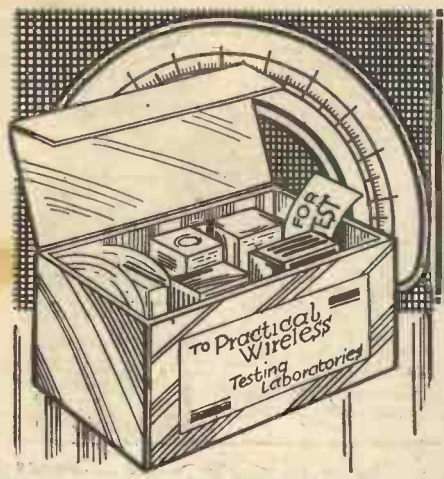


*Fig. 2.—Plan view of the Radiopax Class B Four.*



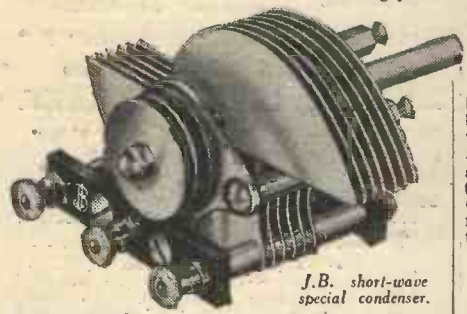

# Facts and Figures

## Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

### J.B. SHORT-WAVE SPECIAL CONDENSER

THE difficulties of tuning on the short waves are very great indeed, and apart from the actual range covered in each degree of a condenser dial there is the question of noise. The contact at the moving plates



*J.B. short-wave special condenser.*

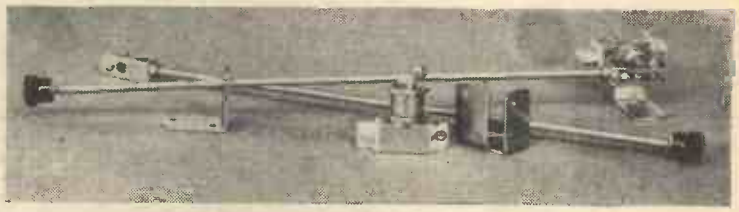
is a source of trouble, and even when using a pig-tail, the rubbing of adjacent turns causes noises which may prevent the accurate tuning-in of a station. Messrs. Jackson Bros. have produced the condenser shown above which is ideal for short-wave receivers, and there is very little that can be found wrong with it. The pig-tail connection is of covered wire, and to prevent inductive effects it is sandwiched between two brass discs. It must therefore always take up the same position as the dial is rotated. It is built up with brass vanes and spindle, and the insulation is carried out with good quality ebonite. Two terminals are provided for connection to the fixed vanes and two also for the moving vanes, so that wiring may be kept conveniently short. In place of the customary one-hole fixing attachment, three screws are employed on this type of condenser, and this ensures that it will not work loose in use and be a source of further trouble. It is a really high-class component and is obtainable in five values, .00005, .0001, .00015, .0002 and .00025. The price for any model is 5s. 9d.

### TUNGSRAM UNIVERSAL VALVES

OWING to the great diversity of different mains voltages and periodicity which are available in this country, there is a great difficulty in standardising receivers. In addition, should one move from one town to another, there is a great possibility that the receiver which you are now using will be of no use in the new situation. The Universal Valve, which is a commonplace on the Continent, solves this difficulty, as it may be used easily on either A.C. or D.C. mains. This is carried out by utilizing a 20-volt heater (including a 20-volt type of valve as rectifier and barretter) and the heater circuit is joined right across the mains, without the intervention of a mains transformer. The whole filament circuit passes .18 amps. (irrespective of the number of valves used) the barretter maintaining the current constant within limits of 2½ per cent. to mains voltage variations of 15-20 per cent. These valves are now being manufactured by the Tungsram Company, and we hope to give more details concerning them at an early date.

### BLUE SPOT LOUD-SPEAKERS

THE Blue Spot Company have had a number of requests to supply their very popular 20 P.M. Moving Coil Speaker (Cabinet version Model 22 P.M.) less the transformer, when the speaker is used for an extension model. This particularly applies, of course, in the case of sets which have Class B output and already incorporate a transformer. They are therefore supplying both these models less transformer; the 29 P.M. Chassis less transformer is 27s. 6d. retail. the Cabinet Model 22 P.M., less transformer, is 40s. retail.



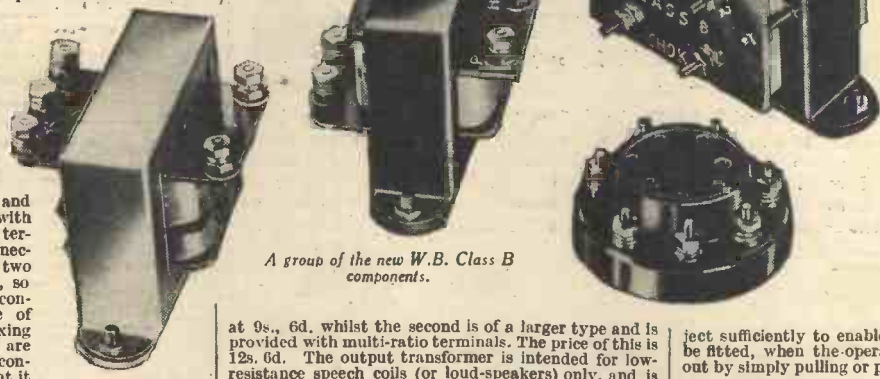
*British Radiophone switches, with extension operating rods.*

### BRITISH RADIOPHONE SWITCHES

WE have already mentioned that the British Radiophone Company are now manufacturing the majority of ordinary wireless parts, instead of specialising in variable condensers. The small toggle switch used in mains apparatus is one of the lines which we have received and these are very well finished. They are of the 3 amp. type, very robust and possessing a very definite action. The majority of constructors have, no doubt, at one time or another experienced difficulty in mounting such a switch in a position on the panel which would prevent the mains leads running right across the receiver or else have fitted it at the back of the cabinet where it is almost ungetatable. The apparatus shown at the top of the page will prove invaluable to the constructor, as it enables the switch to be mounted at the rear of a baseboard and yet be controlled from the panel. As may be seen a small bracket is provided to accommodate the switch, which is fitted by the normal one-hole fixing arrangement. The long rod is then attached to the dolly and held in position by the small nut and bolt. A second bracket is mounted at any convenient point on the baseboard and the rod passes through a hole in this bracket which prevents any unnecessary side play, etc. A small hole in the panel or cabinet front permits the rod to project sufficiently to enable the small ebonite knob to be fitted, when the operating of the switch is carried out by simply pulling or pushing the knob.

### NEW WHITELEY ELECTRICAL CLASS B COMPONENTS

FOUR new W.B. components are illustrated below and these are intended for the Class B type of amplifier. They are driver transformers, output transformers, output chokes, and 7-pin valveholder. On the left is a driver transformer, and this is manufactured in two types, one for inclusion in the anode circuit of small power valves and priced



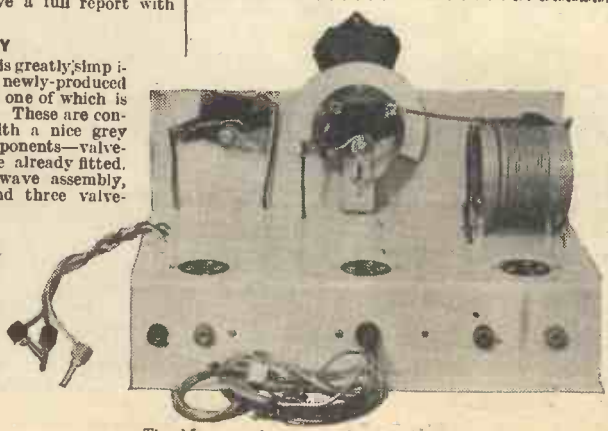
*A group of the new W.B. Class B components.*

at 9s., 6d. whilst the second is of a larger type and is provided with multi-ratio terminals. The price of this is 12s. 6d. The output transformer is intended for low-resistance speech coils (or loud-speakers) only, and is priced at 7s. 6d. The output choke shown on the right, of the group is tapped to provide three different ratios, 1–1, 1.4–1 and 2–1. This costs 10s. 6d. Actual models have not yet been received by us, but as soon as we are able to test them we shall give a full report with characteristics.



### MAGNUM CHASSIS ASSEMBLY

THE construction of a receiver is greatly simplified by using one of the newly-produced Burne-Jones chassis assemblies, one of which is shown at the foot of this page. These are constructed of steel, cellulosed with a nice grey finish, and the principal components—valveholders, coil, condenser, etc., are already fitted. The model shown is a short-wave assembly, fitted with short-wave coil, and three valveholders. Terminals are fitted to the rear of the chassis and only a few components and some wire are needed to complete the assembly of a really-efficient short-wave receiver. A special Q.P.P. model, a super-het model, and a class B model are also obtainable. The Class B model costs 15. 6d., and the remaining models will vary, of course, according to the particular components which are employed.



*The Magnum short-wave chassis assembly.*

# Practical Letters from Readers.

**The Editor does not necessarily agree with opinions expressed by his correspondents.**

### The Finest Weekly.

SIR,—I beg to acknowledge receipt of the "Wireless Constructor's Encyclopædia," with which I am more than delighted. Such a volume is easily worth three or four times the amount it has cost me, and I hope to continue taking the finest weekly for thirteen years rather than merely thirteen weeks.—H. ADAMS (Leeds).

### A Jersey Reader's Thanks

SIR,—I have been studying wireless for the past six months, and, thanks to PRACTICAL WIRELESS, I have made two sets, which work excellently.

I received my "Wireless Constructor's Encyclopædia" recently, and I can assure you that it is a mine of instructive information for both amateur and professional alike. Wishing PRACTICAL WIRELESS every success.—W. J. BULLEN (St. Helier, Jersey).

### "A Mine of Information"

SIR,—I have received my copy of the "Wireless Constructor's Encyclopædia," and wish to thank you most sincerely for such a mine of information. It really *is* a practical gift to wireless enthusiasts. I am delighted with it, and lose no opportunity of showing it to my wireless friends. The contents are so clearly explained that it is a great help to amateurs like myself. PRACTICAL WIRELESS is great, and I wish it every success.—A. WHEELER (Bristol).

### "A Splendid Book"

SIR,—I wish to express my thanks for my copy of the "Wireless Constructor's Encyclopædia," which I received quite safely. It is a splendid book, and I am very pleased with it. Also, I should like to thank you for PRACTICAL WIRELESS, which I am taking regularly.—F. C. SMITH (Shrewsbury).

### "Second to None"

SIR,—I have received my copy of the "Wireless Constructor's Encyclopædia," and my thanks are due to you for the production of such a practical book. I am sure it should have a position second to none in any constructor's library.—E. BRANNAN (Barnsley).

### A Scottish Reader's Thanks

SIR,—The presentation copy of the "Wireless Constructor's Encyclopædia" received safely a few days ago. I am quite delighted with it. It contains a mine of useful information to every wireless enthusiast. I am only a raw amateur, and I have spent quite a moderate sum on books relating to radio, but I find the information in the Encyclopædia much easier to understand. In conclusion, I desire to thank you for such a magnificent bargain, and wish PRACTICAL WIRELESS every success.—DAVID SMITH (Strathaven).

### A "Book of Practical Wireless Information"

SIR,—Many thanks for my copy of the "Wireless Constructor's Encyclopædia." Although I have had very little time to have more than a look through it was quite enough to see what an interesting book of practical wireless information it is. I am sure it will be fully appreciated by all readers of PRACTICAL WIRELESS who have taken advantage of your offer.—W. MCLOUGHLIN (Radford).

### A Bradford Reader's Appreciation

SIR,—May I express my appreciation of the "Wireless Constructor's Encyclopædia," which I have received safely? In my twenty-five years' experience as a wireless amateur, I have not seen such a helpful book before, and it should be of very great value to the thousands of wireless amateurs who have not been fortunate enough to receive the mathematical and scientific training so useful in the pursuit of their hobby. Again, sir, my congratulations and best wishes for your future efforts.—J. C. HALL (Bradford).

**CUT THIS OUT EACH WEEK**

## DO YOU KNOW?

—THAT an electrolytic condenser must be joined in circuit in the correct manner, and that its two terminals are positive and negative.
—THAT the negative terminals of this type of condenser is always the outside casing.
—THAT the value of a variable condenser may be modified by inserting mica or good dry paper between the vanes.
—THAT the on-off switch in a battery receiver is the most frequent source of trouble, and should therefore be periodically examined.
—THAT the "suppressors" recently described in an article on Wireless and the Car in these pages are now obtainable commercially.
—THAT a copper disc stood beneath the telephone often proves very effective as an aerial.
—THAT the aerial should not run close to telephone wires owing to the trouble caused by induction.
—THAT the new metal valves should not be placed near a tuning coil or H.F. choke if the latter is unscreened.

### NOTICE

*The Editor will be pleased to consider articles of a practical nature suitable for publication in* PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

*Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.*

# NEW IRON-CORE TUNING COILS

## THE VARLEY NICORE AND THE WRIGHT AND WEAIRE NUCLEON

FOR nearly seven years "Varley" have been conducting intensive experiments on the use of *powdered iron* for the cores of coils. As far back as 1926 Varley produced in their laboratory some constant inductance chokes with iron powdered cores (incidentally, it was the research work on these chokes which proved the technique of the air-gap in chokes with laminated cores). Now Varley are about to release the new Varley NICORE coils which they consider will prove the biggest advance in radio tuning since the introduction of the famous Square Peak Coils two years ago. As has already been explained in these pages, the main difficulty hitherto with Radio-frequency coils has been to get cores which, while considerably increasing the inductance of a coil, avoid the great loss at high frequencies due to eddy currents. To reduce these disturbing eddy currents to a minimum it was essential that the magnetic material finally chosen should have high initial permeability.

Another pitfall, that Varley are peculiarly fitted to avoid, is the winding technicalities. The design and winding of NICORE Coils are a totally different affair from that of air core coils; owing to the high permeability of the core the coils are very small indeed and the winding is consequently an extremely delicate job involving quite unusual skill. But Varley have specialised in precise winding for many, many years, long before the days of Radio, and so are able to produce the NICORE Coils with complete consistency and dead accuracy. These coils, above all, are CONSISTENT—that has been the great aim in the whole research work and, indeed, the additional research work thereby necessitated revealed an even greater efficiency than was at first thought possible.

Selectivity, so important an essential in modern radio reception, is a maximum with these coils and has to be experienced to be fully appreciated.

The coils will be marketed as Aerial or Tuned Grid, with Reaction, and H.F. Intervalve Transformer with Reaction, each at 10s. 6d. or with both medium and long-wave bands accommodated in a very small, neat and compact assembly (screened against the remote possibility of interaction) at 33s., the set of three ganged together. Self-contained "Varley" wave-band switches are provided and, as instancing how small these coils actually are, it may be mentioned that the switchgear is by far the largest part of the assembly.

*The new Varley Nicore tuning coils; they are available as single, double, and triple-gang units.*

### NEW WRIGHT AND WEAIRE IRON-CORE TUNING COILS

WE understand that Messrs. Wright and Weaire are shortly producing tuning coils employing the iron-core principle. The material of which the core is made is known as Nucleon, and is a product of the Standard Telephone Company. These coils will be available in two different types—open core tuning coils for simple aerial coils, and closed core coils for matching purposes in multi-stage receivers, etc. The price of the open core coils has provisionally been fixed at 8s. 6d., whilst the closed core coils will probably cost 12s. 6d. No further details are yet available, but as soon as samples have been received they will be tested and reported upon in these columns.

### PRICE REDUCTION FOR FERROCART COILS

THE original iron-core tuning coils which appeared on the English market were manufactured by Messrs. Colvern from the patents of Herr Hans Vogt, of Germany. The coils proved immensely popular and the only apparent drawback for many constructors was the price, which was originally 50s. for the set of three. The demand has steadily increased, however, and the General Electric Company are now undertaking the manufacture of this coil in England with the result that Messrs. Colvern are happy to be able to announce a substantial reduction in price. In future the set of three Ferrocart coils will be available, on base-plate, at 37s. 6d.

FOR STOP PRESS NEWS SEE PAGE 440!

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

# REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

*If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.*

## SPECIAL NOTE

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also that all sketches and drawings which are sent to us, should bear the name and address of the sender.

### DIFFERENTIAL REACTION CONDENSER

**"I am at present building a receiver in which a condenser is specified for reaction purposes and this is of the differential pattern. I must admit that I am not quite familiar with this component, but as only one set of plates is joined to the reaction winding, and the other set of plates is joined to earth, it seems to me that this latter could be dispensed with, and an ordinary reaction used instead. I have got one of the latter and should like to know whether it is essential to use the differential type."—(E. N. G., Wroxham.)**

It is true that one set of fixed plates is joined to earth, but it is this connection which gives the value to the differential type of condenser. If you examine the circuit from the anode of the detector valve, you will see that when the reaction condenser is at zero there is no capacity from anode to earth. As the reaction is increased the capacity to earth is also increased. For efficient rectification some value of capacity must be joined from anode to earth, and this should remain more or less constant. The great advantage of the differential condenser is, therefore, that the capacity to earth always remains constant, as the moving vanes enter one set of plates in equal proportions to the amount they leave the other set of plates. If you do not wish to use this type of condenser you must fix a fixed condenser from anode to earth, but the smoothness of reaction will obviously not be quite the same.

### LIGHTNING AND THE AERIAL

**"I have a rather elderly lady living with me, and since I have erected an outside aerial, she has evidenced great anxiety upon the approach of the recent black thunder clouds. She is convinced that there is danger, and likens my aerial to an ordinary lightning arrester. After a week or so of her continual remarks I am beginning to experience some doubt myself, and should therefore be glad to receive your assurance that there is, in fact, little risk from the ordinary outdoor aerial."—(L. A. W., Leeds.)**

The risks of an aerial being struck by lightning are very remote, and whilst it is true that cases do appear in the newspapers after every storm, there is no need to worry. In an area thickly covered with aerials, the good conductivity to earth of the numerous aerial-earth systems, will enable the electric charge in the air to leak away and thus offer a protection as lightning is prevented from taking place. In a case where a solitary aerial is erected in a high position, clear of trees, buildings, etc., there may be a risk of a particularly heavy charge being carried to earth via the receiver and so damaging it. The risk is so small, however, that it should be ignored and you should not worry. If a storm breaks over your district, it is, of course, in the interests of everyone, safer to earth the aerial until the storm has passed.

### IMPROVING THE LOUDSPEAKER

**"My loud-speaker is a commercial one of very recent make—in fact less than six months old. It was supposed to be perfect. After a few nights I decided to experiment, and found that by sticking pieces of paper at different spots round the cone I have improved the reproduction. Does this signify that the speaker was imperfect in the first place? I do not want to feel that I have bought a bad article in these hard times."—(T. V., Llandudno.)**

The fact that the response is altered (we do not say improved) by sticking pieces of paper on the cone is due to the fact that the resonances in the speaker are altered. The speaker may, however, have been a really excellent one in its original condition, and it may quite possibly have been your receiver which was at fault. Your speaker may have a slightly compensating resonance in the bass for instance, and you may have a receiver which is particularly lacking in bass. The additional thickness of the cone occasioned by the extra pieces of paper may have reduced the upper response and thereby made the bass seem louder. We think it would be better first to look to your receiver before condemning a modern loud-speaker of reputable make.

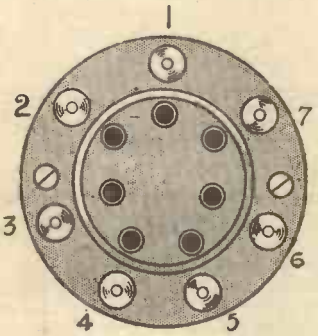
## DATA SHEET No. 38.

*Cut this out each week and paste it in a notebook.*

### SEVEN-PIN VALVEHOLDER CONNECTIONS

In view of the fact that the Double-Diode-Triode and the Double-Diode-Pentode valves have now appeared, it is thought desirable to state the connections which are required to the valve-holders for these valves. A table has already been given, but for the benefit of new readers, and to save referring back to this table it is now given again with the additions.

| Type of Valve | Numbering on holder | | | | | | | Terminal on top of valve. |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Class B (Battery heated) | G2 | G1 | A1 | F | F | — | A2 | — |
| Single Diode Tetrode (Indirectly heated) | — | G1 | G2 | H | H | C | D | A |
| Double Diode Triode (Indirectly Heated) | D1 | — | D2 | H | H | C | A | G |
| Double Diode Tetrode (Indirectly Heated) | D1 | G1 | D2 | H | H | C | G2 | A |
| Double Diode Pentode (Indirectly Heated) | D1 | G1 | D2 | H | H | C | G2 | A |
| L.F Pentode (Indirectly Heated) | — | G1 | G2 | H | H | C | A | — |




*The illustration is of the valve-holder.*

### THE NEUTRODYNE

**"After using a simple detector receiver for the past few years I have decided to make up a set to bring in foreigners. Unfortunately I am limited in the cash I have to spare, and I have no S.G. valves in my collection. Can I use neutrodyne H.F. stages, or are they absolutely obsolete? Why has this form of H.F. fallen away in these days? I should like to have your remarks."—(R. S., Stockwell.)**

The neutrodyne is quite an efficient arrangement, provided it can be accurately carried out. Unfortunately, it is restricted in range, and although a set could be built up, and accurately neutralised on say 250 metres, it is quite possible that at 600 metres it would be unstable. Switching from long to medium waves is therefore out of the question, and provided you are content to use the medium waveband only, you could build up a set of this type, but you will no doubt find that the set will be accurately neutralised at say the minimum wavelength and will have a slight reaction effect at the other end of the scale.

### TWIN AERIALS

**"I am trying to fit up two sets so that I can use the television transmissions. My difficulty is in getting sufficient signal strength for one of the transmissions. My mains home set is used for vision, and I have this joined to the aerial. I have built a three valve mains set for sound, but the Midland is so weak that I cannot hear it on an indoor aerial. I thought of fitting another outdoor aerial, but hesitate to erect it in case of interaction. Do you think it would work? If not, can you suggest how to get this station loud for the purpose?—(T. B., Hastings.)**

It would be possible to erect another aerial, provided it did not run parallel with your present one, but there should be no need to do so. If your present receiver employs an aperiodic aerial coil, and the same form of tuning is used in the receiver you intend to use for the reception of sound, you may join the two sets to the single aerial. The sound set should be joined to the aerial lead-in in the ordinary way, but the earth terminal should be joined to the aerial terminal of the vision set, and the earth terminal of the latter joined to earth in the usual manner. An alternative method is to join the two aerial coils in parallel, or to join a single coil between aerial and earth, and to couple this to both of your receivers. If the receivers employ gang tuning, some readjustment will be necessary.

### HOW LOUD?

**"Several receivers have been published in your excellent paper during the past few months, and they all seemed to have a fairly hefty output valve. I only use a small set at the moment, but have been waiting until a design appears which I think will fulfil my requirements. I should like to know what you consider the maximum volume of which a home receiver should be capable. I notice that the Pentode valve delivers 2 watts. Is this the value that I should aim at? I am not keen on entertaining the neighbours, but I want pure music when I do eventually build up a set."—(W. H., Northampton.)**

If you are keen on getting really high-class musical reproduction at a volume sufficient to prove entertaining in the average living room, you require an output of at least 5 watts. A two-watt output valve delivers a fairly good volume, but on the heavier musical passages, and for certain types of music it fails to deliver "body" and there is a certain amount of distortion unless the input is kept fairly low. A 5 watt output, however, operated so that the volume is at room strength will deliver really high quality, and provided the components used and the circuit which is chosen, are of the right sort, you will find that the quality will be practically as good as it is possible to obtain reproduction by radio.

**FREE ADVICE BUREAU COUPON**

This coupon is available until June 17th, 1933, and must be attached to all letters containing queries.

PRACTICAL WIRELESS, 10/6/33.


*To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.*

### BELLING-LEE TERMINALS

TWO small booklets are to hand from Belling-Lee, Ltd., one dealing with their well-known terminals and connectors and the other with the Belling-Lee "Unit" Pick-up. Full instructions for mounting and working this high-class component are given in the booklet, a copy of which can be obtained from the above firm at Cambridge Arterial Road, Enfield, Middlesex.

### THE MORSE ALPHABET

LEARNING the Morse code is by no means easy by ordinary methods, but by using the "Ready" Method of Memorising Morse the whole alphabet can be memorised permanently in from five to ten minutes. The code signs are embodied in the actual formation of the ordinary letters in a striking manner, which enables the Morse signs to be easily visualised. Full particulars are printed on a thick card folder, which can be obtained for sixpence from the Agents, Percival Marshall & Co., Ltd., 66, Farringdon Street, London, E.C.4.

### FERRANTI CONSTRUCTOR'S CLASS 'B' FOUR RECEIVER.

AN addition to the already popular Ferranti home-constructor's charts has now been made and this time it takes the form of a neat Band Pass Four valver employing Class B in the output stage. This is the First Edition of the 1933 Model and gives every phase of the construction with fully dimensioned drawings. The circuit is of the usual Band Pass Aerial circuit with Screen Grid valve, grid leak detector transformer coupled to the driver valve, which is in turn coupled to the Class B valve. The total price of the receiver (without valves, H.T., L.T. and grid bias batteries or cabinet) is £11 10s. 0½d. Copies of the folder are obtainable from Messrs. Ferranti, Hollinwood, Lancs. Please forward a 1½d. stamp when writing to Messrs. Ferranti for this folder.

## STOP PRESS NEWS!

AT the moment of going to press several new components and new devices have been brought to our notice, and in accordance with our policy of being first to introduce the latest components to our readers, we hasten to give advance notes regarding them. More detailed information will be given later.

### SOUND SALES "ALL-VALVE" TRANSFORMER.

THE driver transformer for use with Class B valves requires a definite resistance in the secondary windings, and also must be matched with regard to the associated driver valve. At the moment the Cossor valve requires one ratio, whilst the Mullard and Mazda valves require different ratios. The problem of accurately matching a Class B valve depends, therefore, upon the component which is in use. When a valve is changed the transformer also would require changing. Messrs. Sound Sales have carefully studied this question, and from the characteristics of the available Class B valves have produced a driver transformer with a tapped primary which enables it to be used with any present (or future) Class B valve and at the same time gives the correct ratio and D.C. secondary resistance. The charge is 1/- more than the original model, namely, 10/-, and it will obviously find great popularity in view of its valuable use to the home-constructor.

### NEW R.I. TRANSFORMER MOULDING.

THE original unshrouded L.F. components of Messrs. Radio Instruments will, in future, be housed in a neat bakelite casing, and we shall show an illustration of this new casing in next week's issue.

### NEW R. AND A. CLASS B SPEAKER

THE Type B "Challenger" loud-speaker, manufactured by Messrs. Reproducers and Amplifiers, Ltd., is listed at the same price as the standard model, viz., 35s., and the transformer with which it is fitted has been wound for a plate to plate load of 15,000 ohms approximately, and is therefore suitable for all types of Class B valves now on the market. Since the "Challenger" was first reviewed by us considerable improvements have been effected in its construction, amongst which are: improved magnet forged of 15 per cent. cobalt steel with a flux density of 6,800 lines per square centimetre, patented dust excluding felt washer, improved cone suspension, whilst by an ingenious method of wool packing it is now practically impossible for metallic grit or dust to enter the speech coil gap. The "Challenger" is now obtainable in four different models of the permanent magnet class, all listed at 35s., viz.: (1) Standard Model, fitted with three-ratio transformer having tappings of 19, 33 and 52 to 1; (2) Model B, as detailed above; (3) Model Q, with a transformer specially wound for quiescent push-pull operation for valves with an approximate load of 15,000 ohms plate to plate; (4) Model P, specially designed for operation as an extension unit with commercial receivers which require a speech coil impedance of between 1.2 and 5.5 ohms.

## LIST OF COMPONENTS FOR THE DOUBLE-DIODE-TRIODE THREE.

(*See page 424*)

One Polar Uniknob .0005 mfd. Condenser.
One pair Colvern Coils, Types K.T.F. and K.G.R.
One Graham Farish H.M.S. Choke.
One Wearite H.F.P.A. H.F. Choke.
One Igranic T.24.B. L.F. Transformer.
One Wearite T.21.A. Mains Transformer.
Thirteen Graham Farish Ohmite Resistances (one each 100, 300, 1,000, 2,000, 10,000, 20,000, 150,000 and two each 5,000, 50,000 and 500,000 ohms.)
One Graham Farish 2 megohm Grid Leak.
Three Dubilier .1 mfd. fixed condensers, Type B.B.
Three Dubilier 1 mfd. fixed Condensers, Type B.B.
Two Dubilier 2 mfd. fixed Condensers, Type B.B.
Two Dubilier 4 mfd. Electrolytic Condensers.
One Dubilier .002 Fixed Condenser, Type 670.
One Dubilier .001 Fixed Condenser, Type 670.
Two Dubilier .0005 Fixed Condensers, Type 670.
One Dubilier .04 Fixed Condenser, Type 9200.
Two Dubilier .01 Fixed Condensers, Type 670.
Two Clix 5-pin Chassis-mounting Valveholders.
One Clix 7-pin Chassis-mounting Valveholder.
One Clix 4-pin Chassis-mounting Valveholder.
Two Belling-Lee Terminal Mounts.
Four Belling-Lee Type B terminals Aerial, Earth, L.S. + and L.S. —.
One R. & A. Challenger Moving-coil Loud-speaker.
One Carrington Cabinet.
One Watmel .5 megohm Volume Control.
One Lissen Mains Smoothing Choke.
One Ferranti VPT.4 Valve.
One Ferranti H.4.D. Valve.
One Mazda A.C./Pen Valve.
One Mazda UU2 Valve.
One Sheet Konductite.
One Bulgin On-Off Toggle Switch, Type S.80.
Two coils Glazite, flex, bayonet plug, etc.
Aerial and Earth Equipment:—
Pressland Cop.
Tin of Filt.

## ADVERTISEMENT INDEX



# RADIO CLUBS & SOCIETIES

*Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.*

### SLADE RADIO

A lecture, entitled "Radio Frequency Rectification," was given by Mr. G. F. Clarke at the last meeting of this Society. Stating that he would deal with an old problem from a new point of view, he proceeded to describe radiation and efficiency. Passing on to sound waves and modulation, also conversion of H.F. modulated waves into audio frequency, he gave details of measurement of H.F. current. Various types of detectors, including the Westector, and their associated circuits were described, after which followed distortion and harmonics. After dealing with Demodulation and Miller effects, pentode detectors, reaction and couplings, the unusually interesting lecture was brought to a close. Anyone interested is invited to write to the Hon. Sec. for details of the Society. Address: 110, Hillaries Road, Gravelly Hill, Birmingham.

### THE CATFORD AND DISTRICT RADIO SOCIETY

The Catford and District Radio and Television Society held their final meeting for the season on Thursday, May 25th, when the members of the Society had the pleasure of hearing how true radio reproduction can sound. The speaker, Mr. Marlow, first of all gave a historic survey of the development of loud-speakers and incidentally demonstrated some of the very early types. He said the present demand was for a small loud-speaker that gave good results under bad conditions. After this came the description of dual speakers. Various technicalities of these speakers were discussed which proved the interest that the members had in this subject. Dr. Bannounah, the Society's Treasurer, provided the radio set, gramophone, and records for the evening and this home-constructed outfit played a very important part in the success of the evening. The Society have had a very successful season and are now closing down until September when they hope to start again in real earnest. All interested are invited to write to the Hon. Secretary, Mr. H. W. Floyd, 38, Como Road, Forest Hill, S.E.23, who will be pleased to send particulars of membership for the coming season.

### INTERNATIONAL SHORT WAVE CLUB

On May 26th a very interesting talk on the "Atomic Theory and Ionisation" was given by Mr. A. W. George English. This was followed by a lecture on "Class B Amplification" given by Mr. R. Poliakoff. Members were greatly interested in this subject and also in a demonstrating receiver which incorporated "Class B Amplification."—A. E. Bear, 10, St. Mary's Place, Rotherhithe, S.E.16.

## Broadcast Query Corner

1. Write *legibly*, in ink. Give your full name and address.
2. State type of receiver used, and whether transmission was heard on headphones or on loud-speaker.
3. State approximate wavelength or frequency to which receiver was tuned, or, alternatively, state *between* which two stations (of which you have the condenser readings) the transmission was picked up.
4. Give date and time when broadcast was heard. Do not forget to add whether *a.m.* or *p.m.*
5. Give details of programme received, and, if you can, some indication regarding the language, if heard.
6. State whether and what call was given and/or kind of interval signal (metronome, musical box bells, etc.) between items.

## Replies to Broadcast Queries

G. L. WILLIAMS (Straits Settlements): Cannot trace from condenser readings; you do not say whether "80" represents metres or condenser dial readings; some estimate of wavelength should be given. We cannot trace a transmission of *Faust* in any European programme. C. O. G. (Sheffield): WIXAL, Boston (Mass.), on 25.45 m., relaying WEEI. MARK 2 (Canterbury): G5SN, N. W. Skinner, 296, London Road, Westcliff, Southend-on-Sea. DA DI DA (Port Glasgow): G6MN, E. R. Martin, Castlemount, Worksop, Notts.; G6NU, W. E. Nutton, 42, Richmond Road, Gillingham, Kent; G2IP, C. J. Reed, 184, Henleaze Road, Bristol, Somersetshire. G5GD, D. G. Sainsbury, Bishampton, Pershore, Worcestershire; G2DD and G6WU, regret, cannot trace; write to R.S.G.B., 53, Victoria Street, S.W.1. F8SY, Henri Brodin, 78, rue Gorge de Loup, Lyon 5e, (Rhone). PAOMU, G. J. Meijer, Koningstraat, 82, Apeldoorn, Holland; PAOOE, F. Bennik, Jr., Breelaan, 14, Bergen (Holland); PAOFB, J. Adama, Waalsdorperlaan, 42, The Hague; POAKB, K. J. Asselberg, Burgemeester Kerstenlaan, 8, Breda. PAOAM, G. H. van Vliet, Ridderstr. 40–A, Rotterdam.

P. W. Gift Stamp No. 37

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*Practical Wireless, June 17th, 1933.*

# CHANGING FASHIONS IN SET DESIGN!

# Practical Wireless

3D

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## FIRST AGAIN!

## A CLASS "B" DETECTOR

## Two Valver

*ALSO INSIDE*

BUILDING THE THREE-STAR NICORE

*Learn More About Your Wireless*

Whether you are beginner or expert, study of this comprehensive and up-to-date work will result in both pleasure and profit. Its author is acknowledged to be one of the most brilliant exponents of Modern Radio both in theory and practice, and this "Outline" is filled with knowledge. It should be on every enthusiast's bookshelf.

## THE OUTLINE OF WIRELESS By RALPH STRANGER

*Obtainable at all Booksellers, or post free 9/- from George Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2.* 8/6

THE THREE-STAR NICORE—See page 450


# ROUND *the* WORLD *of* WIRELESS

### This Ether Freedom

SINCE March 21, when the Hitler Party came into power in Germany, listeners on the amateur band may have noticed that German calls have been less frequent than has hitherto been the case. The "new broom" has swept aside the transmitting licences issued to German experimenters and a complete revision is being carried out. In future no German experimenter will be allowed to go on the air unless his political opinions are definitely in accord with the Nationalist Socialist (Nazi) Party's views!

### Site of the Ulster Regional Transmitter

NO definite site has yet been chosen for the high-power Ulster Regional station, which is to provide the Belfast broadcasting service. A mobile transmitter is used for the purpose of testing out favourable localities for the erection of the transmitter. The neighbourhood of Craigantlet, in the Hollywood Hills, well known to motorists in particular, has made a strong appeal to the engineers.

### Radio Tessin

IT is not an easy matter to find a favourable position in the broadcast band to-day, for transmitters exceeding a power of 10 kilowatts, and *Monte Ceneri* (Switzerland) is experiencing this difficulty. After carrying out tests on wavelengths in the immediate neighbourhood of the shipping band with consequent interference, experiments have now been made on 1,140 metres (263.2 kc/s), a channel which, in the new Lucerne Plan under discussion, is provisionally allotted to Kalundborg (Denmark). But many alterations may yet be made.

### Another German High-Power Station!

IN a recent official broadcast from Königsberg (East Prussia), a statement was made to the effect that the power of the Heilsberg station should be increased without delay to 100 kilowatts, and it is anticipated that in view of the results of the recent Danzig elections, the work will be begun within the next few weeks.

### How to Avoid Interference

FOLLOWING an official investigation in the United States, with a view of ascertaining the range of the existing transmitters, results demonstrated that, roughly, 90 per cent. of the total number of listeners were able to receive broadcasts from numerous local stations without any sign of interference. These favourable conditions were achieved through judicious measures taken by the authorities who, during the peak broadcasting hours, have not allowed more than 382 out of the 600 stations to operate at the same time. Previously, 565 transmitters were on the air together, thus causing mutual heterodyning.



### Italy's Radio Net

WITH the recent addition of the Florence, Bari and Milan (50 kW.) stations, Italy considers that she has now completed her broadcasting system, and it is not likely that any further transmitters will be built for the next three years. The number of licensed listeners, in the course of a few months, has jumped from 220,000 to more than 300,000, and it is computed that the half-million can be reached if a serious campaign is started against the existing radio pirates.

### Vienna on 120 Kilowatts

GOOD reception of the broadcasts from the new Vienna-Bisamberg transmitter have been reported from all over Europe, although, in the British Isles, with unselective receivers, it is difficult to keep Brussels No. 1 out of the background. Experiments are still being made on about 1,255 metres, and there is still the possibility that another wavelength may be allotted to the newcomer.

### Why the "Long" Wave is Preferred

AS the Swiss radio authorities wished to ascertain whether broadcasts from the Beromünster transmitter would be received at greater range if a longer channel were adopted, experiments were recently carried out with a military mobile station working on various wavelengths between 200 to 2,000 metres. It was clearly demonstrated that up to 800 metres little advantage was to be obtained, but on a wavelength of about 1,100 metres, the field measurement showed, roughly, a five-fold increase in the power of the signals received without any appreciable interference. Switzerland, therefore, has asked Lucerne to be allotted a channel in the upper broadcasting band.

### Eiffel Tower and Lucerne Plan

IN the provisional wavelength plan put forward for discussion at Lucerne, it is noticed that no allocation on a "long" channel has been considered for France's oldest transmitter, Eiffel Tower. According to a French report, there appears to be little doubt that Radio-Paris will take over FL's broadcasting activities, and that the latter station in future will devote itself exclusively to official transmissions on a channel above 3,000 metres. France may thus lose, for its entertainment, broadcasts on a channel in the upper band, and in compensation may be allotted another of a higher frequency.

### An S O S for Missing Dogs

APPARENTLY in Budapest the stealing of pet dogs has become a lucrative profession. Under the caption *Lost, stolen or strayed*, the daily papers have regularly published the appeals of anguished dog-owners. In order to assist, Radio-Budapest now nightly puts out a series of special S O S calls, with full descriptions of the missing dogs. Up to the present, in view also of rewards offered through the microphone, some 95 per cent. of these appeals have proved successful.

# ROUND *the* WORLD *of* WIRELESS *(Continued)*

### Lucerne Conference

THE following figures may give some idea to readers of the importance of the discussions which are taking place at this convention in respect to the compilation of a new wave plan, and allocation of channels to the European transmitters. In all forty-two different States are interested in the conference, thirty-six of which are directly represented by 140 delegates. Germany has sent eleven, France eight, England seven, the Vatican three, and Luxembourg *five* members of its broadcasting organization. Roughly speaking, there are 235 channels to allocate, the total energy of the stations to be provided for amounting to 3,140 kilowatts. When the Prague conference was held, there existed only 208 stations, and their aggregate power did not exceed 550 kilowatts!

### Another Silesian Relay Station

GERMANY is anxious that its entire population should be adequately provided with a broadcasting service, and to this end proposes to erect a further series of relay stations. The latest suggestion is that Goerlitz, a town in the Prussian province of Silesia, between Dresden and Breslau, should be endowed with a transmitter. It may be fed entirely by the latter city, but would also, in any case, be directly connected to the capital.

### A New Portuguese Call

A LISTENER reports having picked up a broadcast from a Portuguese transmitter on 433 metres, giving out announcements in Portuguese, Spanish, English and French. The call letters heard were CTICM, Lisbon. According to details broadcast transmissions are carried out every Tuesday, Thursday and Sunday from 9 p.m. B.S.T. Now then DX searchers, have any of you logged it?

### The Latest Spanish Project

WITH a view to securing the necessary annual income for the upkeep of transmitters, the Spanish Government proposes to inflict a tax of one half peseta on all crystal sets, and to charge two pesetas on valve receivers, in addition to the annual licence tax of five pesetas now collected from owners of wireless apparatus. Moreover, to crush radio piracy, it is suggested that all receivers before their use should be compulsorily submitted to official laboratories for test, at the expense of owners; in this manner an accurate record of licence holders and apparatus could be carried out. At the present rate of exchange the peseta is worth sixpence.

### Langenberg's Closing Down Signal

AS a fitting end to the Cologne broadcasts through Langenberg high-power station, the studio has adopted an old folk song played on a bugle. It is the *Old Nightwatchman's Call*, of which a translation from the German is given hereunder: *Listen O people, let me tell you, the clock has struck midnight. Watch your fires and the lights so that no harm may befall the city. Praise the Lord!*

## INTERESTING and TOPICAL PARAGRAPHS

### Was That It?

FOLLOWING investigations carried out by the Radio Research Department of the Bell Telephone Company in New Jersey (U.S.A.), the actual wavelength of radiations from the Milky Way have been measured. According to the time of day and period of the year they vary in intensity, but their length remains constant, namely, 14.6 metres. As these radiations are of an electro-magnetic type they may cause interference in the shape of a steady hiss, resembling atmospheric discharges, and can easily be received on any sensitive wireless set.

### A NEW TRANSPORTABLE

*The new Pye model Q/MT battery transportable at fourteen guineas.*

### British Empire's Radio Net

IN a speech recently made by the Marchese Marconi, at a dinner given in his honour by the Royal Empire Society, he stated that a tribute had to be paid to the British Post Office, inasmuch as through the belief of the officials in the commercial use of short-waves as far back as 1924, England was the first country to erect beam stations for wireless communication with the Empire. The Colonies and Dominions have since been linked together by radio telephony, thus making London the *greatest telephone exchange in the world.*

### The Derby in Mid-Atlantic

FOR the first time in the history of wireless passengers on a liner in mid-Atlantic were able to hear a running commentary on a horse race. The broadcast of the Derby, picked up by the S.S. *Empress of Britain*, was relayed through a large number of loud-speakers throughout the liner. By this means passengers of all classes, and also the crew, were able to follow a description of this classic race.

### Is This a Record?

IN April the Bolivian authorities erected a new station at La Paz, Corocoro, 13,500 feet above sea level, making it the highest broadcasting station in the world. There are two transmitters working simultaneously on a medium and short wave. Apart from broadcasts in Spanish, educational lectures are also given in native Indian dialects.

### The Latest Aerial Mast

THE single aerial tower used for the broadcasts of the Vienna-Bisamberg high-power station is, roughly, 430 feet high, weighs fifty tons, and actually rests on *one porcelain insulator*. The entire construction is painted red and white, and at night is illuminated in red as a warning to aircraft. A beacon, with a flashing light, has been installed in its immediate vicinity as an additional safeguard, and the signal can be seen some twenty-four miles away. The aerial tower is so constructed that if it is found necessary its height can be increased by another sixty-seven feet.

### A Novel Remote Control Device

AN habitual invalid who is also an enthusiastic wireless fan, has invented a means of remote control whereby he can switch on his set and tune it in without so much as moving in his bed. He has utilised a number of lengths of steel cable covered with a sheath of the same type used for the controls of motor-cycles and aeroplane engines. One end of these he arranged to operate the switch, and the tuning and reaction knobs of his set, while the other ends he brought out to lever controls fixed to a tuning board.

## SOLVE THIS!

### Problem No. 39.

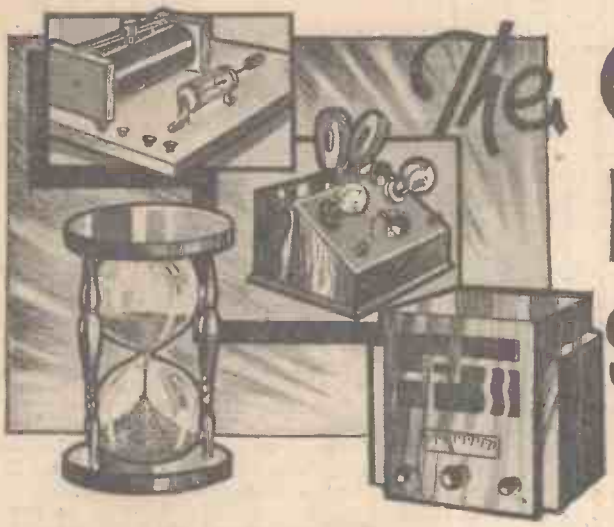
Blackman's receiver had been working for some weeks quite satisfactorily, but signals had gradually got weaker. One night they practically ceased, and he accordingly tested the batteries. These proved to be all up to standard, and he therefore had the valves tested. These also were quite O.K., and he therefore checked over all the wiring and components, but every part of the receiver was in order and correctly wired. The loud-speaker also proved to work quite well on a friend's set. What was the trouble? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., 8-11 Southampton Street, Strand, London, W.C.2, and post to reach us not later than June 19th. Do not enclose any other correspondence with your solution.

### SOLUTION TO PROBLEM NO. 38.

The guy rope of Jackson's aerial had slackened, and due to a slight swaying it had caught on the bough of a tree to which the lower end of the aerial was attached. This resulted in a leakage, and necessitated a resetting of the tuning dial. When the guy rope was tightened the trouble disappeared.

The following three readers received books in connection with Problem No. 37.

T. Pilkington, 1, Law Street, Accrington, Lancs.; R.M.Y. Cameron, "Sunnyside," 62. Buchanan Drive, Cambuslang. E. Brannan, 3, Rhodes Terrace, Gold Street, Barnsley.



# The CHANGING FASHIONS in SET DESIGN

## A Brief Survey of the Development of Wireless Receivers from the Inception of British Broadcasting to the Present Day

## PART 1

By
H. J. BARTON CHAPPLE,
*Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.*

THOSE of you who have been radio enthusiasts since the early days of broadcasting, or even before, have seen and appreciated the great and numerous changes which have occurred in the technical design of receiving equipment, and the enormous improvements thereby effected in the efficiency and performance of wireless sets. The comparatively new listener, however, has had none of these experiences. He has entered right away, as it were, into a radio world already established, and has inherited at once a very high standard of technical and musical efficiency.

But this very fact has deprived him of the wonderful educational value of radio history. We "old stagers" who have built up our technical knowledge mainly by practical experience based, of course, on a groundwork of fundamental facts, were able to follow each improvement and development, step by step; the newcomers to radio have to take so much for granted.

station at Writtle. I cannot tell you much about the apparatus he had installed, but I do know that practically the whole of one wall of a small room seemed to be occupied by mysterious boxes with ebonite covers containing home-made condensers; with panels supporting equally home-made looking coils; with rows of brightly-glowing valves, banks of rheostats, massive terminals and cobwebs of connecting wires. A big six-volt car accumulator was placed under the table, and a small packing case contained scores of small flash lamp batteries carefully soldered together in series to provide a high-tension supply. With all this equipment it took nearly a quarter of an hour of careful tuning and

the inductance to be varied for tuning purposes and, in the case of coils with more than one slider, to permit of an auto transformer arrangement which improved both selectivity and volume. (Readers will no doubt recall that I dealt very fully with coil design in a recent series of articles.) In these crystal sets no variable condenser was used, the self capacity of the coil providing the due proportion of capacity in the resonant circuit.

About the same time, coils of similar design but with a series of tappings taken down to rotary switches were introduced. The principle of tuning—by varying the inductance of the coil—was the same, but the massive and important-looking stud switches had a more attractive appearance. Sets employing these coils, however, were unwieldy and far from neat. Something more compact was demanded—and the variometer tuner was produced. This consisted of two coils, one inside the other,

to r

(*Continued from previous page*)

### Variety in Plenty

For the next few months developments, as far as crystal sets were concerned, were restricted to differences in the tuning arrangements—two coils sliding over each other; a fixed coil and variable condenser; two tuned circuits with variable coupling and many other devices were successfully employed. The types of crystal also were varied. Single crystals of a dozen different kinds sold under a hundred different names, and used with all kinds of "catswhisker," ranging from copper and brass to silver and gold, and held in crystal cups and whisker holders of unlimited variety, exercised the minds and tempted the pocket of the early listener. Double crystals which needed no catswhisker were also introduced. But sooner or later nearly everyone succumbed to the charms of a valve-operated receiver, and I have set out in detail the technical equipment which was available to the home constructor of the period:—

Coils ranged from cylindrical inductances, tapped at intervals for rough wave-selection and with or without a rotor which could be used for reaction purposes; through home-made or shop-made "spider" coils, to various forms of honeycomb plug-in coils.

Variable condensers were of the semi-circular type, having no pretence to straight line, square law or other logical scale of capacity. Standard sizes were .0003, .0005 and .001 mfd. Often they were made at home from aluminium plates, screwed rod and "spacing" washers turned out by the million and invariably woefully inaccurate as to dimensions. Some of these condensers were arranged for panel fixing; many others were for baseboard use, mounted vertically in individual wood boxes with ebonite panels, or on square or round bases with supporting pillars. Grid leaks and fixed condensers were much as we know them to-day, but far less accurate and reliable, and much more expensive. Headphones, invariably employed, were good but costly.

Of valves there was but one type available—the "R" type bright emitter, rated as a general purpose valve. Consuming some ¼ amp. at from 4 to 5 volts, they needed a fairly hefty low-tension battery. High-tension voltages up to about 100 were employed—usually 45 volts to 66 volts satisfied listeners and was quite sufficient to produce oscillation—and it did!

### Strange and Crude

The circuit used in the first receivers was the simple leaky grid detector with reaction. Reaction was always of the magnetic type, with swinging coil or a rotating coil after the style of the old variometer. The sensitivity of these old sets was sometimes quite wonderful; few stations reached, let alone exceeded, 1 kilowatt, yet on good nights Newcastle could be picked up at remarkable strength in London—on 'phones with a single valve. Of course, the ether was not so crowded, so that the reduction of aerial size, and various circuit arrangements intended to increase selectivity and which at the same time reduced sensitivity, were unnecessary.

The appearance of these early one-valvers was as strange as the apparatus was crude. In some the internal wiring and few fixed components were inside a wood box, with a horizontal ebonite panel accommodating the controls—tuning condenser and filament rheostat. The valve would be mounted on the top of the panel—or sometimes inside the box and projecting through a hole in the panel. The swinging coil holder would then be attached to the side of the box. In other cases all the components would be screwed to a wooden base plate and the wiring run on the base, no cabinet at all being used.

When the listener decided to add a second valve, he had to make the momentous decision between a high-frequency amplifier and a low-frequency amplifier. Long arguments were carried on as to the relative merits of the two forms of amplification, even in the technical Press, but as either form, with the apparatus available, generally was highly inefficient, it did not matter perhaps very much which type was chosen.

### H.F. or L.F.

If high-frequency amplification was decided upon, it simply meant an additional tuned circuit—tuned anode or a tuned high-frequency transformer, or very often an untuned transformer. Listeners accumulated stocks of these transformers, all fitted with four pins *a la* valve base, and covering a wide range of wave-lengths. Similar sets of plug-in coils, too, were necessary. Some slight variations in aerial tuning circuits now began to take place. There were, perhaps, a couple of dozen stations "on the air" and people began to talk about an overcrowded ether—how we should enjoy those conditions now! So loose-coupled aerial circuits were introduced, and that made another tuned circuit.

If the listener decided after all to use his second valve as a low-frequency amplifier, low-frequency transformer coupling was almost invariably adopted. His range was not greatly increased, but he got wonderfully strong headphone reception, and might even try to use a small horn speaker about the size of a motor-car klaxon and, so far as my memory serves, doling out about the same quality music. The listener might even use three valves—high-frequency, detector and low-frequency. He was then certain of loud-speaker reception. Remember, however, that all his valves were of the same type—something very much less efficient than a present-day detector valve, so you can imagine that neither output nor quality was superlative.

But principles of reception were by now fairly established and developments came apace. I must devote the next instalment to the stages by which a fairly efficient series of circuits were stabilised, because upon the work of that era the whole foundation of the modern set is based.

# What the B.B.C. is Doing on Seven Metres

## An Interesting Account of the Seven-Metre Experiments which the B.B.C. has made on the roof of Broadcasting House

THE B.B.C. seven-metre transmitter was fitted on the top of Broadcasting House last July. Since then, secret tests have been carried out on the very short wavelengths, and the B.B.C. engineers have been seeing how far the seven-metre transmissions will carry over London. The engineers were afraid that if the public became too interested in the short-wave experiments, there would be interference. Practically every day for nearly a year the short-wave transmitter has been worked, generally relaying the National programme. Television transmissions have also been put out, and very definite progress has been made.

Most of the research work has been done at Clapham and at the points where the special short-wave receivers have been tried out. These receivers were made at the Nightingale Lane Research Branch and were taken to chief points in London, to see what kind of service could be obtained when putting out the National programme on seven metres. There is great difference in the external appearance of the transmitter. It consists of four panels, one being for rectifying the supply for the power supply from the mains, the second an auxiliary rectifier and the third the modulator. The fourth is the final oscillator stage. All the power is taken from the local 450 volts A.C. mains. At one side of the little room immediately beneath the clock tower is a panel carrying all the voltage controls. The current from the mains is rectified by three valves, and the actual H.T. on the anodes of the short-wave oscillators is about 4,000 volts.

According to the B.B.C. engineers, it is difficult to make any accurate measurement of the power being put out at such extremely high frequencies, but it is estimated that the power now radiated is of the order of ¼ of a kilowatt. Although the aerial has been frequently modified, it still consists of an arrangement called the Franklin type. A Marconi concentric tube feeder runs up from the oscillator panel through the wall, up over the roof and to a copper box immediately beneath the Franklin aerial. The copper tube, of course, carries the usual two feeder wires.

The aerial is still supported at full height on the 35ft. mast. The top of the aerial is, therefore, something like 140ft. above street level.

The wavelength used is 7.75 metres, or 38,710 kilocycles! Although it only takes a few minutes to retune the Franklin oscillator stage in order to work the transmitter on any wavelength within the range, there have been practical difficulties in the way of working on any other wavelength. As a matter of fact, the transmitter itself can be worked from any wavelength from 6 to 8 metres. The Radio Research Board have been doing some useful work below 6 metres, and had attained a wide coverage with 5 metres, but the B.B.C. engineers felt that if any useful results were obtained it would have to be on something like seven metres.

### Results Obtained

After the transmitter had been working for only a couple of days, it was found that good reception was obtained at places which were definitely out of sight from an observer standing on the roof of Broadcasting House. The variation in the reception all over London was enormous, but it should be remembered that even with the ordinary medium wave London National transmitter there is a most peculiar reception curve for London, owing to the absorption of the wireless waves by big buildings. In one direction, a range of about 30 miles was obtained. At 15 miles, in practically every direction, there was good reception.

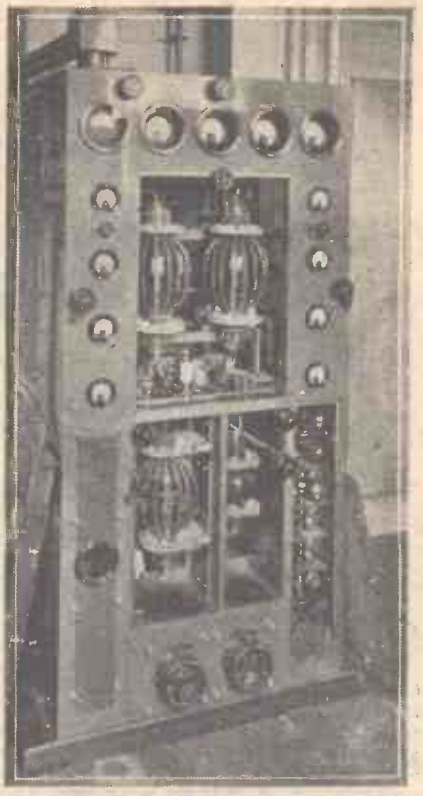


*Fig. 1.—Ultra-short-wave transmitter. Master-oscillator and amplifier unit at Broadcasting House.*

The receivers used are of a kind that an ordinary listener could make up.

Most of the test receivers were made up at Clapham. Three different types have been used, the main one being a single-valve superheterodyne adaptor. This was used in front of one of the ordinary check receivers designed for broadcast band working. A specially-designed short-wave superhet was then tried, and later an ordinary short-wave outfit with a detector and no H.F. stages. The best results were obtained with the specially-designed short-wave superhet. Ordinary short aerials were tried with all these sets and found to be satisfactory, so there is no doubt that if ever the B.B.C. have to confine their transmissions exclusively on seven metres, listeners will have to provide special aerials.

### Quality of Reception

With regard to quality, that of the seven-metre transmissions is definitely better than that of medium or long-wave broadcasts, and there is a sound technical reason for this. Owing to the high frequencies and, therefore, the large number of kilocycles involved, there is far more space in the ether at these low wavelengths than there is on the medium or long-wave bands. Thus there is far more space for the side bands, and that is why such excellent quality is obtained.

This is due to the cut-off of high audio frequencies, which is essential in order to avoid interference. Even on the short-wave superhet, the difference in quality

(Continued on page 456)

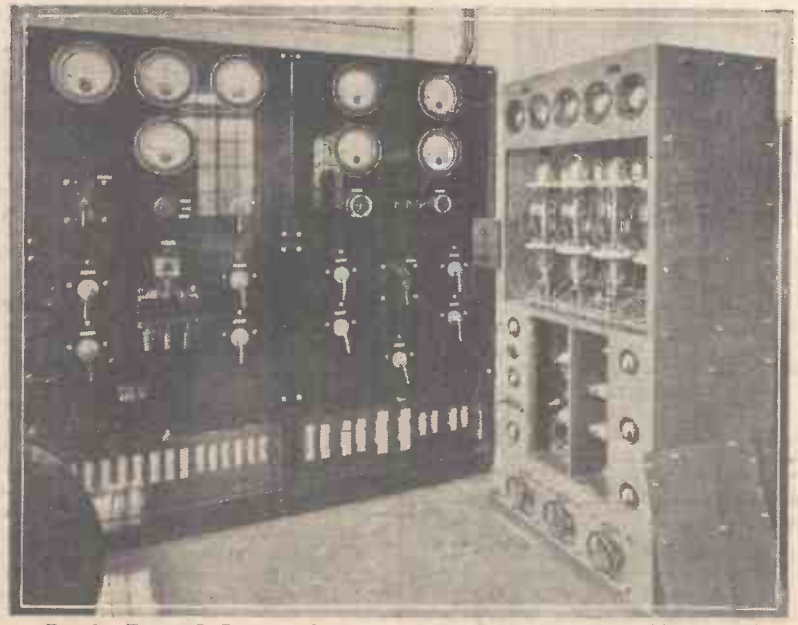
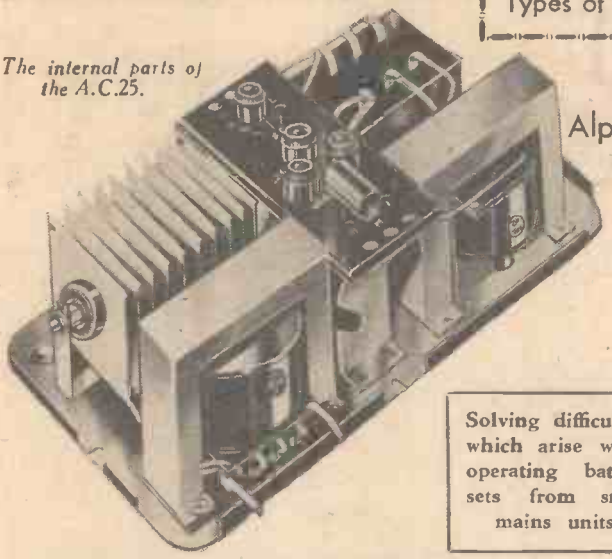


*Fig. 2—The B.B.C. ultra-short-wave transmitter, power switchboard and modulator unit.*

# CLASS "B" AMPLIFICATION AND MAINS UNITS

## Some Points Regarding This Method of Amplification and the Results of Some Tests Carried Out with Different Types of Battery Eliminators.



*The internal parts of the A.C.25.*

By Alpha Omega

**Solving difficulties which arise when operating battery sets from small mains units.**

*The A.C.25 which is similar to the K.25 which is discussed in this article. K.25 has the addition of a trickle charger.*

ON page 136 of our issue dated April 15th, we drew our readers' attention to the fact that the Class B amplifier operates in such a manner that the anode current varies continually with the received signal. It was also pointed out that the varying current caused very peculiar effects when a small mains unit was used to operate a receiver with this type of output valve. Messrs. E. K. Cole, manufacturers of the extensive range of Ekco Mains Units, wrote to us upon publication of this statement, and sent two of their units for test, and it will no doubt prove of interest to home constructors to learn the interesting result of some tests which were carried out in our laboratory with these and other units.

### The Class "B" Characteristic

We have already dealt fully with the *modus operandi* of the Q.P.-P. and Class B output stage, and perhaps it would be as well to repeat here the operating conditions of a Class B valve. The Cossor 240.B (which is at the time of writing the only Class B valve available), requires an associated valve to operate it, and this valve is known as the driver. As this is an essential of the arrangement, measurements were taken of this valve in conjunction with the output valve, and the following details are, therefore, unless otherwise stated, the combined values of the two valves. With a battery potential of 120 volts, the combined current of the two valves with no signal was 6 mA. The London station was tuned in on a three-stage receiver feeding the amplifier, and the current on peaks assumed a value of 8 mA. A reduction in bias on the driver valve enabled a slightly greater output to be obtained, but the total anode current then increased to 10.5 mA. The Beta Universal Four was then used, and measurements with this showed that the total current of the receiver with no signal was 11 mA. On the loudest passages of dance music, where reaction could be forced and slight distortion could pass unnoticed, the total current was 17 mA. All these measurements were taken with a super-capacity H.T. battery.

### The Mains Units

Several different makes of mains units were now taken and used to supply the voltages for this receiver. The first to be tried was a cheap unit made up by a small dealer in one of our towns, and which was supposed to deliver 20 mA. The smoothing in this unit was known to be very poor, but it was connected up in order to see just what the effect would be. Naturally, the regulation was extremely poor, and although hum was not very pronounced, it was found impossible to obtain loud signals without distortion. At a total drain of 12 mA, the volume was good and quality quite up to the standard when using dry batteries. When the signal strength was increased above this value, however, the quality decreased proportionately. Above 15 mA it was impossible to obtain clear signals. All loud musical passages and low notes suffered from a peculiar form of "blasting" which was due, of course, to the fact that as the current rose the voltage dropped, and the measured voltage applied to the Class B valve on some peaks was only 80 volts instead of the rated 120. A well-known make of unit was next tried, and although this was much better, it was still impossible to operate the Class B valve at its maximum. It was possible to obtain 1 watt undistorted output by limiting the signal, under which conditions the current drain was just under 12 mA. This unit was rated to deliver 15-20 milliamps at 120 volts, and when this unit was tested without the receiver it was found that the voltage at 12 mA was 120 volts, and at 20 mA it was less than 110 volts. The signals at moderate volume were quite comfortable, but naturally the best could not be obtained from the system.

### The Ekco Units

We then tried the Ekco Unit Type K.25. This is rated to deliver 120 volts at 20 mA. and 150 volts at 11 mA., with alternative tappings for the remaining valves in a receiver. Connected to the Beta, the voltage on the Class B valve was approximately 125 volts, and the London station was tuned in. It was found that the maximum output from the Cossor valve was obtainable without the blasting effect of the previously tried units, and the driver valve could be biased down so that the full 2 watts undistorted was obtainable without distress. As a further test of the regulation of this particular unit, the reaction control was adjusted (with no signal), so that the receiver was not far off the oscillation point. The Midland Regional was then tuned in, and the setting appeared to remain sensibly constant the whole time. On the London station (only five miles away) the tendency was for the detector to oscillate slightly now and again as the voltage varied between the narrow limits which were set, but for all normal use this unit was found to function admirably. It was found preferable with this unit to employ voltage droppers in the receiver itself, and so utilise only the maximum H.T. output from the unit, which is then rated to deliver 120 volts at 25 mA. and 150 volts at 17 mA. The unit, as probably most readers are aware, consists of a neatly housed chassis provided with three alternative tappings for S.G. valves: 80 to 90 volts up to 3 mA. on the tapping marked H; 70 to 80 volts at the tapping marked M; and 60 to 70 volts at 1.5 mA. at the tapping L. A small ebonite plug is provided to fit into the sockets marked H, M and L on the 50-80 volt tapping provided for the detector, so that the correct selection of the required voltage is easy to obtain. This tapping delivers up to 3 mA. The maximum output has already been dealt with. In addition, a switch is fitted which enables the L.T. battery to be put on charge when the receiver is not in use, and cords are already fitted to the unit for connection to the accumulator. The rectifiers in the unit are manufactured by the Westinghouse Company, and the mains transformer and smoothing choke are very substantial components. The unit is attractively housed, and costs £5 7s. 6d.

# The Why & Wherefore of GRID-BIAS

In this Short Article, the Author Explains in Simple Language the Theory and Practice of Grid Bias.

PROBABLY every wireless constructor knows what is meant by grid bias and realises that the performance of any receiver depends very largely upon the application of correct voltages to the grids of the various amplifying valves. What is not so generally known, however, is why grid bias is employed at all. Much has been written on the subject, and yet the numerous queries that crop up every day are clear proof that the matter is not fully understood. As a thorough knowledge of the "reason why" will enable the reader to get the best out of his receiver or amplifier, a simple explanation should not be amiss.

**The Construction of a Valve**

Before one can fully appreciate the importance of grid bias it is necessary to have an elementary idea in regard to the construction and operation of an ordinary (three electrode) valve. Inside the bulb are three electrodes; the filament, grid and plate (or anode). The filament generally consists of a thin vertical wire coated with some kind of compound coming within the category of a "rare earth." Surrounding the filament is an open spiral or gauze cylinder known as a grid—for an obvious reason. Outside the grid is a metal cylinder, generally made of nickel, called the plate or anode. The sketch of Fig. 1 shows the form of construction just described. It should be added here that the actual shapes of the electrodes differ widely with various makes of valves, but in all cases their function is the same.

**The Valve's Action**

Now, when a valve is placed in the receiver and the switch turned on, the filament is heated by current flowing through it from the accumulator. A high tension voltage is also connected between the filament and plate of the valve so that its positive terminal makes contact with the latter electrode (through the loudspeaker, intervalve transformer, H.F. choke, etc.). The heated filament "shoots" off electrons, which are in effect minute "particles" of negative electricity. Since the plate of the valve is charged positively it attracts the negative electrons to it and thus we get the effect of a current of electricity flowing from the filament to the plate. The amount, or intensity, of the current depends upon the H.T. voltage and the particular type of valve in use, and may easily be measured by inserting a milliammeter in series with the valve and H.T. source in one of the positions indicated in the diagram of Fig. 2.

**Function of the Grid**

It can be seen that all the electrons which are attracted from the filament to the plate must pass through the grid. And, provided the grid has no potential (or voltage) of its own, they have no difficulty in doing so, due to its "open" construction. But what would happen if the grid were made positive or negative in respect to the

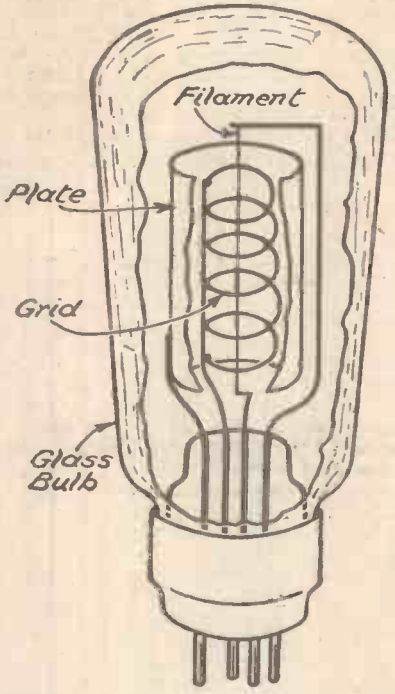



*Fig. 1.—A "break-away" sketch showing the main constructional details of a three-electrode valve.*

filament, by connecting a battery between these two electrodes? An elementary law of electricity states that like poles repel, and unlike poles attract each other. Well, then, if the grid were positive it would attract more electrons, but if it were negative, it would repel some of those normally attracted by the plate. This explanation might be followed more easily by making reference to Figs. 3 to 5. Fig. 3 shows the normal flow of electrons when the grid is at the same potential as the filament. Fig. 4 shows the effect of applying a positive bias to the grid, and Fig. 5 the effect of a negative bias can be observed.

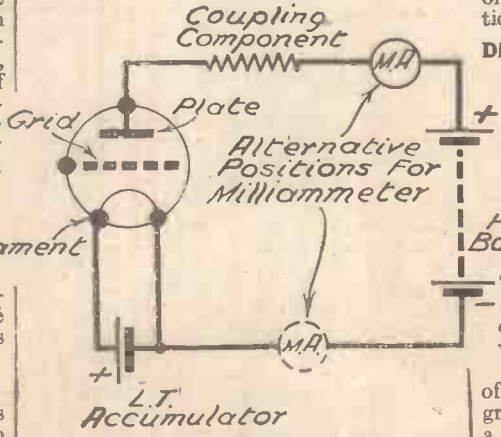



*Fig. 2.—The current flowing from the filament to plate of a valve can be measured by inserting a milliammeter in series with the H.T. battery.*

**"Amplification Factor"**

We are now able to see how a valve acts as an amplifier of signal voltages, which are, in effect, the electrical equivalent of the sound which emanates from the loudspeaker. These voltages are of constantly varying intensity and polarity and are applied to the grid through the L.F. transformer or other coupling device. Thus, they cause a varying current to pass between the filament and plate of the valve, and since the grid is close to the filament, a small change in signal voltage produces the same effect as a much larger change in H.T. voltage. As a matter of fact the "amplification factor" of a valve is the ratio between the change in H.T. (or anode) voltage and the change in grid voltage required to produce a given variation in the filament to anode current. An example will make this point quite clear. The H.T. current passed by a typical small power valve with 100 volts high tension and a zero grid voltage is 15 milliamps. To increase this current up to 31 milliamps (a change of 16 milliamps) the H.T. voltage must be raised by 50, to 150 volts. But the same increase in current can be obtained by making the grid only 5 volts positive. In other words, a change of 5 volts on the grid has the same effect as a change of 50 volts on the plate, and therefore the amplification factor is 50 divided by 5—or 10.

**Distortionless Amplification**

Having gained a general idea as to how a valve functions, we are able to return to the point we set out to consider, namely, the reason for using grid bias. We must bear in mind throughout that a valve is required to give, not only amplification, but distortionless amplification if it is to be of real value.

**The "Characteristic Curve"**

Let us examine the "characteristic curve" of any make of small power valve. This is the diagram you find on the instruction sheet sent out in the box of every valve you buy. It is merely a graph which shows how the anode current of a valve varies with different grid voltages. For example, it can be seen that with an anode voltage of 100 and a zero grid voltage

(Continued on page 462)

# PRACTICAL NOTES ON MARKING-OUT TOOLS AND METHODS

## Some Sound Advice on the Correct Methods of Using Tools

By W. H. DELLER

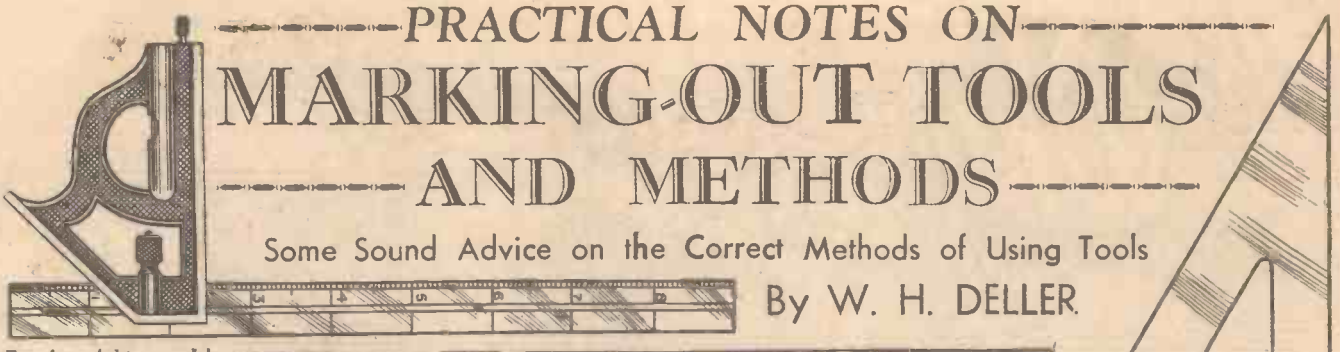


*Fig. 1.—Adjustable square, steel rule and set square.*

THE most necessary tools required for marking out as applied to wireless construction are a scriber, a pair of dividers, a centre punch, a square (a plate square is also handy), and a steel rule.

These are illustrated in Figs. 1 and 2. The scriber is one of the pocket variety, the dividers a pair of 5in., finely pointed, the centre punch is small, that is, at the pointed end, the square has a blade that is movable on the beam and is also rule marked. The small 4in. plate square needs no comment, and if a square such as that illustrated is used, a flexible steel rule will be best, but otherwise a stiffer rule will be necessary.

In its simplest form marking out takes the form of laying a blueprint on a baseboard and pricking the necessary holes off with a scriber. Where a blueprint can be relied upon for accuracy this method has the advantage of being direct, but where the scale of the drawing is, say, half size, all dimensions will have to be doubled; that is, of course, where the distances are being picked off the drawing. In such cases the dividers are adjusted to suit the various hole centres and measured with a rule, and the measurement increased by the number of times that the scale of the drawing is under full size, or where practical the increase can be made as in Fig. 3. Thus, if the drawing was one-third full size the length between the divider points would be plotted three times.

Just a word about keeping the points of dividers in trim. They must be kept sharp and fine, and require oil stoning from time to time, but in doing so see that the points do not gradually become stubby; also see that the points are level when the dividers are shut. This condition is important for marking small circles.

Marking out squares or rectangles for baseboards or panels is carried out as follows. Either one edge of the material is prepared with a perfectly straight edge as a line to work off, or the steel rule is laid on to the material for this purpose. In the first case the blade of the square is set to the vertical height required and one end line is marked, also a line is made against the top of the blade of the square to indicate the height. The square is moved to the other end of the job and the process repeated, the distance between the lines being controlled by a rule held at the first line leaving the required amount overlapping as a gauge (see Fig. 4). Where the other method is adopted the set square is called into use, the rule being used as a guide for the base of the square, and also an indication is at once obtainable as to length by setting the right-angled portion of the square against the appropriate markings on the rule (Fig. 5).

When marking out panels for drilling, a very similar procedure can be adopted. All vertical heights can be made by adjusting the blade of the square so that only the correct amount of rule is projecting beyond the square face of the beam. All distances in the opposite direction are measured with the rule either off one edge or from a previously marked centre line. If properly carried out a very accurate marking will result.

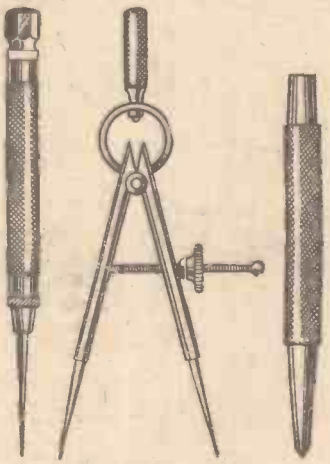


*Fig. 2.—A group of essential marking-out tools.*

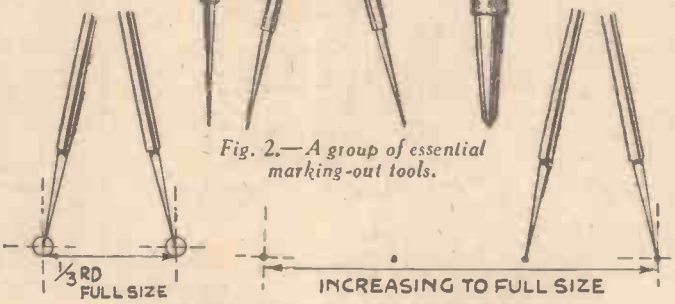



*Fig. 3.—How to "scale off" with the dividers.*

(Continued on page 463)

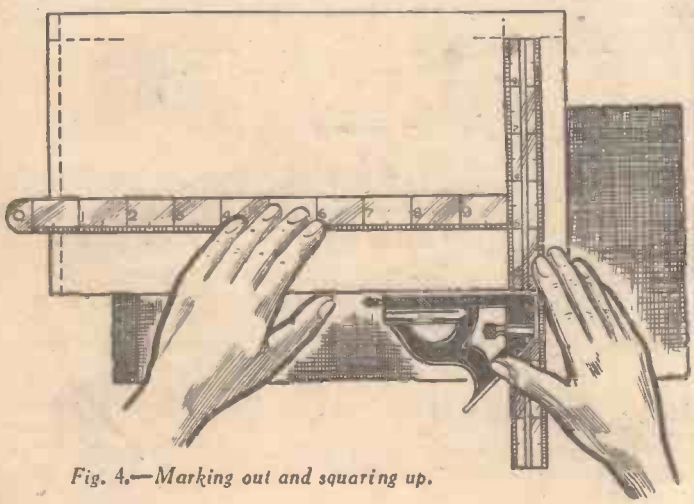


*Fig. 4.—Marking out and squaring up.*

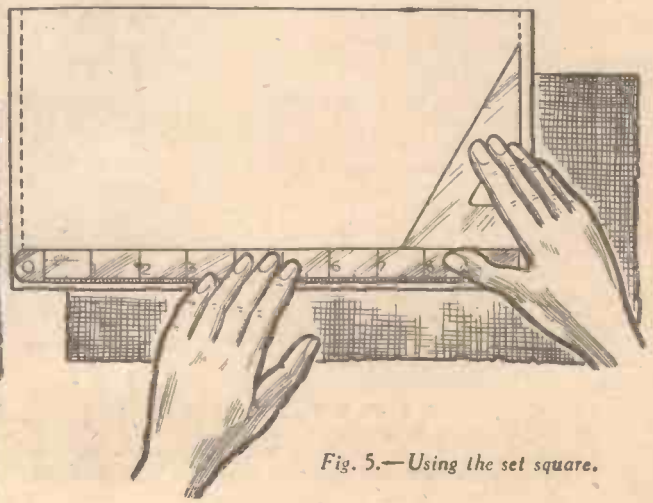


*Fig. 5.—Using the set square.*

# THE THREE-STAR NICORE

**Introductory notes regarding a further addition to the excellent range of PRACTICAL WIRELESS high-class receivers. It employs the latest iron-core tuning coils.**

BY THE THREE DESIGNERS

OUR readers may wonder what justification there can be for producing yet another receiver. It no doubt seems that a large number of different types of receiver has appeared during the past few months, but each one has been produced to introduce some new development in the art, and has had that part of the circuit as its principal requirement. A further point is that the cost of the recent receivers has not been of the order which suits many pockets in these days. There are always keen experimenters, however, who wish to try the latest inventions as they appear and these receivers have been produced in order that these people may be catered for. It was decided, however, that a receiver should be designed which would be more in keeping with the modest amount which can be afforded by the majority, and yet which introduced some new feature or new development. The difficulty is, of course, to design a receiver which is not what might be termed a "re-hash," but which possesses novelty, and which at the same time introduces a new feature. Selectivity is the principal requirement to-day, and therefore it was decided that our new set should possess a high degree of selectivity and be reasonably cheap. Further, it was thought desirable to have the receiver designed in sections by individual members of the PRACTICAL WIRELESS Staff, in order that something really out of the ordinary could be offered to our readers. The result is embodied in the set described in these notes. The choice of valves and circuit arrangements was left to the Editor, whilst the tuning arrangements were left in the hands of Mr. W. J. Delaney. Mr. Barton Chapple took in hand the development of the L.F. side of the receiver and choice of battery supply methods, and we do not think we can do better than leave to these individual members the notes on the production of their schemes.

### LIST OF COMPONENTS FOR THE THREE-STAR NICORE

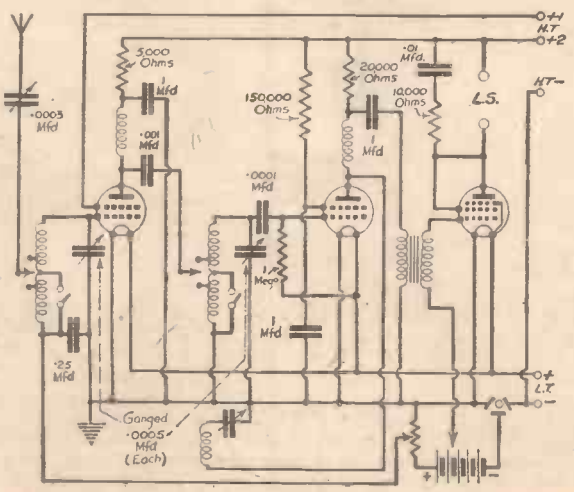
One pair Varley Nicore Coils.
One J.B. Two Gang Unitune Condenser (.0005 mfd.).
One British General Duovol Control with 25,000 ohm resistance.
One Igranic Midget 3-1 L.F. Transformer.
One Wright and Weaire H.F. P.A. Screened Choke.
One Lissen H.F. Choke (L.N.3092).
Four Graham Farish Ohmite Resistances—5,000, 10,000, 20,000 and 150,000 ohms.
One Graham Farish 1 megohm Grid Leak.
One T.C.C. "S" Type Condenser, .01 mfd.
One T.C.C. S-P Type Condenser, .0001 mfd.
One T.C.C. 50 Type Condenser, .25 mfd.
Three T.C.C. Type 50 Condensers, 1 mfd.
One T.C.C. Type "S" condenser, .001 mfd.
Two Clix 4-pin valveholders.
One Clix 5-pin valveholder.
One Bulgin Junior 3-spring switch.
One Sovereign pre-set condenser, .0003 max.
One Belling-Lee 5-way Battery Cord.
Two Belling-Lee Terminal Mounts.
Four Belling-Lee Type B Terminals (Aerial, Earth, L.S.—and L.S.+).
One pair Bulgin Type 3 Grid Bias battery clips.
Three Belling-Lee Wander Plugs—G.B.+, G.B.1 and G.B.2.
Two coils Glazite, odd length flex, screws, etc.
One Becol Ebonite Panel, 12in. by 7in.
One Carrington "Aston" Senior Cabinet, with baseboard.
One Cossor 220 V.S.G. (metallized).
One Cossor 220 S.G. (metallized).
One Cossor 220 H.P.T.
One Smith's "Anodex" 120 volt H.T. Battery.
One Smith's "Anodex" 16 volt G.B. Battery.
One Smith's 2 volt, 40 amp. L.T. accumulator.
One Blue Spot 29 P.M. Loud-speaker.
One British Radiophone Receptru Lead-in.
One Graham Farish Filt for earth.
Approximate cost of all the above parts, £12 15s.

**The Circuit, by F. J. Camm**

I decided that the reader with the average purse could not be expected to pay more than about £10 for a receiver, and accordingly it could not be expected that more than three valves would meet his requirements. Further, in these days of multi high-powered stations three valves efficiently arranged should bring in sufficient entertainment matter to provide any household with an evening's amusement on any evening in the week. I decided therefore on a three-valve arrangement to embody an efficient H.F. stage followed by an efficient detector and an output valve. To ensure good control on the H.F. stage I stipulated that this should be of the now popular variable-mu type, and the detector I decided would be best covered by utilizing a screen grid valve in place of the more customary triode. Having made these stipulations, I handed the skeleton circuit to Mr. Delaney for his choice as to tuning, and he will now tell you of his part in the make-up of this receiver.

**The Tuning, by W. J. Delaney**

The skeleton circuit so far shows three valves, a variable-mu, screen grid detector and output valve. Bearing in mind that one of the principal requirements of this receiver is cheapness, I decided against band pass tuning which would involve a three-gang condenser as well as a three-gang coil. Selectivity is the crying need of the day, and therefore the difficulty appeared to be how to obtain adequate selectivity without band pass or other complicated tuning circuits. The solution is in the use of one of the newly produced iron-cored coils. A study of the make-up of those at present available shows that the Varley has features which should lend it to the development of a very selective circuit employing only a single coil in H.F. and detector stages, and provisional experiments confirmed this. I accordingly chose a two-gang Nicore coil, to be tuned by a two-gang condenser. The selectivity is adequate for normal requirements, and the signal strength does not suffer by the method of coupling adopted between H.F. and detector valves. There only remains the




*Theoretical circuit of the Three-Star Nicore*

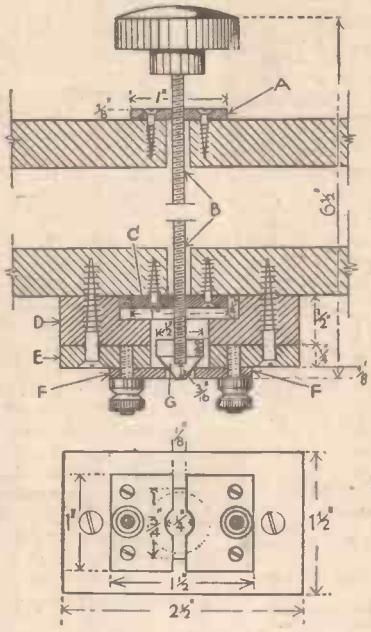
(Continued on page 470)

# READERS' WRINKLES

## The HALF-GUINEA Page

### Novel Earthing Device

MOST amateurs have noticed the inconvenience of the outside earthing switch, which may only be operated, either by opening a window or by leaving




*Section and details of a novel earthing device.*

the house. The novel earthing device which is described on this page entirely overcomes the usual difficulties by having the actual switch contacts outside the room in which the set is installed, although it is operated from inside. The switch is fixed upon the upper part of the window frame above the sash, where it is protected from the weather by the upper part of the reveal. It might, however, be fixed at the bottom of the frame for convenience.

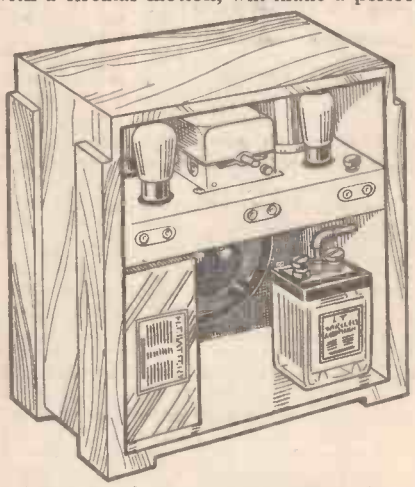
The diagram is a general view of the device as it is fixed upon the window frame. A is a brass strip 1in. by ⅜in. by ⅛in. thick, drilled to clear the 2BA rod B, whilst C, another brass strip the same size as A, is tapped 2BA. G is a conical brass shorting head, attached to the end of the 2BA rod. D is a wooden block, upon which the ebonite E is held by two screws, which also serve to fix the wooden block to the window frame. The wooden block D should be recessed to a depth of ¼in. to clear C. The brass contact strips F are secured to the ebonite by screws; the terminals making contact with the strips F are tapped into the ebonite, which should be drilled right through to facilitate tapping.

The shorting head G may be turned from ½in. diameter brass rod, to the dimensions shown, tapped to take the 2BA rod, or, if a lathe is not available, it may be made from a conical-shaped terminal screw, in which case it will probably be found easier to solder it to the end of the rod B. The contact strips F, made

**THAT DODGE OF YOURS!**

Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles" Do NOT enclose Queries with your Wrinkle.

from ⅛in. brass, should be made in one piece 1½in. by 1in., drilled with a ⅛in. hole, the ⅛in. slot being cut afterwards. This will be far simpler than making the two strips separately. A branch lead from the aerial lead-in should be taken to one terminal, and one from the earth to the other. By turning the knob, inside the room, the shorting head is screwed down upon the knife edge of the shorting strips, thereby switching the aerial to earth. The conical head, being brought into position upon the edges of the shorting strips F with a circular motion, will make a perfect

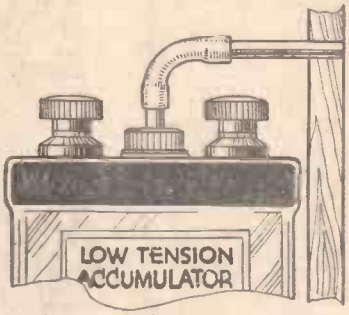


*A vent pipe for carrying away fumes from an accumulator.*

contact for itself, even if it has been out of use for weeks. As far as cost is concerned, 6d. should be ample, even if the constructor has not any useful material in the workshop scrap-box.—A. T. HENLY (Mottingham).

### An Accumulator Dodge

AS every wireless enthusiast knows, the gases given off from an accumulator while discharging are liable to affect parts of the set. This danger is very real when the set is of the transportable type, and, for this reason, some prefer to have the accumulator outside the set, but this is obviously a disadvantage. The little "gadget" illustrated here enables one to keep the accumulator in any part of the set without the slightest danger of affecting the metal parts of the set. It consists of two short lengths of glass tube, of a size to permit them to be easily fixed into the vent plug of the accumulator, and a couple of



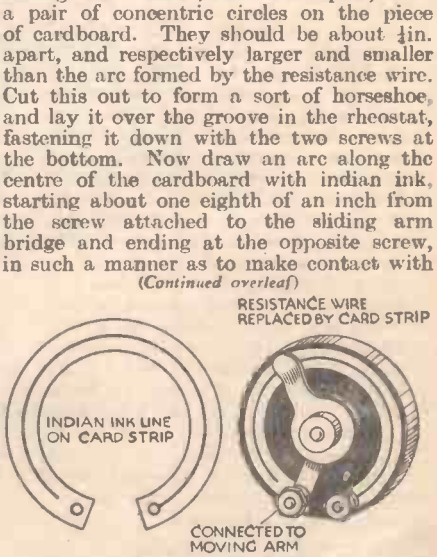

*A vent pipe for an accumulator.*

inches of ordinary bicycle valve rubber. These items are quite easy to obtain. A hole is drilled in the side of the cabinet a little above the top of the accumulator, and of a size to take the glass tube tightly; this is fitted flush with the outside of the cabinet, when it will be almost unnoticeable. The other piece of glass tube is fitted into the hole of the vent plug in the accumulator, and the two glass tubes connected by means of the valve rubber tubing. This arrangement carries away all fumes, and takes only a moment to slip the rubber tubing on or off when changing the accumulator.—B. M. (Teddington).

### Variable Grid-leak

A GOOD variable grid-leak can be made from an old broken rheostat, a piece of firm cardboard, and some indian ink. First, remove the resistance wire from the groove in the rheostat, and take off the sliding arm. Then, with a compass, draw a pair of concentric circles on the piece of cardboard. They should be about ¼in. apart, and respectively larger and smaller than the arc formed by the resistance wire. Cut this out to form a sort of horseshoe, and lay it over the groove in the rheostat, fastening it down with the two screws at the bottom. Now draw an arc along the centre of the cardboard with indian ink, starting about one eighth of an inch from the screw attached to the sliding arm bridge and ending at the opposite screw, in such a manner as to make contact with

(*Continued overleaf*)




*A variable grid leak.*

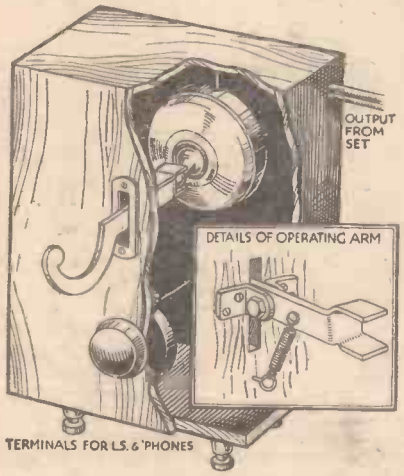
## RADIO WRINKLES

(*Continued from previous page*)

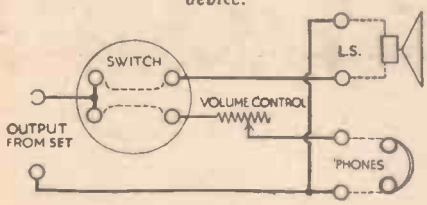
it. By sliding the arm along the line the resistance can be quickly varied from 0 to, say, 1 megohm by simply turning the knob. In wiring up connect the terminals across the grid condenser, as with a grid-leak. The resistance is varied by changing the width of the indian ink line. —A. T. WIGGS (Brighton).

### A Useful 'Phone Hook-up

CONNECTING up the telephones in place of the speaker often proves a source of annoyance to most radio experimenters, especially if the output terminals are situated at the back of the set, or in an awkward position. To obviate this annoyance I have made the following 'phone "hook-up," which, I have had in use for some time. First a hook is made, as in




*An enclosed 'phone and speaker switching device.*

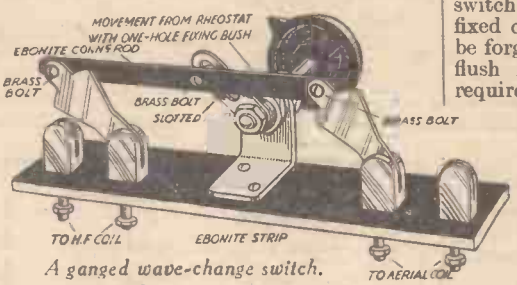



*Circuit diagram.*

sketch, from a piece of fairly strong brass. A box 6in. by 3½in. by 3in. deep is then made and the hook pivoted through a slot in the lid. The hook is pivoted on the underside by means of two small angle-pieces of brass and a small 4 B.A. bolt and nut. A double-throw tumbler, or a like pattern switch is fitted in a suitable position to the back of the box and adjusted so that the "hook" arm engages with the switch arm. A small fairly strong spring is fitted to the arm and to an eyelet hook in the boxlid. The 'phone leads are taken to two terminals on the box. An adjustable rheostat is fitted on the lid below the hook so that signal strength may be adjusted when the change over is made. When the 'phones are hung up on the hook the speaker is in operation, and when taken off the 'phones are in circuit. The box is fixed to the wall in a position near the receiver. The hook-up is wired up as in diagram. Other additions and refinements will suggest themselves to readers, such as the addition of two small chokes in series with the 'phone leads for short-wave work.—WM. D. MORGANS (Merthyr Tydfil).

### A Ganged Wave-change Switch

THIS wave-change switch, to replace the two push-pull switches usually found on the panel of H.F. (S.G.) detector




*A ganged wave-change switch.*

and L.F. receivers, is easily and cheaply made. The switches are taken from a D.P.D.T. knife switch, and the actuating mechanism was taken from an old filament rheostat. The arm is slotted for a sufficient length to limit the movement of the connecting rod over its centre. The rheostat bush should be of the one-hole fixing type in order to simplify fixing the switch behind the panel. The ebonite base may be of any length, preferably of equal distance to that between the coils to be switched. J. H. COWPER (Jesmond).

### A Useful D.C. Switchboard for the Workshop

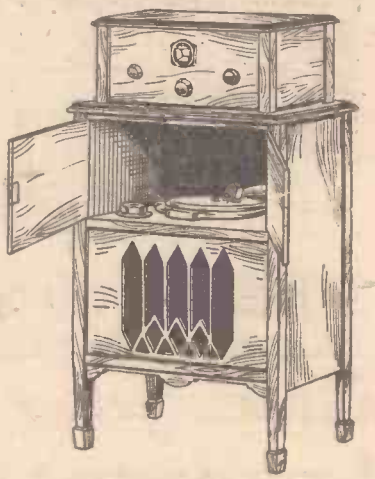
THE sketch shows a useful switchboard which has been in constant use in my radio workshop for nearly two years. It provides an extremely convenient power source, providing *both H.T. and L.T.*

To construct this switchboard everything should be built up on a dry piece of wood. In my case, it consists of a piece of mahogany 3ft. by 18ins. by 1in., supported by large brackets on a table. The various switches, terminals, etc., are fixed to the front of this board, but it is advisable to fix the H.T. section (fixed condensers, "spags," etc.) at the back. The wiring is best carried out by means of well-insulated rubber-covered wire, fixed with insulated staples.

In my case I am using two 4-volt accumulators connected in series for the L.T. The eight volts L.T. thus provided is useful for various electrical experiments where two volts are hardly sufficient. A rheostat is included in the circuit for dropping the eight volts to two volts when using it as an L.T. accumulator for 2-volt valves. To charge the accumulator the D.P.D.T. switch should be in the "up" position, the mains, of course, being switched on. Electric-light bulbs are used as resistances for charging, the current being shown on the ammeter. The H.T. is provided by a mains unit built up on the inside of the switchboard. When using the H.T., the fixed condenser in the earth lead must not be forgotten. The meters should be of the flush mounting type, able to cover the required readings. Plug A has then to be connected to the nearest D.C. lighting socket.—P. E. BUCK (Ipswich).

### Converting a Radio Cabinet

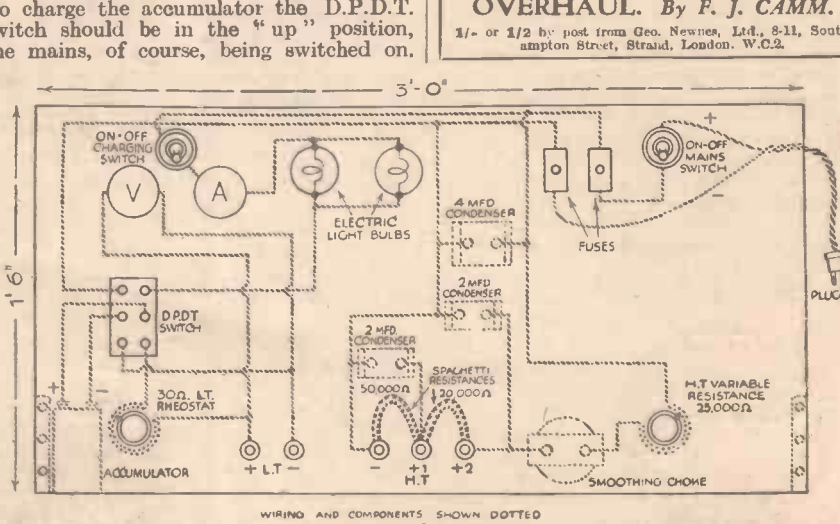
I HAD a commercial radio receiver in a very good cabinet and wanted to turn it into a radiogram, with the pick-up, speaker, set, etc., all in the same cabinet. I did not want to get rid of my old wireless cabinet so I solved the problem as shown in the accompanying sketch. Instead of having the pick-up in the top of cabinet, the set in the middle and the speaker in the bottom, as usual, I arranged my set standing on the top of the radiogram cabinet, the pick-up and motor in a



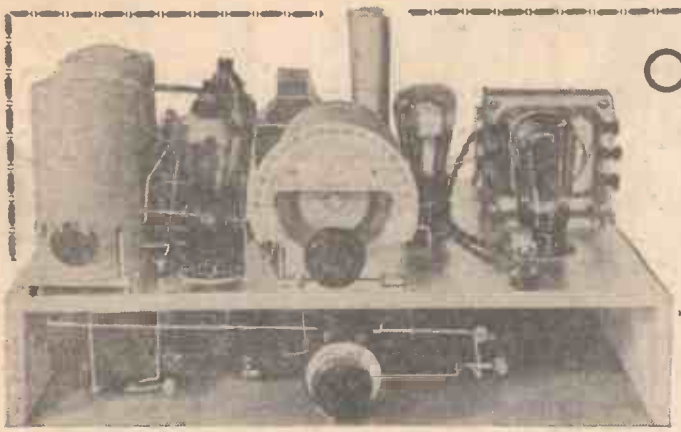
*A converted radio cabinet.*

cupboard in the middle, and the speaker in the usual place. If necessary, a small electric lamp could be fitted in the cupboard. I found this arrangement worked very well, and it has the smart appearance of a radiogram.—H. G. MARTIN (Hoddesdon).





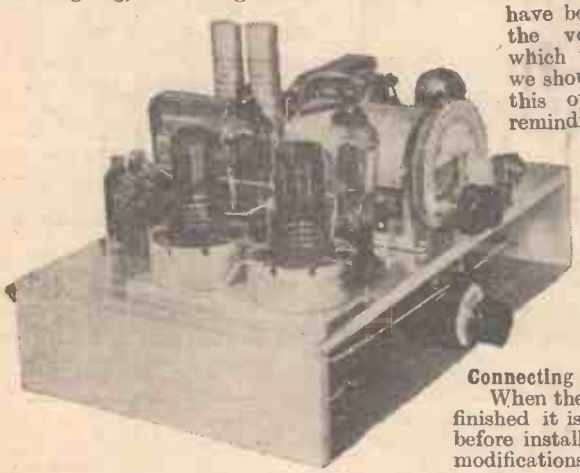

*Layout and connections for a small D.C. switchboard.*

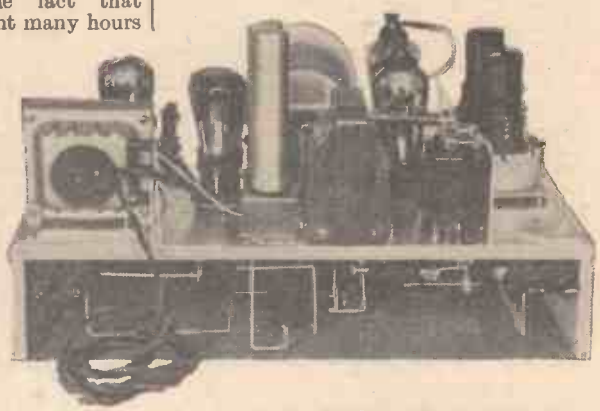


# OPERATING THE DOUBLE-DIODE-TRIODE THREE

## Completing the Construction of the New Automatic Volume Control Receiver, and the Method of Operation

IT will have been noted in examining the constructional details of this receiver that no screened leads have been employed. As only one H.F. stage is used, and the layout has been carefully chosen, there is very little risk of instability, and consequently it has been found totally unnecessary to introduce the complication of screening individual leads. The H.F. choke, which is situated on the lower side of the baseboard is fitted with an earthing tag, but owing to the metal foil on the baseboard it was found even unnecessary to earth this. There is no objection, of course, to individual constructors connecting this choke screen to earth, nor in using metal sheathing for leads, but it is thought worth while to mention the fact that it is unwanted to avoid the usual flock of queries which arise from readers who are afraid that sufficient screening is not employed. It is a curious fact that soon after a design appears in practically any constructional book, readers write and ask questions concerning the design, apparently overlooking the fact that before it has appeared in print many hours have been spent upon the very questions which they ask, and we should like to take this opportunity of reminding our readers that the alternatives have all been tried out, and various schemes tried, before a design is fixed upon and then described in these pages.





### Connecting the Receiver

When the constructional work has been finished it is preferable to test the receiver before installing it in its cabinet, as slight modifications (if necessary) may be more easily carried out. Cut off a length of flex sufficient to reach from the front of the cabinet to the mains socket with which the receiver is to be used. Connect the toggle switch to one end of the twin lead, and fit a mains plug to the other end. Place the switch at the front edge of the baseboard, and then cut one of the leads at a point level with the rear edge of the mains transformer. Attach one end of the cut to the centre terminal on the rear plate of the transformer, and attach the other end to the loose terminal. Then rotate the disc until the socket corresponding to the voltage of your mains is visible, and insert the terminal in this socket. Make certain that the switch is in the "Off" position, and rest it on a book or some other non-conducting material to avoid short-circuits through the metal foil of the baseboard. Insert the VPT.4 valve in the five-pin holder at the left of the ganged condenser, and the H.4.D. valve in the seven-pin socket behind it. The AC/Pen should be inserted in the holder near the electrolytic condensers, and the rectifying valve in the holder in front of the mains transformer. The pigtail lead from the H.F. choke is joined to the cap

(Continued on page 458)

**LIST OF COMPONENTS FOR THE DOUBLE-DIODE-TRIODE THREE.**

One Polar Uniknob .0005 mfd. Condenser.
One pair Colvern Coils, Types K.T.F. and K.G.R.
One Graham Farish H.M.S. Choke.
One Wearite H.F.P.A. H.F. Choke.
One Igranic T.24.B L.F. Transformer.
One Wearite T.21.A. Mains Transformer.
Thirteen Graham Farish Ohmite Resistances (one each 100, 300, 1,000, 2,000, 10,000, 20,000, 150,000, and two each 5,000, 50,000 and 500,000 ohms).
One Graham Farish 2 megohm Grid Leak.
Three Dubilier .1 mfd. Fixed Condensers, Type B.B.
Three Dubilier 1 mfd. Fixed Condensers, Type B.B.
Two Dubilier 2 mfd. Fixed Condensers, Type B.B.
Two Dubilier 4 mfd. Electrolytic Condensers.
One Dubilier .002 Fixed Condenser, Type 670.
One Dubilier .001 Fixed Condenser, Type 670.
Two Dubilier .0005 Fixed Condensers, Type 670.
One Dubilier .04 Fixed Condenser, Type 9200.
Two Dubilier .01 Fixed Condensers, Type 670.
Two Clix 5-pin Chassis-mounting Valve holders.
One Clix 7-pin Chassis-mounting Valveholder.
One Clix 4-pin Chassis-mounting Valveholder.
Two Belling-Lee Terminal Mounts.
Four Belling-Lee Type B terminals, Aerial, Earth, L.S. + and L.S. —.
One R. & A. Challenger Moving-Coil Loud-speaker.
One Carrington Cabinet.
One Watmel .5 megohm Volume Control.
One Lissen Mains Smoothing Choke.
One Ferranti VPT.4 Valve.
One Ferranti H.4.D. Valve.
One Mazda A.C./Pen Valve.
One Mazda UU2 Valve.
One Bulgin On-Off Toggle Switch, Type S.80.
Two coils Glazite, flex, bayonet plug, etc.
Aerial and Earth Equipment :—
Pressland Cop.
Tin of Filt.

# AUTOMATIC Volume Control & Your Set

CONCLUDING ARTICLE

WHEN only a single high frequency valve is used it is better that this should be of the ordinary S.G. type, or otherwise a V.-M. of the kind requiring a maximum grid-bias voltage of about 9. The reason is that the variable bias voltage provided will necessarily be small in amount and would have practically no effect on a valve taking a maximum bias of some 40 volts (as many of them do).

It is clear that although the simple method of A.V.C. just described is applicable to practically any receiver it cannot produce anything approaching constant volume unless at least two H.F. amplifying stages are employed. Nevertheless, it should certainly be given a trial by every reader who wishes to explore the possibilities of automatic volume control, for it certainly does give a partial control which is sufficient to prevent overloading by the local station, if nothing more.

### A Better Method

A better arrangement which can be added to any set—battery or mains—is illustrated in Figs. 3 & 4. This requires a separate valve, two 60 volt high tension batteries and one or two resistances and condensers. Again the connections to a battery set are shown as well as to a mains set. In this method it is the variation in detector *anode* current which is made use of to supply a varying grid-bias voltage, and the degree of control is enhanced by the use of a separate valve, marked A.V.C., which amplifies the controlling voltage.

The principles of operation are in this instance rather more involved, but I do not think there will be much difficulty in understanding them if the action of a leaky grid detector is borne in mind. It was explained before that the grid leak causes a certain negative bias to be applied to the detector when a signal is tuned in, and it was also pointed out that the actual bias voltage is dependent upon the strength of the received signal. We know that, with any valve, the high tension current becomes less as grid bias is increased. Now as the detector's high tension current is reduced the voltage between points A and B in Fig. 3 rises, or in other words, point A becomes more positive in respect to B.

The A.V.C. valve is normally biased by means of the 60 volt G.B. battery and 50,000 ohm potentiometer until it does not pass any anode current when the set is not tuned to a signal. Under these conditions no current flows through the ½ megohm resistance R.1, and therefore there is no voltage drop across it. In consequence of this the only bias voltage applied to the grid of the H.F. amplifying valve is that supplied by its own G.B. battery in the case of a battery valve or by the series cathode resistance with a mains valve. But when a signal is tuned in the extra voltage at A is applied as positive bias to the A.V.C. valve, which then passes a certain amount of anode current. This is passed through R.1 and so a voltage drop occurs across that resistance. The voltage drop so obtained is passed back to the H.F. valve as additional bias.

If you have any difficulty in following the theoretical explanation just given, you need not worry unduly since all practical details will be supplied, and the arrangement can be tried out just the same. As was explained before, this system can be applied to any set having one or more H.F. valves and it does not matter whether it is battery or mains operated, or whether the circuit is "straight" or superheterodyne. The only proviso is that a resistance of no less than 20,000 ohms must be included in the detector anode circuit; such a component will generally be used for decoupling purposes but, if not, it must be added. The automatic control valve may be any "H" or "H.L." type and small 60 volt dry batteries (which must be additional to any others used for the set) will serve both for grid bias and high tension supply. It might appear that 60 volts is much too high for G.B. purposes, but it should be remembered that the bias battery has to "neutralize" the voltage normally appearing between points A and B, besides giving a small additional negative bias. The ½ megohm fixed resistance and 50,000 ohm potentiometer may be of the usual types and any kind of switch will serve for S. The object of this switch, by the way, is to prevent wastage of current through the potentiometer when the set is out of use.

And now, what about making the A.V.C. unit? If space permits all components can be mounted on the receiver baseboard, but alternatively they may be assembled as a separate unit and connected up by flexible wires. When the latter course is adopted the 1,000 ohms decoupling resistance and .1 mfd. condenser must be attached to the receiver itself and placed as near as possible to the coil which tunes

(Continued overleaf)

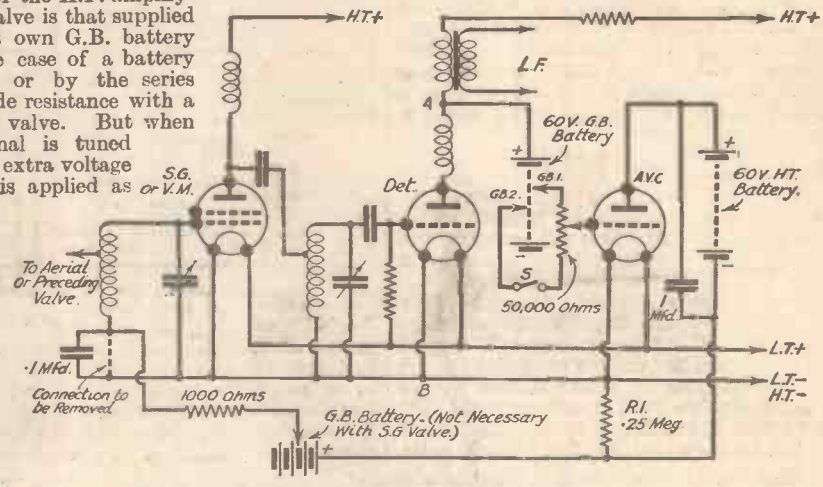



*Fig. 3.—Adding A.V.C. to a battery-operated set.*

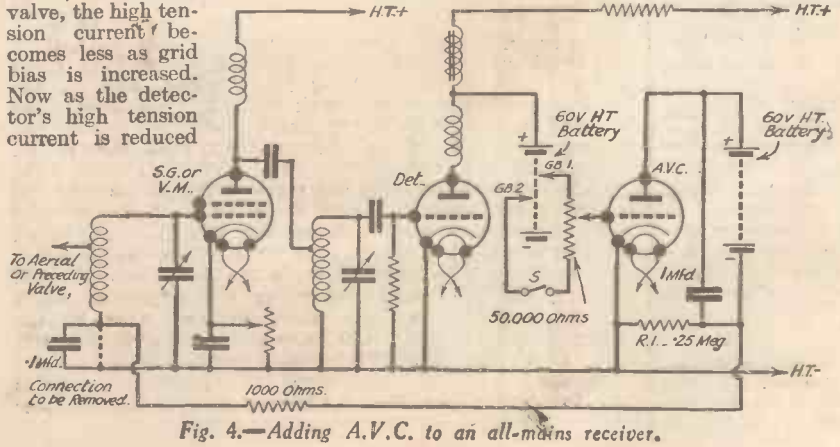



*Fig. 4.—Adding A.V.C. to an all-mains receiver.*

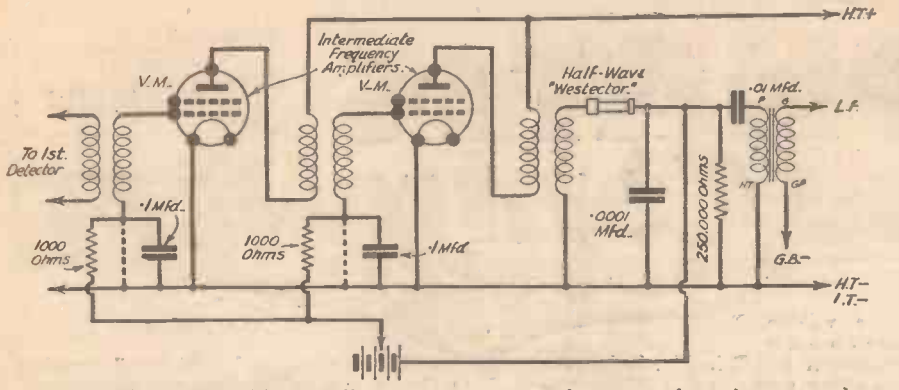



*Fig. 5.—Using the "Westector" in a battery-operated receiver, for volume control.*

(Continued from previous page)

the high frequency valve. It might also be necessary to insert a ¼ megohm fixed resistance between the anode of the detector valve and the positive terminal of the A.V.C. grid-bias battery, to prevent instability.

When the control is first connected up, grid-bias voltage must carefully be adjusted as follows. "Open" switch S and tune in a weak signal in the usual way; disconnect plug G.B.2 and switch on. Now put plug G.B.1 into a negative socket and move it about until a position is found at which signal strength is approximately the same as before. Insert plug G.B.2 into a socket from 6 to 12 volts more negative than G.B.1. Signals will probably vanish altogether, but may be restored to their original strength by adjustment of the potentiometer. This will be the correct setting, and once it is found the control will operate in the proper manner.

It is impossible to state what are likely to be the voltage requirements of plugs G.B.1 and G.B.2 since they will depend entirely upon the voltage actually occuring in the set between points A and B. In most cases, however, it will be found that plug G.B.1 will have to be put into a socket between zero (negative) and 20 volts.

### Using a "Cold" Valve

A third very simple and inexpensive method of A.V.C. which is of particular value in superheterodyne receivers is made possible by the recent introduction of the metal detector—often referred to as a "cold" valve. This detector functions in the same manner as a two-electrode valve, and can be used as "second detector" in a superheterodyne by making very few alterations to the original set. Actually it is only necessary to remove the detector valve and replace it by a half-wave "Westector" connected as shown in Fig. 5 and 6. Besides giving the advantage of automatic volume control, the "cold" valve also effects a saving in current consumption, since it requires neither H.T. nor L.T. It will be gathered from the circuit diagram that the A.V.C. grid bias is that developed across the 250,000 ohm resistance. Just the same as with a leaky grid valve detector, the voltage so produced is proportional to the strength of the signal tuned in. The controlling voltage is applied to both intermediate frequency amplifiers, which should for preference be of the variable-mu type, through 1,000 ohm decoupling resistances; by-pass condensers of about .1 mfd. capacity are again used. The only preliminary adjustment required is the correct setting of the minimum grid-bias voltage, and this can be made on the G.B. battery in the case of a battery set, or on the series cathode resistances with a mains set.

Although the form of A.V.C. just described could be added to a 2-H.F. "straight" set, it would result in a certain loss of sensitivity because reaction would have to be dispensed with, but as reaction is not generally used with a superhet there is practically no reduction in efficiency.

With the ordinary 2-H.F. set selectivity would naturally be impaired by the lack of reaction, and this fact must be borne in mind.

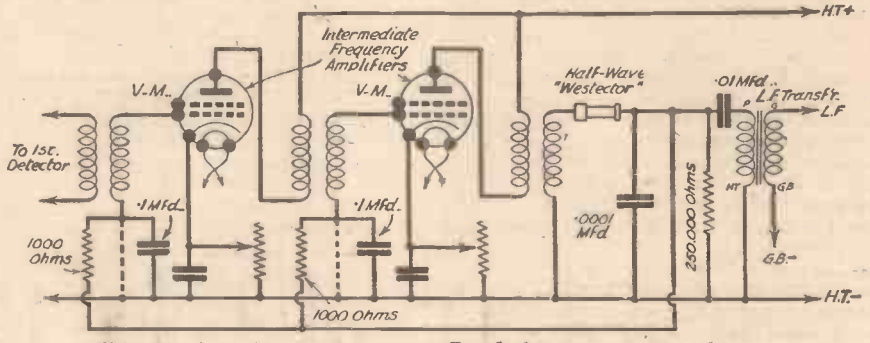



*Fig. 6.—A similar arrangement to Fig. 5, but using mains valves.*

is remarkable, and when you come to television reception, of course, the better quality is definitely improved, owing to the clearer picture obtained in the televisor.

Several of the programmes which are being put out in the television hours have been broadcast through the seven-metre transmitter as well as on the normal medium wave bands. However, no useful reports have yet been received from television enthusiasts who have been able to pick up the seven-metre signals and compare them, so far as television is concerned, with the medium-wave transmissions.

With regard to interference the most serious was caused by cars. Cars were troublesome owing to the ignition-system, which on most systems nowadays causes a radiation of approximately the same frequency as the signals put out from the transmitter. However, if the seven-metre transmissions were ever made a permanency, it is possible that magneto or car spark coils interference could be overcome by the use of some kind of filter.

Although only about a quarter of a kilowatt is being radiated, 1.2 kilowatts is being taken from the power supply in order to overcome the background noise which is inevitably got with any set designed to receive such short wavelengths.

## WHAT THE B.B.C. IS DOING ON 7 METRES

(Continued from page 445)

### Interesting Facts

The voltage on the final valve is about 4,000, and great care has to be taken to keep this constant; if there is any fluctuation in the voltage the wavelength may alter. There is what is known as an induction regulator in order to keep the volts steady. Although crystal drive is used at the Empire transmitters, the Broadcasting House engineers have not tried crystal drive on the Marconi seven-metre plant. The Marconi experts themselves did not favour crystal drive at such high frequencies, and it is difficult to cut the crystals accurately. Moreover the Franklin type oscillator used is easy to control, and is much easier to set up. The Franklin oscillator is really a master oscillator valve, and it keeps the transmitter steady. It is worked at what, if it was a transmitter, would be a wavelength of 139.5 metres. Connected to this stage are frequency-doublers and amplifiers which pick out the various harmonics, and for the 7.75 metre transmissions, the harmonics, of course, are 46.5, 15.5 and finally 7.75 metres.

All these circuits could be retuned in a matter of only a few minutes to alter the wavelength, but the aerial itself would also have to be altered, and that is a much more serious matter. The valves in the seven-metre transmitter are housed in an aluminium frame with the meters arranged on panels round three sides. There are meters in each grid and plate circuit of each of the frequency doublers, and these meters show at a glance if the Franklin oscillator drive is working properly. Actually, there have been no snags in the working of the Broadcasting House plant, and all the research work described has been done with the receivers.

Quite independently from the B.B.C. experiments, we ourselves have been carrying out some investigations into the problems of reception on this particular wave band, not only with regard to sound reception, but in the direction of vision reception. It is too early yet to give details concerning the apparatus which has been used, but as soon as the position is more stable we shall give our readers interesting constructional information regarding the apparatus which is required for the reception of transmissions on these short wavelengths.

## FIRST AGAIN!

MUCH has been written about the class "B" valve as an amplifier, but it has been left to PRACTICAL WIRELESS to show how this valve can be used with great advantage as a detector. The principle employed is that of push-pull detection, an explanation of which is given on page 1,129 of PRACTICAL WIRELESS for March 4th, 1933. The same issue also describes the construction of a three-valve push-pull detector set, and it was on this set (after suitable modification) that the Cossor 240 "B" valve was used as a detector in place of the twin 210 H.L. valves specified for the set. It is interesting to record that the set as originally described proved itself capable of picking up Philadelphia, U.S.A., on the medium waveband, at audible strength on the loudspeaker; this is good evidence of its sensitiveness, considering that it has no screen-grid stage, only one tuned circuit, and one L.F. stage. Naturally the volume from this station was not sufficient for ordinary use, but a screen-grid valve before the twin detectors would probably remedy this.

Fig. 1 shows the circuit diagram, employing one class "B" valve as detector instead of two separate triode valves. Readers who have mentally digested the previous articles will follow this diagram without further explanation, but for the benefit of new readers a brief description is now given.

### Varying Grid Potentials

It will be observed that a tuned circuit is connected between the two grids and that this grid circuit is isolated from the rest of the wiring except for the grid leak; also notice that there are no grid condensers at all. The grid coil is energised by magnetic induction from the aerial coil, so that the oscillating current in the circuit charges one grid negatively at the same instant that the other grid is positively charged. The two grid potentials are therefore always exactly half-a-cycle out of step with each other, consequently the H.F. component of the current from their respective anodes is also half a cycle out of phase. Now the two anodes are connected (after the push-pull reaction coil) to a common output, and in this output the out-of-step H.F. components from the two anodes neutralize each other and disappear, leaving only the L.F. variations which are then passed on through a transformer in the usual manner. Reference to the previous article, which is illustrated by diagrams, will make this point more clear.

# A CLASS "B" DETECTOR Two Valver

A New Type of Two Valve Set—Using a Class "B" Valve in a Novel Manner

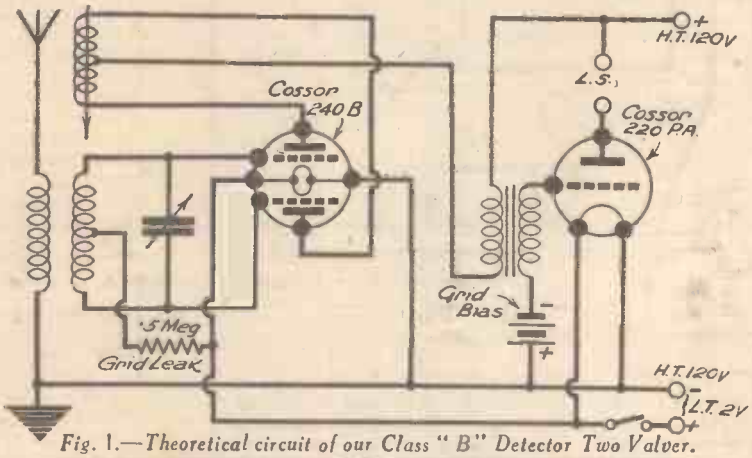
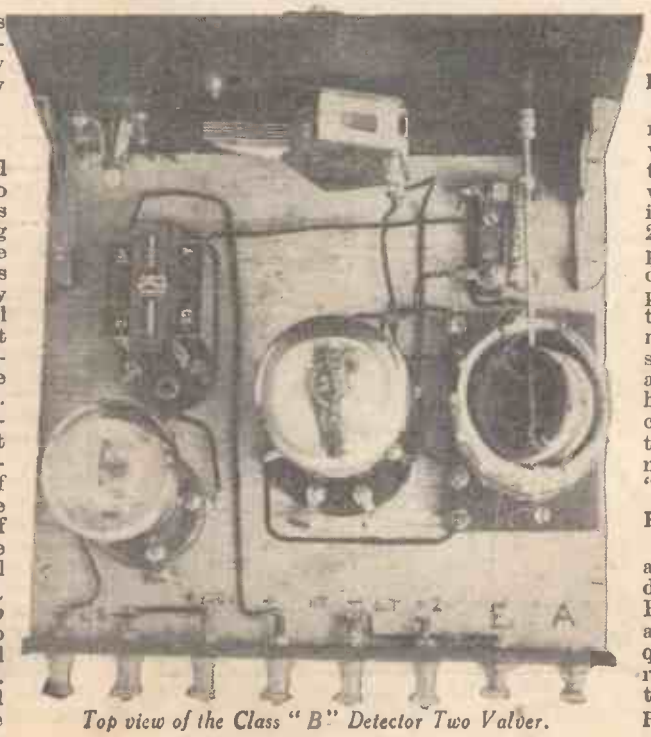



*Fig. 1.—Theoretical circuit of our Class "B" Detector Two Valver.*



*Top view of the Class "B" Detector Two Valver.*

## ORIGINAL AND UNIQUE!

### Method of Detection

Detection is carried out by the action of grid current which causes the *mean* potential of the whole grid circuit to fluctuate in accordance with the audio-frequency modulations and the grid leak functions in the usual manner by giving the grid system a definite tendency to return to a mean potential of zero. The usual system of detection, using one valve with grid leak and condenser, introduces a damping effect on the tuned circuit, which is very much reduced in the push-pull system. The minimum damping effect will be obtained with the grid leak connected to a centre-tapping on the grid coil, as shown in Fig. 1, but in practice the system seems to work just as well with the grid leak connected to one end of the coil, as shown in the circuit diagram of the receiver as originally described. The effect of this reduced damping is to render the set more sensitive and more selective. Even with the home-made coil the P.P. detector set shows up well on these points, but if the makers of "Ferrocart" and similar coils could be induced to make a special coil for this circuit some wonderful results might be achieved.

### H.T. Voltage

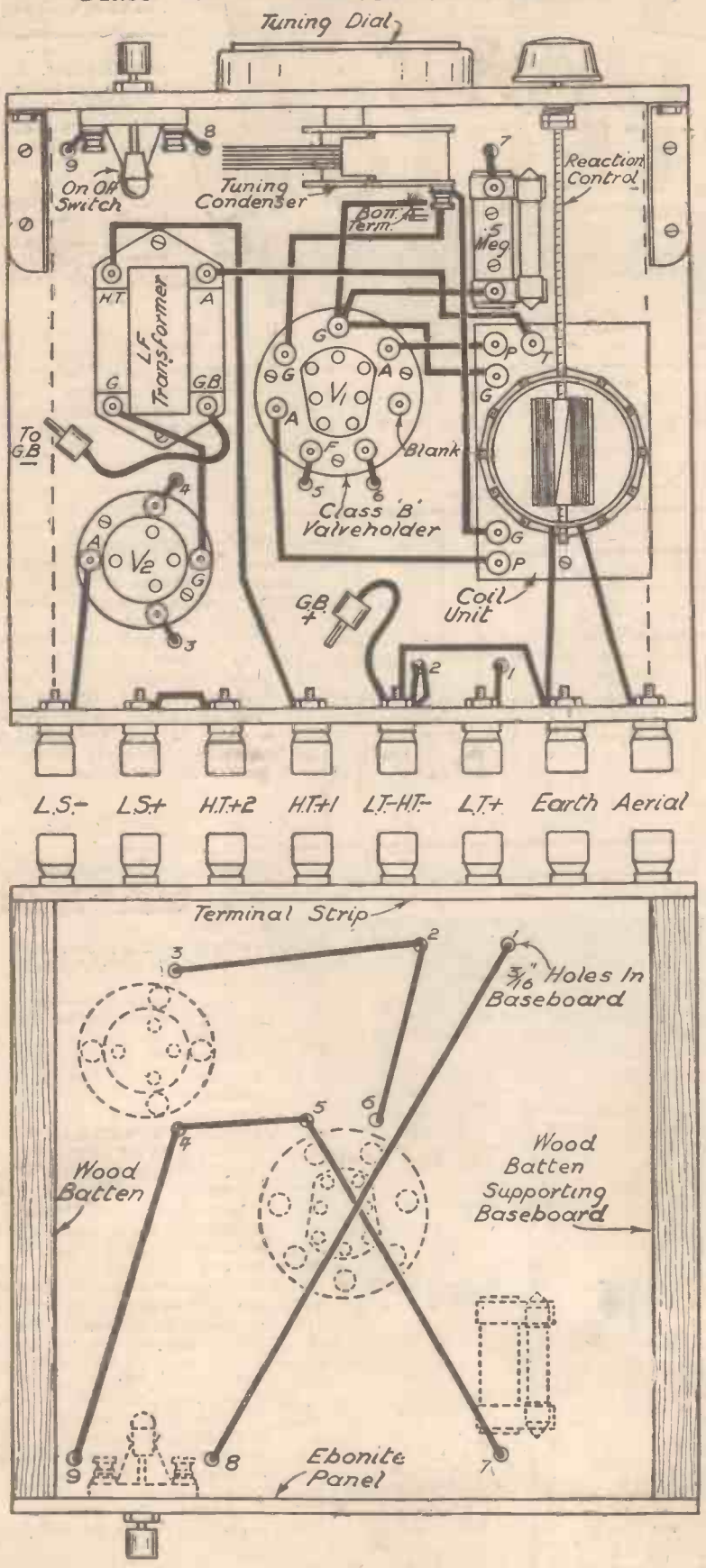
The class "B" valve was found to require a somewhat higher anode voltage than the original twin triode detectors. The best result was obtained with about 90 volts instead of 72 volts for the twin 210 H.L. valves. Except for this point there appears to be very little difference as far as operation and performance is concerned. If anything, the new valve gives rather more volume on local and distant stations, and the tuning is perhaps a little less sharp; the difference, however, is very slight and is chiefly noticeable in the case of the local station which has a little more "spread" with the class "B" valve.

### Reaction Control

The reaction control is best set at zero for local stations up to a distance of 50 miles or so from a Regional or National, and probably only a little will be required above this. The Continentals require plenty of reaction to bring them in at good strength.

**For Wiring Diagram see next page.**

# Top and Sub-baseboard Wiring of the Class "B" Detector Two-Valver




**OPERATING THE DOUBLE-DIODE-TRIODE THREE** (*Continued from page 454*)

on top of the VPT.4 valve, and the flexible lead which comes through the baseboard from the volume control is then connected to the cap on top of the seven-pin valve. The short length of flex attached to the 5,000 ohm Ohmite at the rear of the baseboard is then connected to the terminal on the side of the valve base of the pentode valve,

The aerial may be of the ordinary type, about 60ft. in length, providing sufficient pick-up for ordinary purposes. The earth should be beyond reproach as an H.F. stage is employed, and you cannot do better than use the Filt preparation, which is fitted already with a copper container and a terminal. Ample protection against statics is provided by using the Pressland Cop Aerial connector, and this also ensures that the insulation of the aerial where it passes into the house is of a high order. Connect the loudspeaker to the L.S. terminals, using the correct ratio. Now see that the mains switch is on, and then switch the small toggle switch on. After a few seconds a very faint hum will be heard from the speaker, showing that the valves have heated up. Not until you hear this faint hum should you attempt to tune in a station, as the emission from the valves will be insufficient, and you may think the receiver is not functioning correctly. Slowly rotate the tuning dial until the local station is heard, and then adjust the potentiometer until the volume is at the level which you desire to hear this station. There should be no further need to touch this control, all the tuning being carried out on the main tuning condenser. To ensure that the two sections of this are correctly ganged, when a station is heard the smaller concentric knob should be rotated in either direction and left at the maximum position. The automatic volume control device will ensure that fading on the weaker distant stations is more or less compensated for, and you will find that the majority of stations are reproduced at the same signal level. In view of the absence of reaction it will be found impossible to build up the strength of some of the stations which will be heard when the hand volume control is in its maximum position.

## LOOK TO YOUR EARTH

I HEAR that listeners in the West Country are experiencing trouble in separating the new West Regional transmission from signals from stations operating on near-by wavelengths, and those using "oldish" sets can really expect little else. There is no need for me to go into the various methods of increasing the selectivity of your sets, West Country listeners, for this has been explained several times in these columns, but I should like to suggest that you pay particular attention to your earth. Try a few experiments with different types of earths. Bury a tin can or an old bucket, hook up to the water tap, or sling an insulated counterpoise under your aerial, and see which gives the best results. In each case, however, use insulated wire of heavy section, and try to keep the earth lead as short as possible as both of these points will give a definite improvement in the selectivity of your set.

# The BEGINNER'S SUPPLEMENT

THE EASY ROAD TO RADIO

*Conducted by F.J. CAMM*

### Ganging

A TERM used to denote the arranging of two or more components to work from one control. Variable condensers, for instance, may be "ganged" by controlling them all with one spindle so that as the spindle is rotated they all move together. By ganging, the number of controls on the front of a receiver may be considerably reduced. Switches and potentiometers as well as condensers may be coupled up in the same way.

### Gramophone Pick-up

A device used to replace the ordinary soundbox and tone arm of a gramophone. It is similar in appearance as will be seen from the typical example shown in Fig. 1, but instead of conveying the sound waves

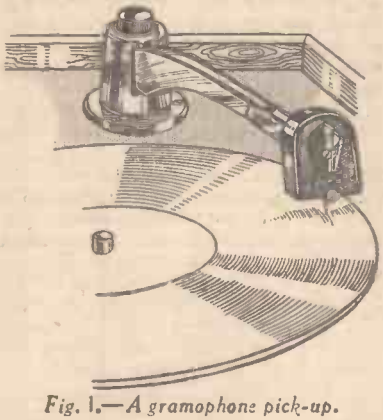


*Fig. 1.—A gramophone pick-up.*

directly to a horn, they are converted into electrical impulses and sent along a wire to an ordinary wireless amplifier. In this way they can be amplified to almost any volume desired. The working of the pick-up is really the opposite to that of a loud-speaker. Whereas the latter converts electric currents into sound, the former converts sound into current. As might be expected, the internal construction of a pick-up is somewhat similar to that of the unit of a speaker.

### Grid

One of the electrodes of a valve. It consists of a wire mesh or screen which surrounds the filament, and interrupts or controls the stream of electrons from the filament to the plate. In Fig. 2 is shown how the grid surrounds, but does not actually touch the filament. The filament is the "M" shaped wire which passes up through the mesh. On the right is shown the anode which normally surrounds the two other elements. The valve shown is the ordinary type or "triode." Others

## THE BEGINNER'S A B C OF WIRELESS TERMS (*Continued*)

such as the screen-grid valve, pentode, etc., have two or three grids surrounding one another. Each one is a little larger

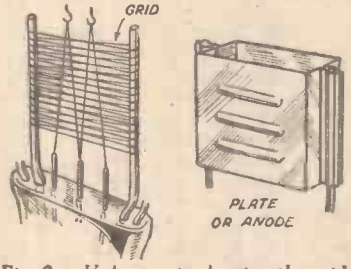



*Fig. 2.—Valve parts showing the grid.*

than the previous one like the sets of Chinese boxes, and each has its particular function to perform. See also *VALVE*.

### Grid Bias

When a valve is used as an amplifier it is nearly always necessary to apply a voltage to the grid. This is done by connecting a small dry battery known as a *grid-bias battery*, either directly or indirectly to the grid. With the type of valve known as a variable-mu valve, grid bias is used as a volume control, thus as the grid bias is increased above a certain figure by means of a variable resistance, so the amplification of the valve drops off, and the music or whatever is being received is reduced in volume. This is quite a special application of grid bias. In the ordinary way grid bias is necessary chiefly with L.F. valves, and unless the necessary few volts of bias is applied to the valves, distortion will result. A worn out grid-bias battery is another cause of distortion, and with a battery set it is advisable to test the grid-bias battery with a voltmeter once every two or three months to see that it is still in good condition. With a mains set there is usually no grid-bias battery as the voltage is derived from the mains.

### Grid Leak

A high resistance connected to the grid of a valve to allow any excessive charges of electricity which may collect there to leak away. When a valve is used as a detector as in *grid detection* a grid leak is a fundamental necessity. Examples of grid leaks showing one in a holder are given in Fig. 3. The usual value for a grid leak is between .5 and 3 megohms. (A megohm is a million ohms.) See *VALVE*, *RECTIFICATION*, etc.

### Heaviside Layer

An upper layer of the atmosphere about 60 miles from the surface of the earth. It is supposed to be what is called "ionized" by the sun's rays and to cause reflection of wireless waves back on to the earth. It was first expostulated by Oliver Heaviside.

### Henry

The unit of inductance. See *INDUCTANCE*.

### Heterodyne Reception

A process of receiving radio waves by combining the received current with another high-frequency current generated by the receiver itself. The result of this is to produce a resultant current whose frequency is the difference between the two component frequencies. By this means it is possible to convert high-frequency impulses into those of a lower frequency. These are easier to deal with than the higher frequencies. This principle is used in the superheterodyne receiver.

### H.F.

Abbreviation for *high frequency*.

### High-frequency Resistance

The resistance or opposition offered by a conductor or circuit to the passage of high frequency currents through it. This is always greater than the resistance offered to direct current as there are other forces due to the rapid movement of the current which come into operation.

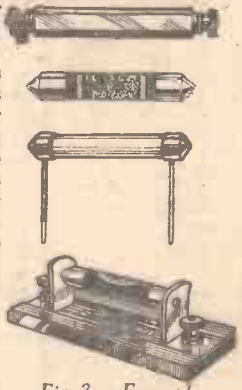


*Fig. 3.—Examples of grid leaks.*

### High-tension Battery

One of the three different batteries necessary in a battery receiver. It supplies current to the anode of each of the valves. Its use is to attract and maintain a stream of electrons from the filament to the anode (plate) of the valve. To do this it must exert a pressure of anything from 60 to 200 volts. High-tension (or H.T.) batteries are therefore made up of a large number of small cells connected together. For instance, no less than eighty cells are used in a standard 120-volt battery.

### Hydrometer

An instrument for measuring the specific gravity of liquids. Its chief use in wireless

is in testing the gravity of the acid in accumulators. A typical example of an hydrometer and how it is used is shown in Fig. 4. The instrument itself consists of a glass tube into which the acid can be drawn by depressing and releasing a rubber bulb. Inside the tube is a little glass float weighted with shot. When sufficient acid has been sucked up to cause the float to rise the hydrometer is held upright. If the acid is very dense then the float will stand up high above the surface, but if it is too weak it will be almost submerged. The correct density is marked on the side of the float and if the surface of the acid comes just level with this mark then it is of the correct specific gravity.

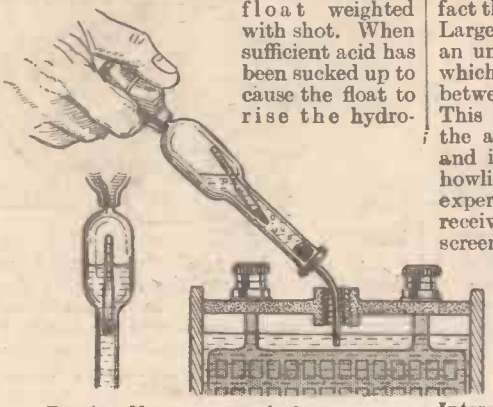


*Fig. 4.—How to use an hydrometer.*

**Impedance**

The opposition offered to an alternating current by a resistance, capacity, or inductance, or a combination of the three.

**Inductance**

The tendency that a conductor has to oppose the change in direction or strength of any current that is passed through it.

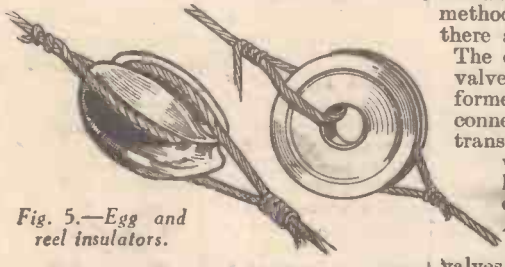


*Fig. 5.—Egg and reel insulators.*

It is due to the magnetic field created by the passage of the current. This field surrounds the wire or other conductor and induces a current in the wire in the opposite direction to the original one.

**Insulator**

Any substance which offers such a high resistance to the passage of electric current that practically none will flow through it. Glass, air, rubber, sulphur, silk, and porcelain all make excellent insulators while dry wood, cotton and paper are quite good. Silk, cotton, rubber and enamel are amongst the usual coverings used to insulate wires from one another or from other apparatus. Two types of insulator used to keep a wireless aerial electrically unconnected with the rope which supports it are shown in Fig. 5. They are both made of porcelain. See also *COWL INSULATOR, CORRUGATED INSULATOR*, etc.

**Inter-electrode Capacity**

This term is used in referring to the capacity which exists between the various electrodes — the filament, grid, plate and so on — in a valve. The nearer these are together the greater will be the capacity between them, in fact the electrodes act as a small condenser. Large inter-electrode capacity is usually an undesirable feature in a valve. That which is most delecterious is the capacity between the anode (plate) and the grid. This gives a capacity coupling between the anode and grid circuits of the valve and is likely to cause self oscillation or howling. The worst effects are naturally experienced in the H.F circuits of a receiver and until the introduction of the screen-grid valve inter-electrode capacity was the great bugbear of H.F. amplification. With the screen-grid valve, however, it is practically negligible as the capacity is balanced out by the screen inside the valve itself.

**Intervalve Coupling**

The components used to connect one valve in a set to the following one. The coupling between two H.F. valves or between an H.F. valve and the detector valve is usually a tuned circuit similar to the aerial circuit, that is to say, it consists of another tuning coil and variable condenser as are used in the aerial circuit. These circuits are very often gauged by having identical tuning coils and condensers and by rotating the condensers together.

A less efficient method of coupling valves in the high-frequency side of the circuit is to use a high-frequency choke. This method, nevertheless, has the advantage that no tuning is required other than the tuning of the aerial circuit.

After the detector valve that is in the low-frequency side of the set, different methods of coupling are used. Here there are no tuning coils or condensers. The commonest form of intervalve coupling is the transformer. The simplest way of connecting two valves with a transformer is shown in Fig. 7 which gives both the actual layout and the corresponding theoretical diagram. Another popular method is to connect the two valves by means of a resistance and a condenser. It is called *resistance-capacity* coupling and although it does not give so great an amplification per stage as the transformer method, yet it gives very pure reproduction and is cheap.

**Intervalve Transformer.** *See TRANSFORMER*

**Ionisation**

Under certain conditions a gas such as air, neon, etc., is split up into minute particles each either negatively or positively charged. In this state the gas becomes a conductor of electricity. Of course, normally, the molecules of the gas, like those of any other substance, are electrically without any charge, that is to say, the negative and positive particles exactly neutralise one another and are as it were linked together. In a gas in an ionised state they are free and move about so that although they will reunite again if the gas ceases to be ionised, each particle or *ion* may not rejoin the same ion of the opposite kind to which it was linked before. The air in the Heaviside layer is thought to be ionised.

**Jack**

A device in the form of a socket with various spring contacts which is used in conjunction with a plug for switching purposes. The plug has a metal stem with a little metal ball at the end. See Fig. 6. The stem and ball are insulated from one another and connected to terminals inside the handle of the plug. When the plug is inserted in the jack the stem makes contact with the body of the jack and the ball makes contact with one of the spring contacts. In a multi-contact jack the first spring contact in being forced over by the ball also in turn pushes other springs together.

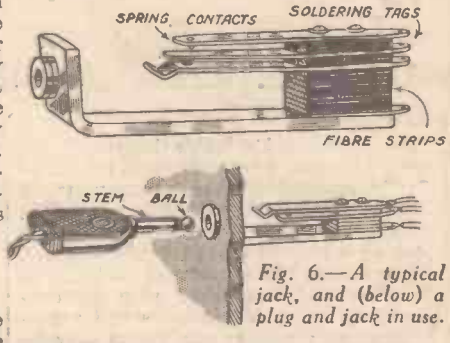



*Fig. 6.—A typical jack, and (below) a plug and jack in use.*

Jacks are often used in wireless when it is desired to connect a loud-speaker or 'phones in different rooms or when it is required to cut out the last valve in a set. The speaker is connected to the plug, and jacks are wired up in the various rooms, or in the case of the cutting out of the last valve the two jacks are mounted on the panel of the set. The speaker can then be plugged in at any point as desired.

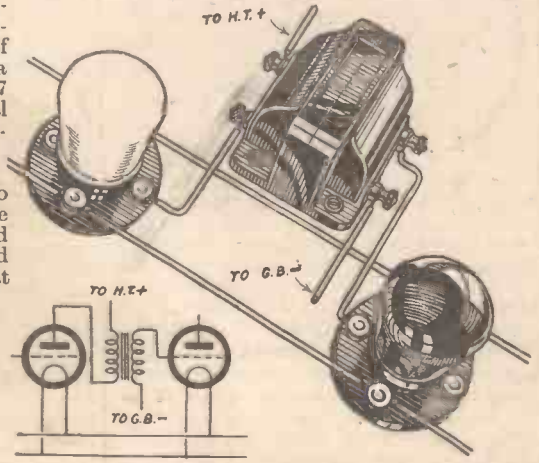



*Fig. 7.—An example of an intervalve coupling—in this case a transformer.*

**Jar**

A unit of capacity. The usual unit referred to in wireless is the microfarad. A jar is equal to 1-900th of a microfarad. The jar is a nautical term.

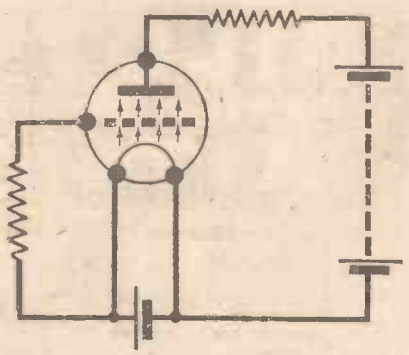


*Fig. 3.*

(*Continued from page 447*)

the valve will pass 15 milliamps of H.T. current. On the other hand, if the grid is given a negative bias of 5 volts the current falls to 5 milliamperes. It is clear, also, that the greater the G.B. voltage is made the smaller does the anode current become. In the interests of economy, therefore, it is evident that we should employ the greatest possible amount of negative grid bias. But there are limits beyond which we must not go. This is obvious, because the curve shows that if the bias voltage is made to be about 13, the valve will not pass any current at all, and therefore it will fail to operate.

**Effect of Signal Voltages.**

There is another restriction which can only be appreciated by studying the effect of applying signal voltages to the grid of the valve. The latter are represented in Figure 7 by a wavy line drawn below the ordinate upon which the "grid voltage" is marked off. The signal voltage represented has maximum values of 2 volts positive and 2 volts negative, or of 4 volts in all. For purposes of comparison it has been assumed that a normal G.B. voltage of 7½ is being applied to the valve, and the signal voltages are thus shown "above" and "below" this mean figure.

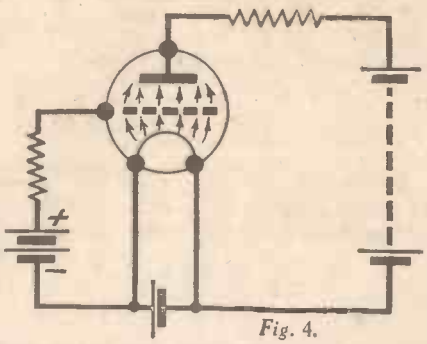


*Fig. 4.*

*Figs. 3, 4 and 5.—These diagrams show the effect of different grid voltages on the number of electrons (or amount of current) flowing from the filament to the plate.*

**HELD OVER!**

**We much regret that, owing to great pressure on space, we are compelled to hold over the concluding article on the Catkin valve.**

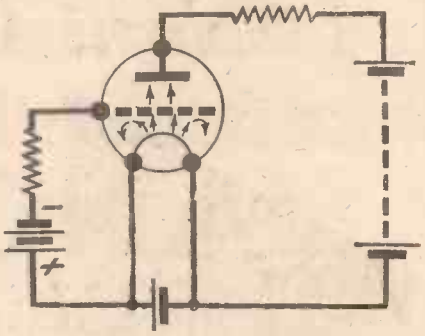


*Fig. 5.*

**"Bottom Bend" Distortion.**

When the grid voltage is reduced to 5½ by the positive half of the alternating signal voltage the anode current is increased by about 2½ milliamps, but when the grid voltage is increased to 9½ by the negative "half-cycle" (as it is generally called) the change in anode current is only just over one milliamp. Clearly, this would lead to distortion due to the valve's uneven response to changes in signal voltage. The actual changes in anode current are shown by a broken line to the right of our diagram (Fig. 7) where it can be seen that the "wave-form" of the signal has been changed or distorted. Distortion in this case was brought about by using too much grid bias and is due to what is called the "bottom bend" in the valve's characteristic curve.

(*To be continued*)

# A Volume Control Adrift

By H. J. B. C.

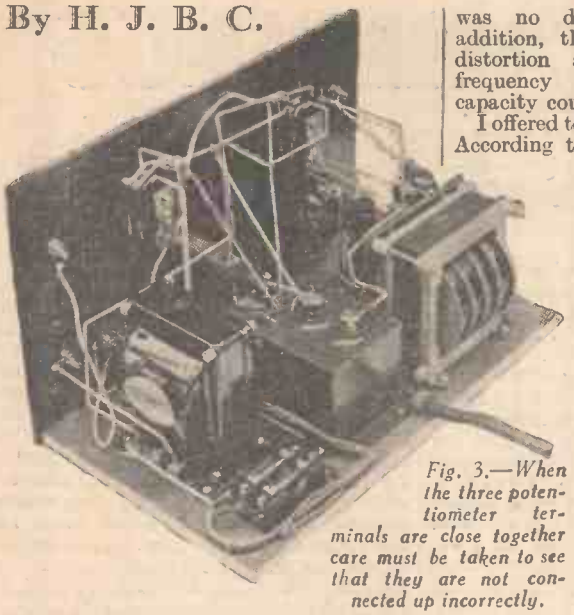
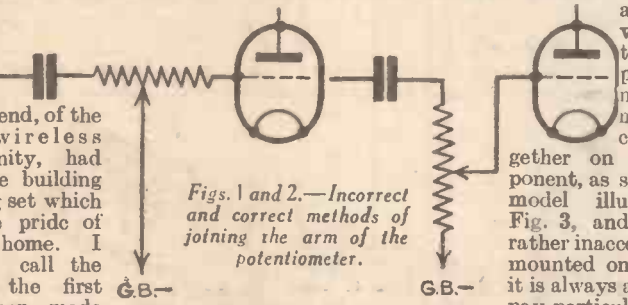


*Fig. 3.—When the three potentiometer terminals are close together care must be taken to see that they are not connected up incorrectly.*

IT really is surprising how quite a simple mistake in a wireless set can upset all one's preconceived ideas of performance. That has been my impression for a long time, and it was borne out again only the other day. A personal friend, of the enthusiastic wireless band fraternity, had completed the building of a receiving set which was to have pride of place in the home. I happened to call the night after the first tests had been made and found him a trifle crestfallen. It appeared that the set had functioned all right, but when the local station was tuned in and recourse was made to the manipulation of a post detector volume control, nothing happened; that is to say, there was no diminution in volume. In addition, there seemed to be traces of distortion arising from the first low frequency valve which was resistance capacity coupled to the detector valve.

I offered to see if I could trace the trouble. According to his diagram of connections, the volume control was the usual form of potentiometer grid-leak in the resistance capacity stage to which reference has just been made, and this is shown in skeleton form in Fig. 2. At first glance the connections in the set itself appeared satisfactory, and then I noticed that his potentiometer had the three terminals close together. A more careful inspection revealed the simple fact that he had, by accident, changed over two of the connections, with the result that the low frequency valve grid was joined to one end of the potentiometer resistance and G.B.—to the variable contact. This is shown in Fig. 1, and it is small wonder that no volume control effects were obtained as well as distortion being present. Interchanging the leads rectified matters immediately, and since very often the three potentiometer terminals are close together on this component, as shown in the model illustrated in Fig. 3, and sometimes rather inaccessible when mounted on the panel, it is always advisable to pay particular attention to this point.




*Figs. 1 and 2.—Incorrect and correct methods of joining the arm of the potentiometer.*

**If you are making a "Practical Wireless" Receiver, use one of our Blueprints!**

## MARKING-OUT TOOLS AND METHODS

*(Continued from page 448)*

It remains to centre punch each hole position. The best way to do this is to make a hole with the point of the scriber at the point of intersection of two lines where a hole is located. This will make a guide for the point of the centre punch. By the way, panels, particularly if they are of ebonite, or will otherwise be visible on the completed apparatus side, should be marked off on the inside or invisible portion when the set is assembled. For this reason it should be remembered that markings will have to be made in reverse, *i.e.*, right-hand when viewed from the front becomes left-hand on the back side. Large holes that can be drilled direct should have an indicating circle scribed round the centre dot and will be a check on drilling after the centre dot has been removed by the point of the drill.

Large holes, such as cannot be conveniently drilled in the ordinary manner are cut out by drilling a chain of holes Thus, for a large circular hole, a circle of required diameter is first scribed with the dividers. Inside this a further circle is made (Fig. 5).

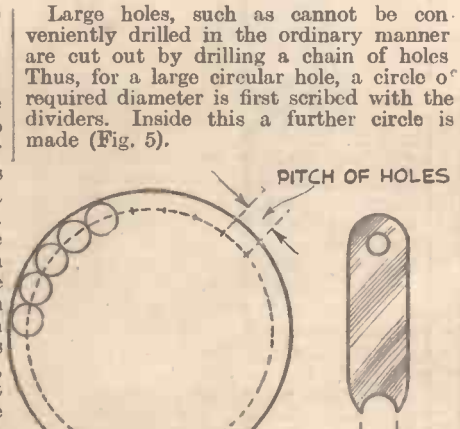



*Fig. 5.—Marking out and cutting large holes.*

# RADIO RAMBLINGS

*Jottings from my Notebook*

By JACE

## Aluminium Versus Copper

FOR over ten years experiments have been carried out in different parts of the world in order to determine if aluminium can replace copper as an efficient conductor of electricity. In our radio sets and, indeed, in almost every other apparatus of an electrical nature, copper wire forms the nucleus from which other components are fabricated and designed. Light weight and other advantages have led scientists to believe in the possibilities of aluminium wire as a carrier of electricity, and particularly in the case of overhead transmission lines do these advantages become more apparent.

It has been found that of the two methods of making wire from aluminium the hot-rolling process gives the better conductivity standard, the level of conductivity being much depressed when wire formed by cold drawing is the subject of experiment. The reason given for this is that the continual heating and cooling of the wire as it is gradually reduced in size by the hot-rolling method, tends to work out the impurities that have such a detrimental effect on the conductivity value. So successful have the experiments been that in one instance the figures obtained with an almost pure metal slightly exceeded those set out by the Bureau of Standards as being the correct ones for aluminium, and it is expected that an experimental transmission line will be set up as a preliminary to the wider use of aluminium in form of wire for electrical purposes.

## About Aerial Insulators

HAVE you ever stopped to think of the vastly increased strain applied to insulators of aerials at transmitting stations with the greatly increased powers now used? Insulators have proved quite a problem both to their makers and to broadcasting station engineers, and the policy of increasing the height of the aerial masts have also imposed additional mechanical strains on the insulating devices. The wind pressure at a height of 70ft. is considerably greater than at sea level, and in order to withstand these great stresses, modern insulators are tested with pressures and strains to the order of fifty tons or more. In addition there is the electrical strain to be considered, and in this connection the design of the insulator is of paramount importance. Just as important in a smaller way is the question of insulation at your end, and discerning amateurs pay particular attention to their aerial insulators. The cheap egg insulators are perfectly satisfactory if you use enough of them in series, but I really think the more elaborate affairs repay their slightly additional first cost. And at this time of the year when reception of distant stations becomes more difficult any little gain of efficiency in the aerial circuit may quite be worth an extra valve.

## Use Stout Flex for Mains Connections

HAVE you ever noticed how the flex that we use for mains leads, and many other purposes, becomes brittle after some use? This is due to the oxidization of the rubber covering, a process that we term "perishing." Particularly does this embrittlement of flex occur where the apparatus connected generates some little heat and with modern "all-in" tariff systems of supply where a standing charge is made for the current consumed, there is a tendency on the part of consumers to connect appliances taking quite heavy loads into the domestic lamp-holders. This practice is not one to be encouraged, and I have seen heaters taking anything up to 1,000 watts plugged in to a lighting point. In these cases the heat generated may be considerable, not only by reflection and conduction, but by the excessive load being carried by the wire, and you will see what I am driving at when I suggest that you use flex of heavy capacity when connecting up your all-mains receiver.

## French Broadcasts

ONE of the first things that strikes a radio amateur when travelling in France is the really small number of radio sets in evidence. There are several reasons for this, one of the chief being that the home life of the average French family is a much less tangible thing than in this country. Most of the French leisure is spent outdoors, or at least under roofs other than the domestic one, and rarely does one hear a consistently good programme, that is, of course, from a Frenchman's point of view, if one goes to the trouble of staying at home to listen in. Gramophone records of doubtful merit and indiscriminate advertising of sponsored programmes for his foreign neighbours' benefit forms the greater part of the fare served up through his loud-speaker. Moreover, French radio advertising is much behind the worst of what we are accustomed to.

## The World's Wireless Listeners

"EVERYBODY'S got a wireless set these days," you probably would say if you were questioned on this point, but if you review the number of your acquaintances who do not enjoy the pleasure of broadcasting you will see that saturation point is still a long way off. Still progress is being made, and during the past twelve months it is estimated 20,000,000 more people in the world were introduced to wireless. It is also estimated, how I don't know, that there are 40,000,000 receivers in use, giving an approximate listening population of 160,000,000 people. In the matter of receiving sets per head of population Denmark leads the way with 140 sets per thousand inhabitants, with the United States close behind with 130.34 sets per thousand. You may not credit it, but Great Britain is far down the list with only 117 sets per thousand.

# IMPRESSIONS ON THE WAX

## A REVIEW OF THE LATEST DISCS

By E. REID-WARR

THERE is a marked predominance of vocal records this month which deserve mention in comparison with other classifications.

From the viewpoint of novelty, there is one which really *is* original. For once, the record has enabled the artist to do something which he could not possibly do on a platform, that is to sing duets with himself! The effect is quite startling when you realize that only one person is singing two parts, perfectly and with beautiful balance. The singer is Tauber—the duets *I would That My Love Might Blossom* and *Shimmering Silver, Whispering Wave*. The record is *Parlophone RO*20219. Another new tenor appears, one John Hendrik. He has several of Tauber's characteristics and a fine voice to support them. He sings two songs of two-year-old vogue—*Vienna, City of My Dreams* (in English) and *Frag' Nicht Warum* (in German). *Parlophone* again—*R*1509.

Stuart Robertson is always good. There is quantity and quality on his last record—*H.M.V. B*4381. There are four songs—*The Road to the Isles, Wrap Me Up in My Tarpaulin Jacket, Down Among the Dead Men* and *Funiculi, Funicula.*

*There's Something About a Soldier* must, of course, be sung by Cicely Courtneidge—and how very good it is. It is so good as to make *The Moment I Saw You* (on the other side) seem quite ordinary by comparison. On *H.M.V. B*4418. Boy sopranos always evoke interest since Tommy Lough's *Hear My Prayer*. *H.M.V.* have a new one—Raymond Kinsey. This young singer has some beautiful notes and the ability to use them in the grand manner. His singing on *H.M.V. C*2556 of *Let The Bright Seraphim* and *Rejoice Greatly* shows training and pluck, for he sails triumphantly through both. The other boy, Leslie Day, is a *Columbia* discovery—*DB*1112. This young Londoner is not so mature, either in voice or diction. His singing is a trifle shrill, but true. Again, composure stands out, but the choice of songs is poor.

*The Merry Widow* never seems to grow stale. There are some splendidly sung "vocal gems" on *Imperial Z*145. The Palace Opera Company (under Joseph Lewis) include a lady who sings *Vilja* surpassingly well. When the chorus enters it sings—it does not shout. I liked this immensely—it is all splendidly done.

### The Big Noises

The Orchestras have less than usual to offer this time. But there is one which I have long waited for—Strauss's *Perpetuum Mobile*. The Amsterdam Concertgebouw put in some of the deftest playing one may hear in a piece which just sweeps you along with it. And on the other side—Tschaikowsky's *Cossack Dance* (Mazeppa). This is by the Hallé Orchestra. *Columbia LX*240 provides two of the happiest contrasts in these two. Whilst talking of Russia there are two other pieces which you must hear. These are the *Cherkess Drumbeat* and the *84th March* (Komzak). Again two orchestras are employed—Dol Dauber's and a Salon Orchestra. Here are very understandable pieces, the first being especially picturesque. Yes, you'll like *H.M.V. B*4393 very much.

*Dream Pictures* and *Merry Vienna* (Ferdy Kauffmann's Orchestra) are titles which tell their own story. You know exactly the *genre*—but you have here some unusually good orchestration. Oh, there's an organ, too, so *H.M.V. C*2541 may be safely used for lighter moments for quite a long time. There are two modernizations of Delibes on *Columbia DB*1109. Debroy Somers' Band play *Naila* and *The Fountain* with customary skill. Edith Lorand's Orchestra have a new idea for a pot-pourri. *A Radio Roundabout* (*Parlophone R*1500) is a collection of tunes caught up from European stations. Finally, there is that fine Band record *The Passing of the Regiments* (*H.M.V. B*4397).

### And Briefly—

For dancing: *Parlophone R*1499—*Rendezvous of the Dolls* and *Little Fool* by Jack Bund's Bravour Dance Band. Pianistic brilliance—very modern arrangement. A sedative—*Spring Song* (Mendelssohn) and *Serenade* (Schubert)—*Regal Zono MR*909. The Angelus Octet play smoothly to bird solos. Staccato—*Dance of the Nymphs* and *Clatter of the Clogs* (*Columbia DB*1110). Xylophone with Bournemouth Municipal Orchestra.

"A History of Music—why bother to write or to read such a thing? Cannot we, as busy men and women, be content to enjoy an art without spending time upon a study of the manner of its development?"

That anyone setting out to prove an argument should postulate in his first words what seems to be a clinching, commonsense retort of his opponent shows that the protagonist is quite sure of his case, and is endowed with ample courage to see it through. Now this is exactly what Mr. Percy Scholes has done in his effort to make better music-lovers of us all, thus continuing his splendid work which listeners remember so well. There must be a reason why one can enjoy Bach and not Rossini—Schubert and not Grieg. Similar prejudices exist in everyday life as in the colour of one's political views, for instance. But could the *real* student of history, with a clear, balanced view of the causes and circumstances which influenced our national development, hold pronounced political bias? No: his knowledge of history would prevent it. This is the case for Mr. Scholes' History of Music Through Ear and Eye—that an understanding of the infancy of music, and its development through the centuries will endow the listener-reader with the poise and, feeling to appreciate *all* music that merits appreciation, because of some newly-revealed aspects of beauty.

(Continued on page 472)

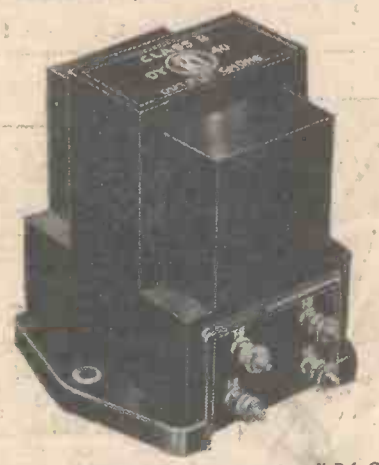
# Facts and Figures

## Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

### NEW R.I. MOULDING

WE mentioned last week that Messrs. Radio Instruments proposed in the future to enclose all their Class B components, which were formerly of the unshrouded type, in a new moulding. This is illustrated below, and it will be seen that it is



*The new neat moulding which will be used on all R.I. Class B components in the future.*

quite distinctive and will enable readers readily to distinguish such components. The price of these components will remain unchanged, but a new model has now been introduced. This is type DY.43, which has been designed at the special request of the Ediswan Company for use with their driver valves P.220 and L.2. This transformer has two ratios, 2 to 1 for driver valve L.2, and 1.6 to 1 for the P.220 valve. When used with these valves the results are fully up to the standard of the previous transformers which we have tested from this company, but it must be remembered that as the correct matching is a rather critical matter, these transformers must be used with the valves for which they are intended. Disappointment may result from misuse, and incorrect matching is as important as with the output valve.

### NEW WEARITE CLASS B TRANSFORMER

MESSRS. WRIGHT AND WEAIRE have now produced a Class B transformer which is manufactured in two distinct types. One employs a silicon iron core, whilst the other utilizes the nickel alloy. The winding is so arranged that it may be used for either Cossor or Mullard type Class B valves, the secondary being provided with five terminals. The centre terminal is a common centre tapping, and is, of course, connected to earth. The terminals on each side of this centre tapping give a ratio of 2 to 1, whilst the two outside terminals provide a 1 to 1 ratio, suitable for the Cossor type of valve. The primary has a D.C. resistance of approximately 400 ohms, and the total resistance of the secondary is 300 ohms. This provides a resistance for each valve of 150 ohms, which is tapped at approximately 100 ohms. With a current of 2 mA through the primary the inductance is 35 henries for the silicon iron core model and 48 henries on the nickel alloy core model. The finish is especially neat and worthy of comment. The silicon iron model is sprayed with cellulose in a battleship grey, and the nickel alloy model is finished in gilt. The silicon model (known as type BJ) costs 8s. 6d., and the other model (type BF) costs 13s. 6d.

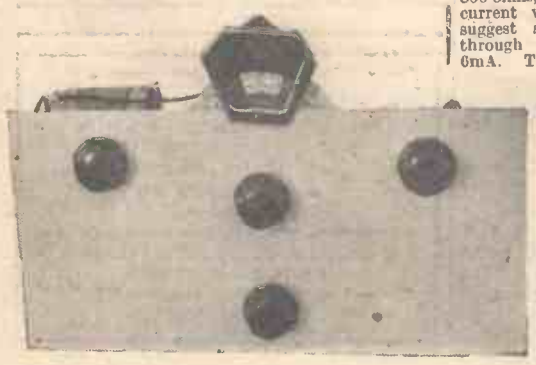
### BAKER'S CLASS B SPEAKER

MESSRS. BAKER (Selhurst) Radio have for a long time been renowned for their moving-coil loudspeakers, and several interesting features are included in these speakers. The latest type we have tested is illustrated on the right of this page. As will be seen, it is complete with a small mounting baffle, which enables it to be easily mounted in a cabinet or on your own baffle by means of ordinary wood screws. The magnet is a substantial affair of the two-claw type, and possesses great strength. The cone is seamless and provided with a corrugated edge, whilst the centring spider is of the ordinary thin type. The sensitivity is quite up to the average, with a slightly better top-note response than our standard. The lower register falls off slightly below 60 cycles, but is well maintained down to the lowest broadcast frequency. The overall tone is very good, producing that "clean-cut" type of reproduction which has now come to be the standard for a good speaker, without the boomy or mellow effect which was popular not so long ago. This shows up to best advantage on speech, which sounds very realistic and devoid of that "shut-in" effect so characteristic of cheap moving-coil speakers. The transformer fitted to this model is for Class B valves, and the price is 41s. It may be thoroughly recommended.

*The new Wearite Class B Driver Transformer.*

### VARLEY CLASS B TRANSFORMER

ANOTHER addition to the already large range of Varley transformers takes the form of a Class B driver. This is type DP.41 and has a tapped secondary to provide ratios of 1.5 to 1 or 2 to 1. The primary inductance with no D.C. flowing is 48 henries, and this drops at 2 mA to 28 henries. The D.C. resistance of the primary is approximately 800 ohms, and the maximum current which the makers suggest should be passed through the secondary is 6mA. This transformer is intended, of course, for use with the Mazda Class B valve using a P.220 or L.2 as the driver. The price is 15s.

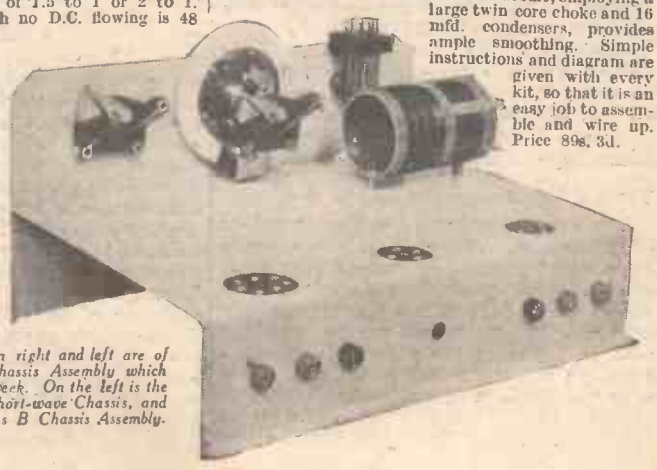


### HEAYBERD CLASS B MAINS UNITS

THE voltage regulation of cheap mains units is not good enough for Class B amplification or Q.P.P. Current demands are constantly fluctuating, and it is therefore essential that there should be a constant voltage output from the mains unit. The only satisfactory method of ensuring *perfect* voltage regulation in all units is by incorporating the Neon Stabiliser Tube produced by Cossors. This tube has a self-adjusting action, and, no matter what current is taken from the unit, the voltage remains the same. Heayberd are the first to manufacture and market units for use with this tube. Two models are available, a complete unit for D.C. mains, and a kit for an A.C. unit. The D.C. unit is designed to work receivers operating on the Class B amplification system or, with slight modifications, the Q.P.P. system from direct-current mains. Exceptional smoothing is provided through a really efficient filter circuit, employing high inductance chokes. All components, with the exception of the regulator tube, are securely housed in a handsome metal case with a black crystalline finish. Rubber safety feet are fitted to the base, and fuses supplied in both mains leads. A bakelite panel carries the output sockets and plugs and the variable resistance knob controlling the S.G. tapping. Flex and adaptor are also fitted.

*Baker's new Permag Loud-speaker Chassis.*

Suitable for mains 200-250 v. D.C., this unit gives a practically constant voltage of 120 v. over a current variation of 5 to 50 mA. with two intermediate tappings. The Cossor Regulator Tube, type S. 130, at 7s. 6d., should be obtained and plugged into the valve-holder in the Heayberd mains unit. The price is 55s. The A.C. mains unit is provided in an unassembled kit form for the convenience of those wishing to incorporate the mains unit in an existing radio or radio-gram cabinet. The kit comprises Heayberd components and incorporates Westinghouse metal rectifier. The only component not supplied is the Neon Stabiliser Tube, which should be obtained direct from Messrs. Cossor. An excellent filter circuit, employing a large twin core choke and 16 mfd. condensers, provides ample smoothing. Simple instructions and diagram are given with every kit, so that it is an easy job to assemble and wire up. Price 89s. 3d.



*The illustrations on right and left are of the new Magnum Chassis Assembly which was described last week. On the left is the front view of the Short-wave Chassis, and on the right the Class B Chassis Assembly.*

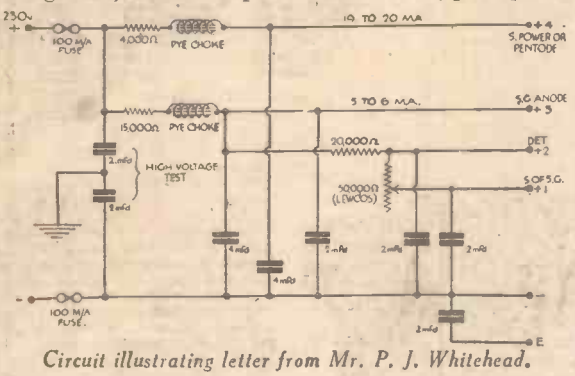
# Practical Letters from Readers.

**The Editor does not necessarily agree with opinions expressed by his correspondents.**

### D.C. Eliminator Circuit

SIR,—In pointing out to you that I do not agree with your circuit (in Vol I, No. 9) of the D.C. Eliminator, I give my reasons, as follows.

Most three-valve circuits employ valves of the following order S.G. Det. Power, having characteristics similar to, say PM 12 (5mA. 150v), PM 1HL (2mA. 100v.) or PM 1DX (4mA. 100v.) and an output valve PM 252 or PM 202 or PM 12. Using these, a total output of some 19 to 28 mA. is required dependent on the valves used. The circuit as shown would not be efficient, and further, it lacks a nice adjustment to the screen of S.G. valve. Would not the circuit shown in the accompanying illustration be more efficient? I am making one up, using colour strip resistances, Lewcos potentiometer, T.C.C. condensers and Pye chokes. The "rough try out" worked excellently. Mains here are "difficult" owing to pronounced hum and voltage variations. The hum is entirely cured by using two high voltage test condensers centre tapped to earth.—P. J. WHITEHEAD (Birmingham).




*Circuit illustrating letter from Mr. P. J. Whitehead.*

### A Novice's Thanks

SIR,—I have received my copy of your Encyclopædia and believe me the material advantage which such an elementary student of the principles of radio as myself will derive from its pages is almost infinite. Anyway, you will probably be gratified to know that although I have been actively engaged in the accumulator trade for some years, there are several points in the section on accumulators which I did not know. The binding, too, is a handsome piece of workmanship.—"ENTHUSIASTIC NOVICE" (Timperley).

### Reports Wanted

SIR,—I should be glad to get in touch with amateurs who receive my transmissions. Reports on my transmission, either 'phone or c.w. on 7,200 kc/s (41.67 metres), crystal control, would be welcomed. —A. E. GROOM, G.2QX (13, William Street, Luton, Beds.).

### A Welsh Reader's Appreciation

SIR,—I write to you as a "Radio Novice" who only became interested in wireless in February of this year. I became a regular reader of PRACTICAL WIRELESS on March 25th last, after having seen a copy in a friend's house, and I should like to express my appreciation of your paper. I consider PRACTICAL WIRELESS the best "wireless" periodical existent to-day, irrespective of price. It gives the finest descriptions of the principles and practice of radio that I know, and I state this, after much delving into wireless books and other periodicals. I owe it a great debt. I have cut out all the articles in PRACTICAL WIRELESS from March 25th onwards and have inserted them in a "spring-back" loose leaf cover, so that all articles dealing with similar subjects, *e.g.*, "H.F. Pentodes," are together and constantly available without much searching. I intend doing the same with all other copies of PRACTICAL WIRELESS, so that ultimately I will have the finest reference "book" on wireless available, and one always up to date. Your paper has gained a regular reader through sheer merit, and

*(Continued on page 470)*

**CUT THIS OUT EACH WEEK**

## DO YOU KNOW?

—THAT a screened lead can introduce instability if not carefully arranged.
—THAT screening the wiring in a receiver should only be undertaken if you thoroughly understand the circuit arrangements, as large losses can be introduced by this means.
—THAT the present gap in tuning between 600 and 1,000 metres may prove to offer some interesting programmes in the near future.
—THAT the short waves offer more programme material than the normal bands for a given tuning range.
—THAT six different ratios are obtainable with one transformer when this is parallel-fed.
—THAT a pentode valve will work quite well with a very small H.T. voltage.
—THAT an economical receiver may be constructed if the above fact is borne in mind.
—THAT at least one receiver on the market employs such a valve with an H.T. of only 20 volts.

### NOTICE.

*The Editor will be pleased to consider articles of a practical nature suitable for publication in* PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

*Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.*

## PRACTICAL LETTERS

(*Continued from page 469*)

I am grateful for what it has done, to give me a sound grasp of wireless.—W. L. (Carmarthen).

### Wonderful Value

SIR,—Your "Wireless Constructor's Encyclopædia" received safely. I need hardly state that I am very pleased with same. It has already been of assistance to me on several points, and is in fact wonderful value in every way. I am a regular reader of PRACTICAL WIRELESS and have succeeded in getting two of my friends to subscribe to your valuable paper.—T. B. W. SMITH (Brighton).

### Case for Featherweight Four

SIR.—Having constructed the case for the Featherweight Four, complete with carrying handle, and covered with Horrocks's cloth, its weight is exactly 2½lbs. I have put 26½lbs. weight of books in it, and the load was lifted without a creak and not a nail, screw, or plate is to be seen.—R. GELSTHORP (Nottingham).

## THE THREE-STAR NICORE

(*Continued from page 450*)

question of the L.F. side and Mr. Barton Chapple devoted his attention to this.

### The L.F. Side, by H. J. Barton Chapple

The circuit so far presented to me shows a selective receiver employing two valves, and the question arises as to the best form of output valve, as I understand that only one more valve may be employed in this circuit in the interests of economy. The Class B valve is very popular, but requires a driver which rules this out. A small power valve would obviously be very economical in operation and would no doubt prove sufficient in many cases. There are thousands of listeners, however, who are situated in positions where added volume is required in this stage, and the pentode valve, whilst not exactly economical in running costs, is definitely of advantage as a deliverer of power. Quality is a point which depends upon the choice of the L.F. coupling and, therefore, in the interests of output and quality, I decided to use a parallel-fed transformer coupling with a pentode valve employing a tone-correcting circuit across the loud-speaker terminals. The constants of the coupling were chosen to provide slight bass resonance and assist in reducing the "squeak" of the pentode, and this, in conjunction with the Blue Spot loud-speaker results in a very satisfying tone of reproduction. It will be noticed that I have not employed a separate battery supply for the priming grid of the pentode, but that this is coupled direct to the anode. The supplies for the remaining valves are taken through decoupling resistances, but to ensure that the H.F. valve may be operated at its maximum it has provided a separate battery supply for the screening grid, and this enables the optimum voltage to be applied to this valve to ensure stability with volume. The results of this combination will be obvious to the reader, and next week some of the results obtained on the set will be detailed, together with constructional notes.

P. W. Gift Stamp No. 38

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# A NEW CONDENSER PRINCIPLE—BY HANS VOGT

# Practical Wireless

3D

Published every Wednesday by
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Building the

# THREE STAR NICORE

All About Permeability Tuning

Why & Wherefore of Grid Bias

Tele-Talkie Topics

Fashions in Design

Practical Notes on Drills, etc., etc.

VARIABLE-MU DETECTOR & PENTODE With IRON CORE COILS


# ROUND *the* WORLD *of* WIRELESS

**Athlone's Relay Station**

AS the transmissions from the Athlone high-power station are not well heard by owners of simple crystal sets in and around Dublin, the Irish Free State authorities have decided to bring the old 1 Kw. station into operation. It will relay the programmes on 218 m. (1,373 kc/s).

**Japan's Super-super Stations**

THE Japanese Government has earmarked in this year's budget a sum exceeding one million *yen* for the construction of two 500 kilowatt transmitters. New broadcasting stations are also to be erected at Ashigawa, Tokushima, and Nagasaki.

**Poste Parisien, Paris**

SOME of the older radio fans may recall *Radiolo*, the original announcer of Radio-Paris in the early days, who since the Parisien 60 Kw. station has been launched, fulfils the same duties in that studio. From this Paris transmitter, however, you will now also hear a female voice giving details of the programmes, as following an election by listeners, Jacqueline Aldo presides at the microphone during certain hours of the day.

**Radio Svizzera Italiana**

IT is in this way you hear the call of the new Swiss *Monte Ceneri* station now testing on 1,150 metres. Until the station has been officially launched only skeleton programmes are broadcast between B.S.T. 8.30 and 11.0 p.m. The entertainment opens with gramophone records followed at 9.0 p.m. by a concert from the Lugano studio orchestra. A short news bulletin in Italian is sent out at 9.10 p.m., and from 10.20 p.m. listeners may hear dance music or some other light musical items. The wavelength used is a provisional one subject to alteration at short notice.

**The Luxembourg Transmissions**

ALTHOUGH the 1,191 metre channel arbitrarily adopted by this station is a bone of contention at the Lucerne conference, the studio merrily broadcasts on this wavelength every day from B.S.T 7.0 until 10.30 p.m. Each day of the week offers a special entertainment to foreign listeners and the *rota* of countries to which the broadcasts are destined has now been fixed as follows: Monday (Italy); Tuesday (Belgium); Wednesday (Luxembourg); Thursday (Germany); Friday (Holland); Saturday (France); Sunday (Great Britain). There are three announcers in the studio (two men and one woman) and all calls and details of the programmes are clearly given in German, French and, according to the day of the week, in the language of the interested foreign listeners. The transmitter is now working at full power.



**Imminent French Radio Scandal**

ACCORDING to reports published in a Paris newspaper, questions are to be asked in the Chamber of Deputies regarding the purchase of Radio-Paris by the French State authorities. It is stated that the sum of thirteen million francs was paid for this transmitter, notwithstanding the fact that experts valued the station at less than half that amount.

**Listen to Hendon Aerodrome**

THE annual *Royal Air Force Display* at Hendon on June 24th will be relayed in the National programme. Amongst the events described by Squadron-Leader W. Helmore as commentator will be one which should provide a special thrill. All the aircraft taking part in this item will be linked together by light cables to which streamers are attached. The least inaccuracy on the part of any one 'plane would break the cable and spoil that part of the show.

**B.B.C. Relays German Opera**

ON July 1st listeners to the Regional programmes will hear a relay from Dresden in co-operation with the Central German Broadcasting Company, and the Reichs-Rundfunk Gesellschaft. The programme, which will last one hour, will consist of Act I of *Arabella* by Richard Strauss with Eva Plaschke van der Osten as soloist.

**Broadcasts from the Stratosphere**

THE Belgian engineer, Max Cosyns, and the aeronaut Demuyter, accompanied by a Dutch engineer, propose to make another balloon ascent with a view to beating Professor Piccard's altitude record, during July. Although the actual date has not yet been definitely fixed—it will depend on weather conditions—the start will be made from the valley of the Lesse in Belgium. During the flight it is proposed to broadcast a running commentary on 41.1 m. and 21.4 m. and everything will be done to remain in two-way communication with European stations. Until their departure, tests of the short-wave apparatus will be carried out under the call letters XXON4AU between B.S.T. 15.00 and 18.00 every Thursday and Sunday. The practice transmissions will be carried out from an aeroplane.

**Brazilian Short-wave Broadcast**

THE *Imprensa Naçional* sponsors a daily transmission of a news bulletin in English, French, Spanish and Portuguese at 7.30 p.m. (local time) or B.S.T. 23.00 through PRAB on 31.58 m. The aerial power of the station is roughly 500 watts.

# ROUND *the* WORLD *of* WIRELESS *(Continued)*

**Efficiency**

THE arrangements made for the broadcast of the proceedings of the World Economic Conference at the Geological Museum, South Kensington, London, were more complete and elaborate than any hitherto attempted. From a local control room leads were run to three points in the main conference hall, including a glass walled observation box from which running commentaries were given. Microphone points were installed in all committee rooms, and a special studio was built to enable delegates to broadcast summaries to their own countries. The speeches relayed from the museum through the local control point were passed to Broadcasting House and then despatched over the trunk telephone cables. In many ways, but on a smaller scale, the elaborate equipment installed at the museum resembled that used by the B.B.C. at its own headquarters in Portland Place.

**Radio Wien from 5.0 p.m. Only**

VIENNA-BISAMBERG has not yet taken over its full duties, neither does it yet utilise for its broadcasts more than 100 kilowatts. This new station comes on the air daily at 5.0 p.m. B.S.T., the previous programmes being assured by the old Rosenhügel station. Occasionally from Vienna you may now hear interesting talks in both French and English, as a series of lectures on the beauties of the Austrian watering spas is being given by prominent foreign residents in the capital.

**French Television Transmissions**

LISTENERS to Paris PTT may occasionally have picked up television signals from this station at odd hours. A regular programme of broadcasts according to the Baird-Natan system has now been instituted. Transmissions are carried out on Mondays, Tuesdays and Fridays between B.S.T. 3.0 and 4.0 p.m., and on Wednesdays, Thursdays and Saturdays between B.S.T. 9.0 and 10.0 a.m. On Mondays, Wednesdays and Fridays the "sound" portion of the programme is broadcast through Radio Vitus, Paris (308.9 m.) or Eiffel Tower (1,445.8 m.). In addition, Paris PTT is also experimenting with a new system of television on Tuesdays and Fridays between 4.15 and 5.30 p.m. on 447.1 m., sound being broadcast by a private station, F8VU, at Montrouge (near Paris) on about 250 m.

**Berlin's High-power Transmitter**

WORK on the new station destined to take over the duties of the Berlin-Witzleben transmitter is being hurried forward with a view to its official opening simultaneously with the Radio Exhibition in the German capital in September next. The wavelength, so far as can be foreseen, will be 339 metres, namely, the channel at present used by Brussels (2).

**Hearing Buenos Aires**

REPORTS on the reception in Great Britain of broadcasts by Radio Excelsior, the new Buenos Aires station on 361 metres, have been sent to the Argentine. The newcomer on the ether is a "super," with a nominal power of 200 kilowatts. Although during the summer months its signals may not be heard regularly, there is little doubt that the station will appear in many logs in the darker months of the year. The call is *Ella-air-Cinco Radio Excelsior, Buenos Aires.*

## INTERESTING and TOPICAL PARAGRAPHS

**THE WORLD'S YOUNGEST RADIO OPERATOR**

*Although she is only 8 years old and has to sit on a dictionary to properly operate her typewriter, little Jean Hudson, of Laurel, Delaware, has just passed the examination for amateur radio operator's licence. She is the youngest person in the United States, and probably in the world, to own such a licence.—(We merely add that this announcement comes from America.—Ed.)*

**Pocket Wireless Sets for Police Use**

AS the tests recently carried out at Brighton with pocket wireless sets have proved so successful, the Home Office has approved the adoption of such apparatus, and has agreed to share the cost of thirty sets. As greater improvements are made this practical invention will become indispensable to the police force.

**Dearth of German Announcers**

AS in some of the decrees made by the Hitler Government a large number of studio officials have been discharged from their duties, many of the German broadcasting stations find themselves sadly short of suitable announcers. At Frankfurt-am-Main, a special school has been established to train persons for this vocation; they are to be drawn from the ranks of unemployed stage artists.

**New Jerusalem Short-wave Station**

THE Zionist organisations in Palestine, according to a report, are busily constructing a short-wave station in the neighbourhood of Jerusalem for the broadcast of programmes from that city. The wavelength will be in the neighbourhood of 50 metres, and entertainments will be made in both Yiddish and Arabic.

**New Interval Signal**

BUCAREST on 394 metres now possesses a melodious interval signal; it consists of the first four bars, repeated *ad lib*, of an old folk song entitled *Hai Lelitzo*. The metronome has now been completely discarded from the studio. Bucarest has a woman announcer.

**Bordeaux-Lafayette PTT**

THE French broadcasts heard almost immediately below the wavelength of Western Regional emanate from the French State station at Bordeaux transmitting on 304.9 m. (983.9 kc/s). Its power is 13 kilowatts. Most of the daily programme is relayed from *Ecôle Supérieure* and when such is the case the Paris PTT call is heard. Local entertainments are, however, given frequently, and are announced as from *le poste de radio-diffusion des postes et télégraphes de Bordeaux Lafayette.* The studio does not use any special interval signal.

**Anonymous Broadcasts**

CONTRARY to what might be expected, the inhabitants of Toulouse are not dissatisfied with the present state of affairs concerning their local station. Although no permit has been obtained to use the St. Agnan high-power transmitter, Radio Toulouse broadcasts a concert every morning and afternoon without giving any calls. As, moreover, these entertainments are free from the habitual publicity *puffs* local listeners consider that they have no cause for complaints.

## SOLVE THIS!

**Problem No. 40**

Smith built up the Fury Four, but when he switched on no signals could be heard. Faint oscillation was audible from the loudspeaker, but nothing more could be obtained. After a few attempts at solving the trouble, he removed the grid bias negative plug (without first switching off the receiver) and immediately this was done the signals came through very loudly but distorted. What had he done wrong? Three books will be awarded for the first three correct solutions opened. Address your envelopes to The Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2, and mark your envelopes Problem No. 40. Do not enclose any other correspondence with your solution.

**SOLUTION TO PROBLEM No. 39**

The spark gap fitted on Blackman's aerial-earth switch was responsible for the trouble, as it was uncovered and had become corroded with the result that the gap shorted by the sooty deposit usually found on copper exposed to the air. This resulted in the loss of signals as they leaked to earth.

The following two readers receive books in connection with Problem No. 38, as they were the only correct solutions received:—

R. Debens, 7, Avenue Road, Bow, E.3; J. A. Fontnam, 10, Queen's Road, Thame, Oxford.

# What is PERMEABILITY TUNING?

## A Practical and Interesting Article Dealing With the Possibilities of This New Tuning System. By "LAMBDA"

AFTER a period of comparative stagnation, 1933 has seen considerable changes in the design of tuning coils. For several years steady progress has been made in the design and improvement of other types of components in a receiver, such as loud-speakers, low-frequency transformers, and, quite recently, valves. Now attention is being focused on the tuning system. Iron-cored tuning-coils are becoming very popular, and further developments are foreshadowed. During the past two years the small diameter air-cored coil has been popular, and although not so efficient as the large litz-wound coils of six or seven years ago, they were quite suitable for use with modern valves.

In the same manner as other components have evolved so has the tuning condenser; the earlier types of square-law tuning condensers were expensive, and could hardly be described as fine examples of engineering skill and ingenuity. Real precision components are now available in which the angular displacement of the moving vanes gives an equal variation in each section of a ganged tuning condenser, so that single dial tuning can be achieved with considerable success. Condensers are now totally screened, and manufacturers generally guarantee each section to be accurate to within about half of 1 per cent.

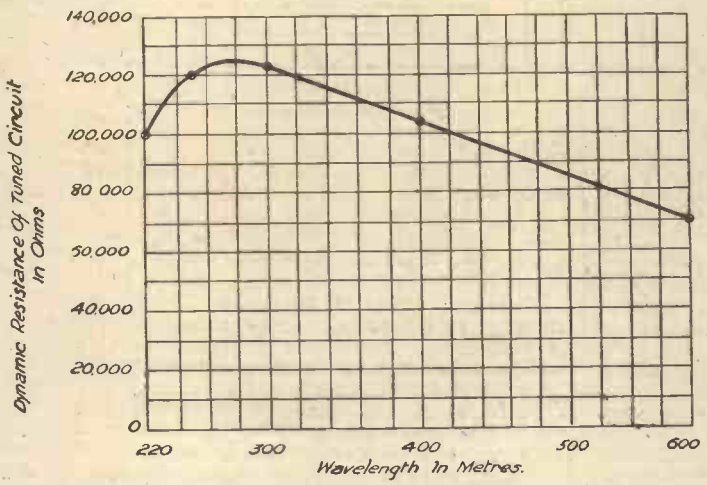
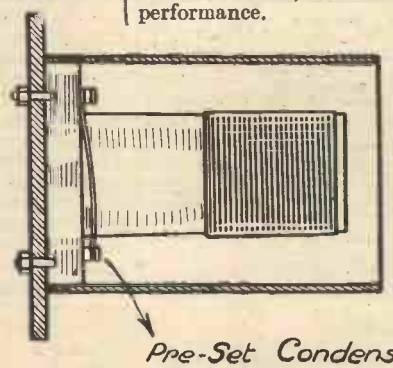



*Fig. 1.—Curve showing variation in resistance of a tuned circuit at different frequencies.*

### Disadvantages of Condenser Tuning

Unfortunately, the chief difficulty with existing tuning systems is that they are inherently incapable of producing uniform performance, selectivity and sensitivity not being constant over the whole of the tuning range.

Efforts have been made from time to time to overcome this difficulty, but, so far, results have not been entirely successful. An early system was variometer tuning, which was employed in receivers some years ago. This fell into disuse because its resistance varied with frequency in the same way as the fixed inductance, and it could not, therefore, produce uniform performance.



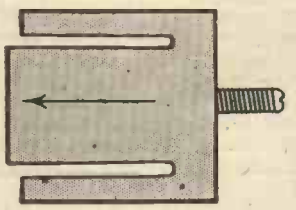



*Fig. 4.—Showing arrangement of coil with core withdrawn.*

Other methods have been tried, one being the employment of a metal shield which, when brought into close proximity with the coil, decreased its inductance, but this method also increased the losses and was also incapable of producing uniform performance.

With ordinary air or iron-cored coils the coil is fixed and, therefore, the inductance remains constant, tuning being effected by the usual variable condenser. At the lower wavelength the selectivity is relatively poor, and at the upper end of the scale selectivity improves, but sensitivity falls off. This defect appears to be inherent in all condenser-tuned circuits, and an examination of the curve in Fig. 1 shows the falling off in the dynamic resistance at the 600-metre end of the coil. The dynamic resistance of a coil is ascertained from the formula $\frac{L}{CR}$ where L represents the inductance of the coil, C the capacity of the tuning condenser at any particular setting, and R the high frequency of the coil.

We know that the quantity C varies over the tuning scale, increasing as the moving vanes of the tuning condenser are gradually brought into closer proximity with the fixed vanes until the maximum capacity, usually 0.0005 mfd. is reached and there is a loss of sensitivity. A slight compensation is effected as R decreases somewhat, but this is not sufficient to compensate completely. Selectivity in terms of actual ability to reject signals on undesired channels can only be constant over the range when the ratio of inductance to resistance does not change.

A good tuned circuit may have a resistance of about 4 ohms at 550 kc/s. and 30 ohms at 1,500 kc/s. If the resistance can be maintained at 30 ohms, we then have constant selectivity over the tuning scale, and it will be just as broad at 550 kc/s. as it now is at 1,500 kc/s. What we desire is a tuned circuit so designed that the

(Continued on page 476)

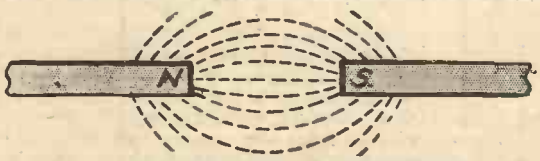



*Fig. 2.—The lines of force set up between two magnets.*

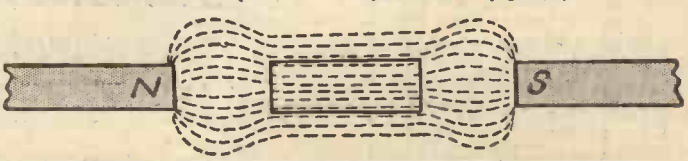



*Fig. 3.—How the lines of force shown in Fig. 2 are concentrated when a piece of soft iron is interposed.*

(Continued from page 475)

inductance and resistance will increase together, and the ratio remain constant. The permeability tuning system appears to have achieved this. The tuned circuit is designed at the high-frequency end 1,500 kc/s. (200 metres) to have such properties as we desire to obtain high gain and selectivity by using a relatively small inductance and a relatively large fixed condenser, both designed to have low losses. This combination will then be tuned down to 550 kc/s. by gradually inserting an iron core into the inductance. This will increase both its inductance and its resistance.

**Permeability**

In order to appreciate the merits of permeability tuning which comes to us from America, it will be advisable now to consider the meaning of permeability. For practical purposes we regard every substance as possessing a certain power of conducting lines of force and of offering a certain resistance to the passage of the lines, and this can be deducted from the following experiments.

First of all, take two bar magnets as shown in Fig. 2. Place them about 1in. apart and arrange a piece of thin paper on top of them. On the paper place a small quantity of iron filings so arranged that they are in close proximity to the pole pieces, N and S. The position which they will adopt should be somewhat similar to that shown in Fig. 2.

Now repeat this experiment with a piece of soft iron placed in between the poles N and S (see Fig. 3). You will notice that the iron filings will re-arrange themselves, appearing to crowd into the iron, as if they found it easier to go through the iron than through the air. The lines of force indicated by the arrangement of the iron filings will now appear as shown in Fig. 3. We therefore deduce from these two experiments that iron has greater permeability than air. Now we can define permeability as the ability of a substance to conduct lines of force as compared with air and, therefore, we are now in a better position to appreciate this new system of permeability tuning.

Having considered the existing tuning system, let us see what permeability tuning has to offer. The tuned circuit consists of a coil wound on the usual bakelite former, and a core of Polyiron, as the new material is called, which is so arranged that it can slide into the coil. This core is made up of very fine iron particles, which are reduced to a dust so fine that they will float in air. The individual particles are insulated by a special process. This insulated iron powder is now moulded with bakelite, and any desired form that is capable of being mounded can be obtained.

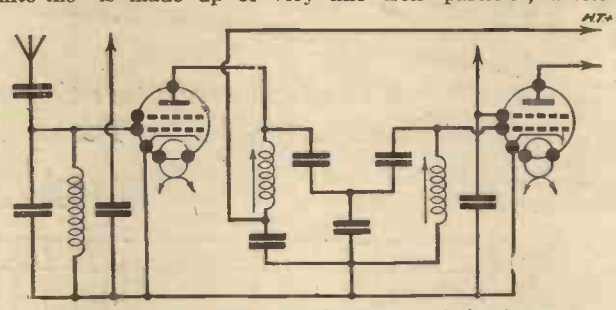



*Fig. 5.—Permeability tuned circuit with band pass intervalve coupling.*

It is now necessary to secure initial resonance at 1,500 kc/s. This is achieved by withdrawing the core, and placing a semi-variable condenser across the coil. By adjusting this condenser the circuit is tuned to a minimum wavelength of 200 metres (1,500 kc/s.). The coil and condenser are then mounted inside a screening cover of copper or aluminium, and we may expect that they will increase together, since both depend upon the amount of iron which is actually inserted in the magnetic field. What really happens is that we are not only increasing the inductance of the coil, but the permeability of the surrounding medium as well, hence permeability tuning.

With ordinary tuning systems employing coil and variable condenser, there is always a certain minimum capacity which cannot be avoided. This is equal to the maximum spacing obtainable between the rotor and stator of the variable condensers, and also by the various stray capacities existing in the circuit itself. In designing a coil to tune over a given waveband this minimum capacity must be taken into consideration, therefore the maximum value is also determined so that taken with the same value of inductance it must tune to 550 kc/s.

With permeability tuning the inductance of the coil may have any value desired to produce the required performance. Whatever the value of the inductance may be it will be increased approximately eight times by the insertion of the core, and also whatever the resonant frequency of the coil and condenser may be, it will be decreased approximately one third of this value when the core goes into the coil. Therefore, we can assume that if we have two coils of different inductance but of the same physical dimensions, and if we insert two cores into them, the percentage change in inductance will be the same. One unique advantage claimed for the system is that we now have a method of tuning the aerial circuit of a receiver, and keeping it exactly aligned with the other tuned circuits.

This, therefore, is permeability tuning. How far this system can be applied in practice remains to be seen. Great things are being claimed for it, and if they materialize the constructor can look forward to an entirely new type of receiver which will be unique.

We shall watch the development of this system with the closest interest and pass on developments immediately.

## NEW FERROCART COILS

THE special iron-core coils made by Messrs. Colvern and sold under the name "Ferrocart" are now available in a different combination. Hitherto these coils have been assembled only in a set of three for use as a band-pass aerial tuner followed by an intermediate H.F. coil with reaction winding. The theoretical circuit of this combination is given in Fig. 1. The great utility of this type of coil has inspired Messrs. Colvern to develop a different combination of the same type of coil for use in a more powerful type of receiver. The combination now consists of a single-aerial coil, an intermediate H.F. band-pass tuner, and an H.F. coil with reaction. The theoretical circuit of the new coils is given in Fig. 2. The third circuit is not shown in this diagram, as it follows the lines of coil F.3 in Fig. 1. This combination should enable a most powerful and selective receiver to be built, and a great many of the difficulties of matching the two halves of the band-pass tuner should be removed as the variability of the aerial circuit is now removed from one-half of the tuner, and the two sections may therefore be more accurately adjusted with the knowledge that the adjustment will remain. Naturally, the receiver will be slightly larger as the four coils will be mounted on a rather long baseplate, the actual length being just over 12ins.

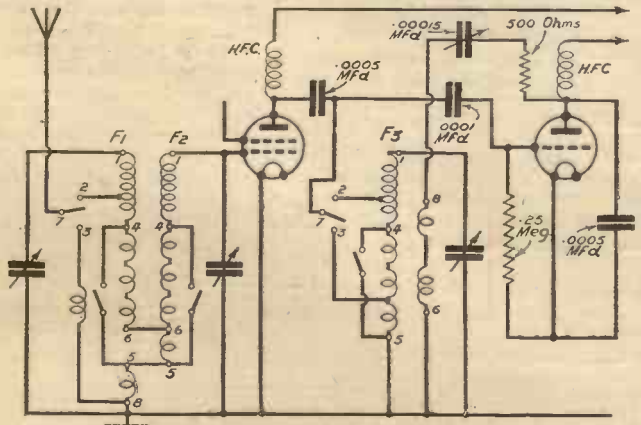



*Fig. 1.— Connections of the first models of the Ferrocart Coils.*

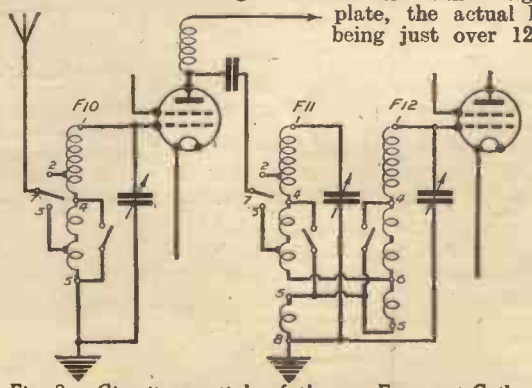



*Fig. 2.—Circuit essentials of the new Ferrocart Coils.*

# A NEW CONDENSER PRINCIPLE

An Important Article Describing a New Compression-type Condenser

By HANS VOGT (*Inventor of Iron Core Tuning Coils*)

UNTIL recently, radio components were considered to be of definite construction, and fundamental improvements were believed to be out of the question. The development of the Ferrocart coils, however, I think has shown

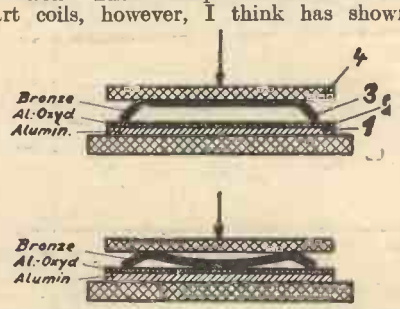



*Fig. 1.—The principle of the new Vogt flat condenser.*
(1) *Circular stationary electrode of aluminium.*
(2) *Special low-loss dielectric material.*
(3) *Elastic counter electrode of bronze.*
(4) *Press plate of insulating material.*
*Stage (a) Initial position — minimum capacity.*
*Stage (b) Intermediate position—increased capacity.*

that there is still a wide field open for new discoveries and improvements, and personally I feel sure that the new development thus initiated will still disclose various other surprising new things.

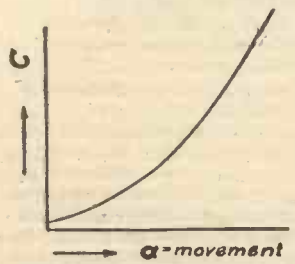
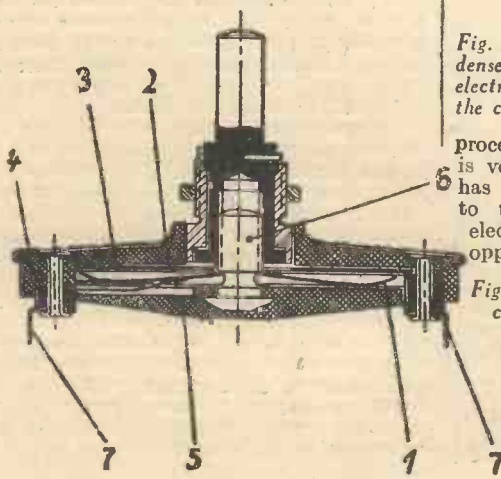



*Fig. 2.—By a careful choice of curve the quadratic capacity characteristic shown above results, thus giving an equally divided wavelength scale.*




Starting from this conviction, besides the research work on the Ferrocart coils, I developed a tuning condenser of novel principle. As in the case of the tuning coils, the variable condensers did not give rise to any fundamental improvement since the beginning of radio technique. True, the losses in the condensers are practically eliminated by using air condensers, but these condensers are large and expensive, and, therefore, cannot be used for cheap one and two-stage sets, rejector circuits and the like. The hard paper condensers, on the other hand, which now are used for these purposes, produce considerable dielectric losses, and thus will increase the damping, and reduce the selectivity and sensitivity.

**Component Parts**

I therefore undertook to create a small and cheap variable condenser with very low losses. The new principle will be seen from Fig. 1. A circular stationary electrode of aluminium (1) is covered with a very thin layer of a special dielectric material (2), which is produced electrochemically on the aluminium plate by a special process. The dielectric layer thus produced is very hard and thin, and in particular has very low dielectric losses. Opposite to the stationary electrode an elastic electrode of bronze (3) is arranged, two opposite edges of which are bent down to the stationary electrode. Now, when pressing down the press plate (4) by a sort of angle lever effect, the medium part

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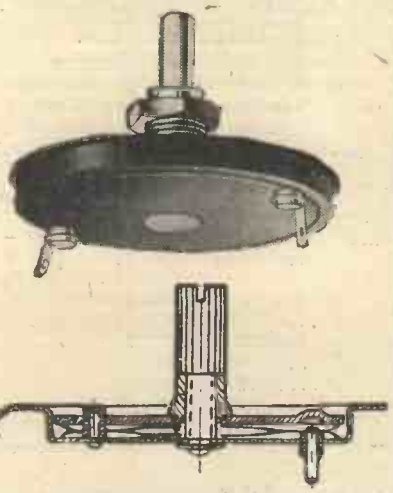

*Fig. 4.—A very cheap type of the new condenser, having two elastic and two rigid electrodes, one of which is movable to vary the capacity.*

*Fig. 3.—Practical execution of the new condenser :*
(1) *Elastic bronze electrode.*
(2) *Stationary aluminium electrode.*
(3) *Special dielectric layer.*
(4) *Insulating casing.*
(5) *Movable cover.*
(6) *Adjusting axis.*
(7) *Terminals.*



*Hans Vogt in his laboratory at Berlin-Dahlem.*

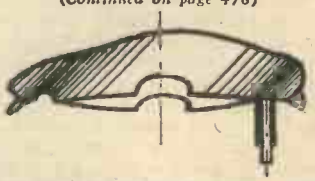

*Fig. 5.—The electrodes of the new condenser.*


*Fig. 6.—A highly selective rejector circuit embodying a Ferrocart coil and a Vogt flat condenser.*

*Fig. 7.—A high efficient selection circuit with Ferrocart coil and Vogt flat condenser, compared with an air circuit of similar characteristics.*

(Continued from page 477)

of the elastic electrode is first approaching the stationary one, so that the increase of capacity is accelerated. When further pressing down the plate (4) only the remaining portions of the elastic electrode are moved down, and the further progression of the capacity takes place more slowly accordingly. By properly choosing the curvature of the elastic electrode, the increase of capacity can be so arranged that a quadratic capacity characteristic (which means an equally divided wavelength scale) results, as shown in Fig. 2.

### Low Losses

Regarding losses, the new condenser is almost identical to an air condenser, especially in the critical range of the shorter waves. The two electrodes are in the position of maximum distance, and the condenser is practically acting as an air condenser; only with longer waves, when the plates are in close face to face position, the solid dielectric is of no influence at all. As explained, however, it likewise has very low losses, and by the curves, Fig. 3, the low losses of the new condenser will be demonstrated.

The new condenser is not suitable for multi-stage sets, at least, in its present form it is difficult to be ganged in mass production. I am, however, working further in the matter to make it fit for this purpose, too. Anyway, it is the ideal condenser for one and two-stage sets, for rejector and selection circuits, and for reaction and coupling condensers, in other words, for any purpose where ganging is not necessary.


*Fig. 8.—Damping curve of: (a) an air condenser. (b) a Vogt flat condenser. (c) a hard paper condenser.*

Fig. 4 shows a practical example of the new principle. Fig. 5 is another example, consisting of two elastic and two rigid electrodes, one of which is screwed down to vary the capacity. The bilateral example means a further reduction of size and cost as the capacity is the double one, so that the diameter may be smaller accordingly.

Figs. 6 and 7 are radio components, embodying Ferrocart coils combined with condensers employing the new principle.

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# VALVE ABBREVIATIONS EXPLAINED.

**An article explaining the meanings of some of the peculiar designations which are given to modern valves.**

By W. J. DELANEY.

THE newcomer to wireless is undoubtedly confused upon looking down a catalogue of valves, as the valves are all represented by initial letters and figures which at first sight have no bearing on the particular use of the valve. For instance, one valve-maker's list which I have before me shows that there are four screen grid valves, the references being SG.215, S.215A, S.215B and S.215VM. It is fairly easy to see from these references that the letter S stands for "screen," and this is straightforward. But upon referring to another well-known valve-maker's list the two screen-grid valves which this firm makes carry the references P.M.12A and P.M.12V. In this instance there is not the slightest indication that the valve is of any particular type. However, in general, the following references will be found to hold good through most of the different ranges, and the exceptions will be fully referred to as they are met. The letters usually denote the use to which the valve is to be put, and the figures give the actual rating of the filament or the heater. Thus a valve bearing the reference H.210 will be found to be one designed for use as a high-frequency amplifier and has a filament which consumes .1 of an amp. at 2 volts. It would, perhaps, be better to deal with the terms in two sections, taking the letters first.

### The Letters

If you refer to the PRACTICAL WIRELESS Data Sheets Nos. 10 and 11, you will be able to see that the majority of valves are divided into classes. A valve of the three-electrode type (triode) may be used as a high-frequency amplifier, a detector, a low-frequency amplifier or a power valve. A valve of the five-electrode type (tetrode) may be used as an H.F. amplifier or as an output valve, and so on. In general, therefore, the letter or letters which are included in the reference show for what purpose the valve is most suitable, and these may be tabulated as follows:—

H ....High-frequency.
HL. ..High- or low-frequency.
HF. ..High-frequency.
D ....Detector.
L ....Low-frequency.
LF ...Low-frequency.
P ....Power.
SP ...Super Power.

The screen-grid valves are of the ordinary or the variable-mu type, and therefore in addition to the letters S or SG, the letters V or VM are added to signify that the particular valve is of the variable-mu type. The pentodes are referred to as PEN, PT, HPT, or PP. This should be quite straightforward and should enable a valve to be picked according to the position in the set which it is to occupy.

### The Figures

The figures which are appended to the name are a little more confusing, and it is these which seem to give the novice the greatest difficulty. Actually, it is quite simple in the majority of cases, and it will be found that it gives the voltage and consumption of the filament (or heater). In practically every case it may be taken that the first figure is the voltage, and the succeeding figures are the consumption expressed as the decimal part of an amp. Thus, 210 may be taken as 2 volts .10 amps. There are, unfortunately, exceptions, and these are the stumbling blocks which render the system a failure. Thus in the 6 volt class will be found a valve by one maker which is known as the 256, which instead of being a 2 volt .56 amp valve is actually a 6 volt .25 amp. type. In this case the figures are reversed. It should be noted that this particular valve maker does not endow his valves with any indication of type, and it will be found that in the two-volt class every valve bears the initials P.M., and the only difference between a 2 volt .2 amp super-power valve and a 2 volt .3 amp. pentode is the addition of the figure 2. Thus the former is known as the P.M.2A and the latter as the P.M.22A. In general, however, it should not be difficult for the novice to choose a valve if he bears the above notes in mind. The letter states the purpose and the figure denotes the rating of the filament.

**NEXT WEEK!**

Another Important Article by HANS VOGT, entitled: "IMPROVEMENTS IN IRON-CORE COILS."

### A Suggestion to the B.V.M.A.

Perhaps it would not be out of place now to suggest that the British Valve Makers' Association should in future adopt the system which is adopted in America and give a number for each type of valve, irrespective of the maker. Thus a valve bearing the number 10 would be a screen-grid valve; a number 12 could be a variable-mu; a 15 would be a detector, and so on. To identify the individual make this number could be followed by the initials or first syllable of the maker. This would remove all difficulty, and if you wanted a Marconi screen-grid valve you would ask for a 10MAR, or if you preferred a Cossor it would be a 10COS.

*Second Article*

# CHANGING FASHIONS in SET DESIGN

By H. J. BARTON CHAPPLE,
*Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.*

BY the end of the second year of broadcasting, the position, as far as the average home constructor of sets was concerned, was this: He was able to make a receiver having from two to four or five valves, and capable of receiving, say, a dozen stations at what we should now call medium loud-speaker strength, but at a quality which no modern listener would tolerate for a moment. Selectivity was not so essential as to-day, yet the sets of the period were so flatly tuned that interference was one of the most frequent topics in the technical Press.

The receivers at this time may be conveniently divided into three groups. First were those with detector and one or two low-frequency stages, corresponding to a form of set which is even now not entirely obsolete. Then there were similar sets with the addition of one high-frequency stage, and finally others with two or more high-frequency amplifiers. At first the circuits of all were much the same; leaky grid detector, transformer coupled low-frequency stages, and either tuned anode or tuned transformer H.F. stages, or else aperiodic high-frequency couplings of the transformer type.

Three typical circuits are reproduced in Figs. 1, 2 and 6, from which it will be seen that there was nothing very striking about the sets from the design point of view, and I can assure you there was nothing very striking in the performance either.

**Valves with a Dual Purpose.**

The need for economy in low-tension current brought about some interesting developments. Chief among these was the "reflex" circuit—or rather circuits, for there were several variants of the principle. The idea was to make use of a valve for a dual purpose. By various ingenious systems of feed back, one valve would be made to function as both radio frequency and low-frequency amplifier, or as both amplifier and detector. In one of the most popular arrangements, a crystal was employed as detector, and of the two valves, one acted in the dual capacity of high-frequency and low-frequency amplifier, while the second valve was simply the output stage. In another, a single valve served as H.F. and L.F. amplifier and was supplemented by a crystal detector, while in a third type of set no crystal was used, but one valve acted as H.F. amplifier and detector while the other looked after the audio-frequency side.

It was about this time that special power amplifier valves came into common use—bright emitters, consuming about one ampere at 6 volts, but capable of handling more power than the general purpose valve. With them came the need for negative grid bias—hitherto practically unknown in the average set. Once the idea of special purpose valves had gained a footing, the number of types began to increase. First of all valve makers began to grade the general purpose bright emitter valves into H.F. and L.F. types. The differences between the two were not great, and I believe I am right in saying that at first, at any rate, the grading was done by selection from each batch manufactured, and not by any differences in design.

**Studying the Problems.**

Problems of reception and of set design were being studied systematically and mathematically, however, so that it was not long before the desirable characteristics of a valve for any particular purpose were fairly accurately known, and the methods by which these characteristics could be assured in manufacture were discovered.

Having now obtained more efficient valves, from the receiving point of view—although still very uneconomical in current consumption, set designers were now faced with difficulties in using them to the best advantage.

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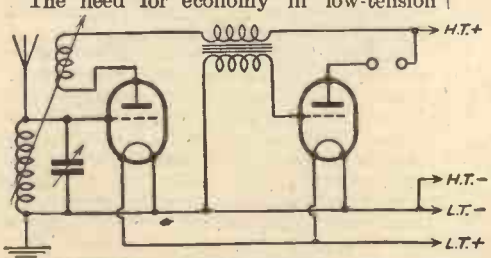



*Fig. 1.—Early 2-valve detector with magnetic reaction.*

*Fig. 3—An early type loud-speaker.*

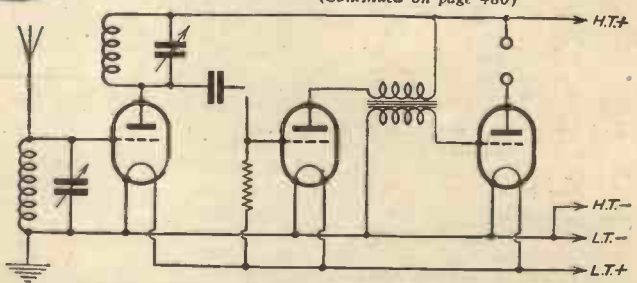



*Fig. 2.—Early H.F. detector and L.F. with tuned anode coupling unneutralized.*

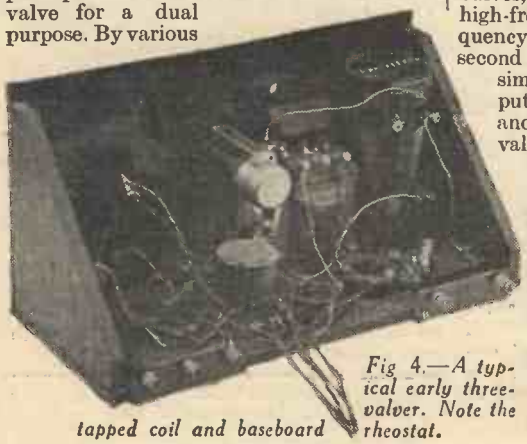


*Fig 4.—A typical early three-valver. Note the tapped coil and baseboard rheostat.*

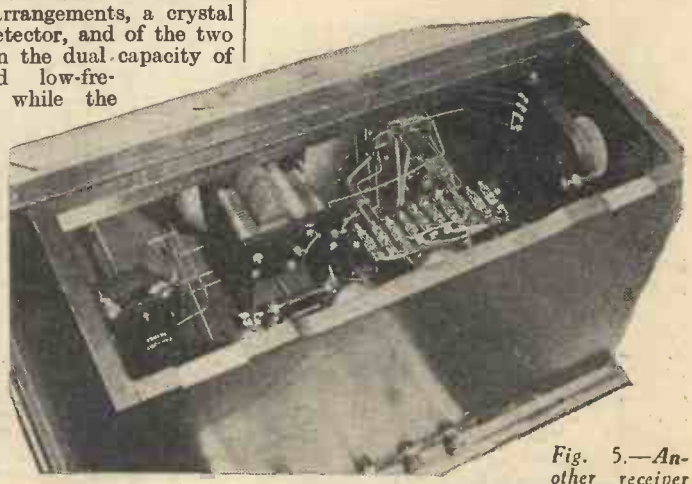


*Fig. 5.—Another receiver showing elaborate switching and coil connecting devices.*

(*Continued from page 479*)

The actual difficulty which designers had to face at this time was that the three electrode valve, used as a high-frequency amplifier, could only be employed very inefficiently. In those days, the inter-electrode capacity of the average valve was appallingly high, and a substantial portion of the amplified high-frequency energy in the anode circuit of the H.F. valve was transferred back to the grid circuit through this capacity. Besides, no attempt was made to screen components and circuits from each other. It is true that it was generally recognized that wiring and components should be spaced widely apart to prevent interaction, but even in the best sets a very serious amount of unwanted high-frequency coupling took place.

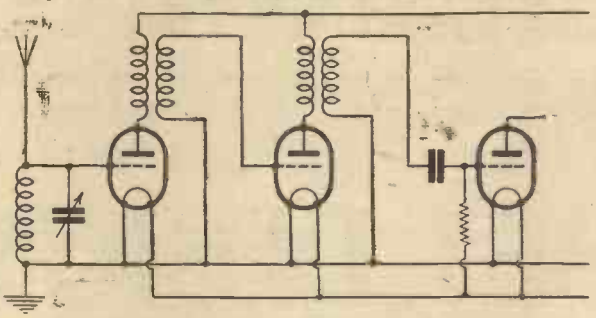


*Fig. 6.—Typical untuned H.F. transformer coupling.*

**Instability.**

As a result, high-frequency stages were very prone to instability, especially if, by careful design of the tuned circuits, anything like a high-stage gain was attempted. In fact, stage gain was chiefly limited by considerations of stability. In order to maintain stability damping was often deliberately introduced in the grid circuit of an H.F. valve—curing one trouble by creating another! So the overall efficiency remained still very low.

Then came the first of the revolutionary discoveries—that of the neutralized high-frequency stage. The new principle worked on these lines. The chief cause of instability was feed back between the anode and grid circuits within the valve, the practical effect being that energy so fed back was reamplified again and again until the valve went into oscillation, that is, generated more energy than was put into it, and more than the circuit could absorb. The solution—neutralizing—was found in permitting a similar amount of energy to be fed back, not through the valve, but through a special outside circuit, in such a way that the two feed backs cancelled out each other.

Fig. 7 shows how this was done. The dotted condenser C1 represents the inter-electrode capacity of the valve—actually there was no condenser, but the valve electrodes acted as one. The neutralizing feed back was taken from the outer end of a centre tapped anode coil, through a small adjustable condenser, the capacity of which was varied until the two feed backs were identical in amount.

**Different Reaction Control**

This invention immediately increased the efficiency of high-frequency amplification several hundred per cent., for it enabled more efficient tuned couplings to be used without introducing instability. It did not go all the way, however, because even then no one had thought to prevent unwanted magnetic coupling between components by screening. But there was, undoubtedly, a great improvement in spite of this.

Simultaneously with these developments in high-frequency amplification, improvements in other parts of the circuit were taking place. The crude swinging coil magnetic reaction, which was difficult to control to any degree of delicacy, began to give place to capacity controlled reaction on the Reinartz principle, a modification of which is still the normal method of applying reaction to-day. By the new form of reaction control, the tuning of the set was not so greatly affected by changes in reaction—and this was an important point because, although there was no "ganging" to be upset, most receivers with any pretence to sensitivity and selectivity had at least three tuned circuits, all of which had to be separately adjusted, and matters were not made any easier if the tuning of one coil varied with the degree of reaction.

**Dull Emitter Valves**

It was then that the valve manufacturer stepped in again and made a further contribution to radio progress. Their next effort was the production of the first dull emitter valves. As early as late 1923 the "peanut" or "Weco" valve appeared—

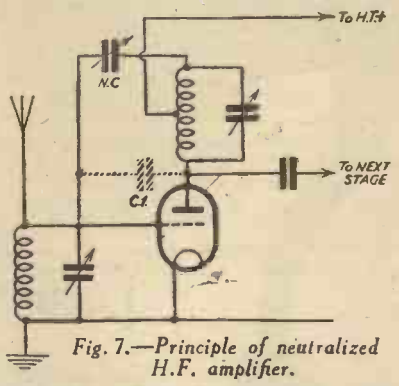



*Fig. 7.—Principle of neutralized H.F. amplifier.*

a diminutive tube for dry-battery operation, taking a quarter of an ampere at 1 volt. These valves, however, did not gain a very firm hold in this country. They were of American origin, and required special holders; and before they could be firmly established British dull emitters were forthcoming. With a low tension consumption of about .3 amp. at 4 volts, the first types were rated as H.F. and L.F. valves, and represented a great reduction in battery power over the old bright valves. These were closely followed by dry battery valves taking .06 amps. at 3 volts, but in spite of this still greater economy, dry battery valves did not "take on" very well, and the 4-volt accumulator still held the field, valve types being rapidly produced in H.F., L.F. and power classes, and taking about .1 amp. at 4 volts for filament heating.

This brings us to the autumn of 1925 and the early days of 1926, and we may here pause to glance through a file of old catalogues and magazines of that period.

**Circuits Again**

The chief constructional circuits cover four and five-valve sets—and even some six valvers having so called "straight" circuits, as opposed to super-hets. By the way, super-hets. had come in a year or more earlier, but deserve, and must receive, a special chapter to themselves. Four tuned circuits are not uncommon—each individually adjusted. Panel sizes are, of course, inflated in proportion. Here is a specification for a 5-valve set—ebonite panel, 24ins. by 8ins.—and to-day we do without ebonite entirely!

Here is another set. Detector and two L.F. circuit much as employed in thousands of homes to-day—but oh! those variable components! There are variable grid leaks, three filament rheostats, main tuning condenser with vernier reaction condenser, as well as several jacks for inserting 'phones and loud-speaker. Another five-valver has neutralized H.F. valve, detector, and three resistance capacity low-frequency stages.

But here is something distinctly new—a five-valver with a three-gang condenser and canned coils. So it has been found out at last that every little bit of unnecessary coupling must be avoided if the full benefit of neutralized valves and high-efficiency tuned circuits is to be reaped. In fact, so efficient has high-frequency amplification become, it would appear that it is necessary in some of the more advanced sets to make provision for volume control. The methods adopted are crude in the extreme—a filament rheostat in the low-tension supply to the high-frequency valve.

**Even Push-pull**

Another straw which shows the way the wind is blowing—some of the more advanced sets have condensers fitted with slow-motion drives. It is evident that tuning is getting sharper! And no wonder, for the number of "plug in" coils used is growing less and less. Efficient low-loss coils, with aerial taps, sometimes wound with "litz"; special so-called "low-loss" condensers—all must be having a profound effect on the efficiency of tuning.

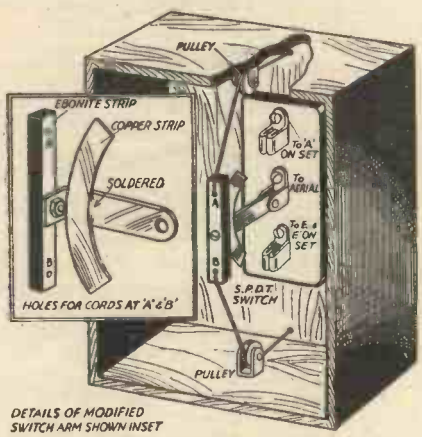
But the point which stands out most prominently at this period is the comparatively small part that valve choice plays in the design of the set. Description after description can be seen in the technical Press of the period, in which no mention whatsoever is made of the type of valve to be employed. As a matter of fact, in most cases valves of the general purpose type were used throughout, including the output stage, and I have before me, as I write, a specification of a five-stage set in which two general purpose valves are used in push-pull! Fancy trying to operate a loud-speaker nowadays with two detector type valves in push-pull in the last stage!

Actually, the period 1925–1926 was one in which circuits and circuit components were passing through the fire, and many of the foundations of modern radio technique were being laid. Both manufacturers and listeners were learning their lessons, and upon the work done at that time much of the present-day achievement is based. But at the same time, important developments were being hatched in the research laboratories and factories. The time was rapidly approaching when valve makers would fire off another of their wonderful bombshells which would turn reception models inside out, and register a direct hit on another milestone in radio history. For in the very next year there appeared two entirely new types of valve, leading to radical changes in set design.

# READERS' WRINKLES
## The HALF-GUINEA Page

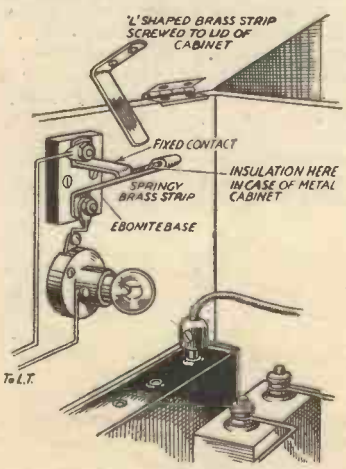
### An Enclosed Aerial-Earth Switch

THE accompanying sketch shows an earthing switch I have used for some time. It saves opening the window or going outside to switch the aerial on or off. The device consists of a single pole double-throw switch, the knob on the moving blade being removed, and a strip of ebonite about 2½in. long by ½in. wide bolted in its




*An enclosed aerial-earth switch.*

place, for keeping the cord away from the copper contact strip, which is a little longer than the ebonite, as shown. The curtain runners should be placed so that when the cord is pulled the copper strip is well home in the aerial clip. I use Bowden brake wire joined on to the cord, and the wire passes through a small hole in the beading round the window, between the frame and the window sash and through a small hole in the inside beading, and finishes with an acorn as a pull-button. When the top wire is pulled the aerial is connected to the set, and when the bottom wire is pulled the aerial is earthed. The box can be screwed to the mast or wall.—R. D. LUCAS (Stockwell).




*A simple arrangement for switching a pilot light.*

### THAT DODGE OF YOURS!

**Every reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.**

### Interior Set Lighting

THE sketch illustrates a simple arrangement for lighting the interior of the set whilst adjusting G.B. plugs, coil tappings, etc. It is made as follows: A lamp-holder and bulb are conveniently placed inside the set (say, at the back of cabinet). Immediately above the lamp-holder a switch device is mounted, consisting of a small panel to which is screwed two strips of brass, one of which is slightly longer than the other (see sketch) and is, if desired, tipped with a piece of insulating material. The switch is actuated by means of an L-shaped piece of strip brass, which is fitted to the lid (just above the switch) and is so arranged that it comes into contact with the longer strip of the switch when the lid is lowered, thus parting the contacts and opening the circuit. When the lid is opened the contacts come together again, thus closing the circuit and lighting the bulb.—J. G. SIMPSON (Durham).

### A Cabinet for the Experimenter

THE chief drawback of the new type of cabinet described some time ago in PRACTICAL WIRELESS is the difficulty in fixing the hinges so as not to spoil the cabinet (Fig. 1). A much simpler way in which to accomplish the same object is to remove the nails or screws which fix the sides of the cabinet to the bottom (Fig. 2) and to replace these with four hooks and eyelets. In the majority of cabinets the back is cut away at the bottom to allow for the terminal strip, and no adjustment is therefore necessary at the back. To remove the section of the cabinet it is then only necessary to disengage the four hooks and the side, back and top may be lifted off in one piece, leaving the panel, baseboard, terminal strip with all connections intact and accessible, Fig. 3.—CHARLES E. KIDD (Scarborough).

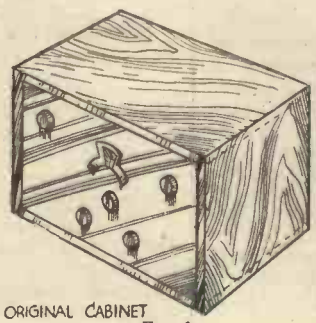



*Fig. 1.*

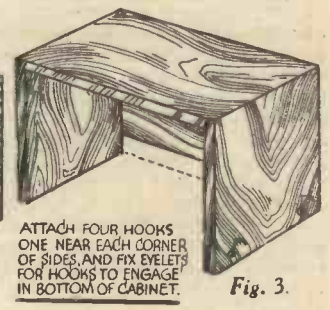



*Fig. 3.*

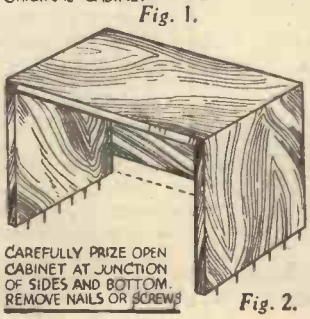
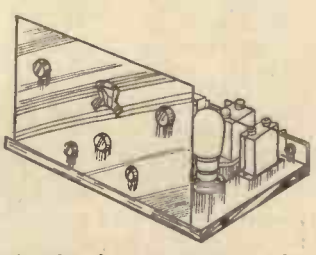
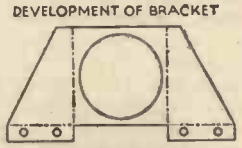
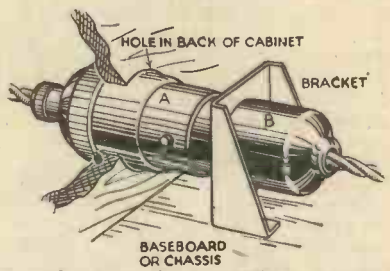



*Fig. 2.*



*An idea for an experimenter's cabinet.*




*A useful dodge for interlocking a mains-connector.*

### An Interlocked Mains-Connector

THE accompanying illustration shows how to interlock an eliminator or mains set so that it cannot be opened until the current is off. The flex from the mains terminates in an ordinary lamp socket A. This goes through a hole in the back of the cabinet, and connects to a lamp adaptor B, which is mounted on a bracket on the baseboard. The baseboard cannot be pulled out without first removing the lamp socket. In addition to being inexpensive, this arrangement has the advantage over more complicated switch interlocks, that, although unauthorised persons are prevented from gaining access to live parts, the experimenter can conveniently connect up the set for test purposes without replacing it in the cabinet.—F. G. R. (Newcastle-on-Tyne).

*(Continued overleaf)*

## RADIO WRINKLES

(Continued from previous page)

Fig. 1.

Fig. 2.

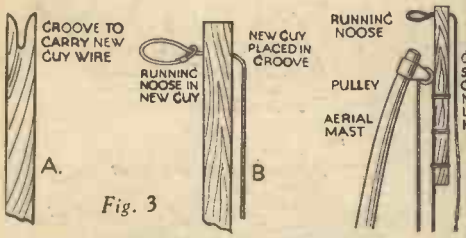



Fig. 3

*Method of fixing an aerial straining wire.*

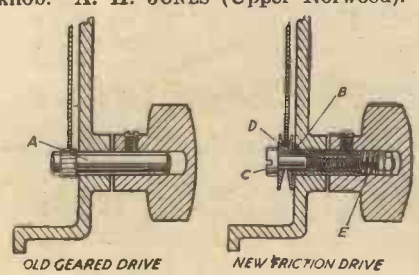
### Fixing an Aerial Straining Wire

IF you have an unsightly aerial, as shown in Fig. 1, and desire to make it appear as in Fig. 2; or, not having a straining wire already, and wishing to place one on your pole, the following method shows how it can be done without having to remove pole from the ground.

The method is to obtain a stick or broom handle about 4ft. long, make a cleft in one end as at A (Fig. 3). The cleft stick is fastened to pulley rope, tying it in two or three places, but leaving 2ft. from the top free. Now make a loop in the wire with a running noose, and secure this in the cleft of the stick as indicated at B (Fig. 3). Proceed to hoist stick and wire carefully, and you will find that the looped wire can be raised above the top of aerial pole, providing pulley is within 18in. of top. By carefully twisting the pulley rope, the loop can be manœuvred over the top of pole, when, by lowering pulley rope and tugging at the wire, the new strainer will bind itself at a point above the pulley. The straining wire can then be pegged down where required.—E. DAVEY (Plymouth).

### An Efficient Friction Drive

THE accompanying sketch shows a way of utilizing a geared slow-motion dial which has been scrapped because the teeth have stripped, or because of backlash, if the teeth are well worn. The method is to convert it into friction drive. Most of these geared drive dials have a large spindle, as shown at A. This is removed, and a piece of brass tube (which is an easy fit in the hole) has a bevelled washer sweated on one end, as shown at B. A screw, C, has another washer, D, also bevelled (with a file) slipped on it, passed through the tube, then a spring E and two small nuts, as shown. All that remains is to fit the knob.—A. H. JONES (Upper Norwood).




*An efficient friction drive.*

### Economizing in H.T.

IT is seldom realized, and, as far as I know, no attention has ever been drawn to the fact that where a battery set is fairly heavy on H.T., or where another L.F. stage is added to a set which has previously worked on a standard battery, a more economical scheme than purchasing new, double-capacity batteries can be effected by obtaining a further standard capacity battery. In the case of some sets using three or four valves the arrangement shown in the sketch (Fig. 1) will be cheaper and more efficient. Take a 3-valver as an example. (*Do not couple a new H.T. to an old one.—Ed.*)

I have naturally omitted decoupling reaction, etc. In view of the fact that many people to-day make use of the cheaper H.T. batteries, from necessity, this method is cheap and efficient. I have used a 60-volt block for Det. and 1st L.F. with good results.

An alternative method is also practicable, although slightly less efficient. The leads from detector and 1st L.F. are taken to

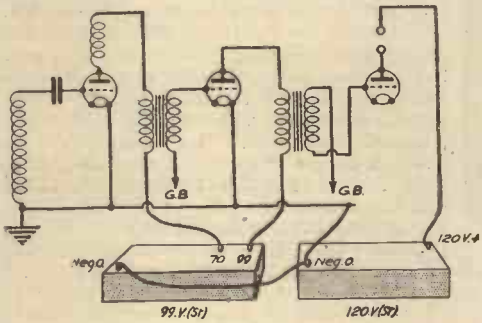



Fig. 1.

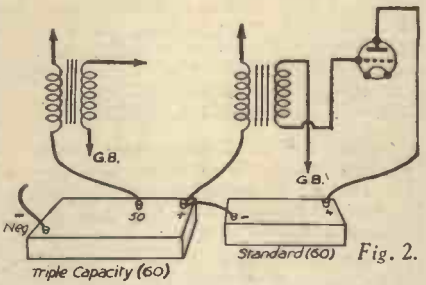



Fig. 2.

*Connecting up batteries for economizing in H.T. current.*

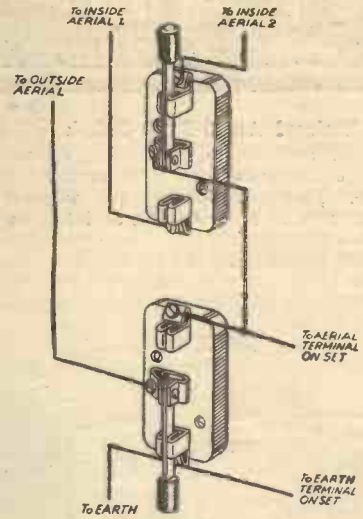
60 v., and the last H.T. lead to 120 v., as shown in Fig. 2.—F. PALMER (King's Lynn).

### An Aerial Switching Arrangement

FOR the short-wave listener, who usually has a separate aerial, or perhaps two, for the short waves, and also retains one for the broadcast band, this wrinkle should be useful, for it will save the necessity of plugging in the appropriate aerial and also save any possibility of confusion, at the same time providing an earthing switch. The switches used are the single throw type, as used for earthing the aerial.

With the top switch open and the bottom switch up, the outdoor aerial is connected to the set, and with the top switch still open and the bottom switch down, the outdoor aerial is earthed. With the bottom switch open, the top switch may be closed up or down, thus connecting the desired aerial of the other two.

If you wish to go all out for the 100ft.

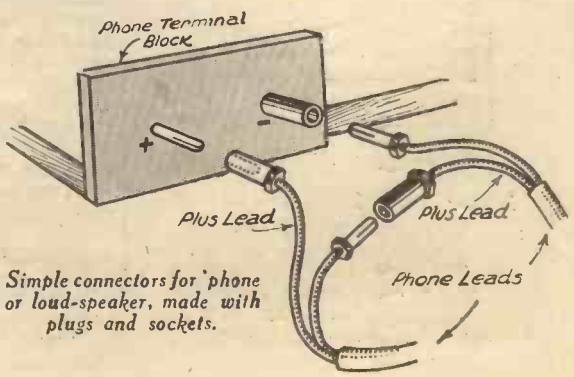



*An aerial switching arrangement.*

allowed by the B.B.C. licence, close the bottom switch up and the top one either way, thus connecting two aerials. You will find there are many variations of this idea. For instance, if you wish to try a counterpoise earth, the switches can be connected to include this, instead of one of the aerials. The connection to the set need never be undone, and I have made mine a permanent job.—ARTHUR COOK (Manchester).

### Simplified 'Phone or Loud-speaker Connection

THE alteration made to the telephone or loud-speaker leads, shown in the accompanying sketch, has been found to be exceedingly useful, firstly because it is impossible to connect the leads wrongly to the set (as if this is done the magnets will become demagnetized) and, secondly, that it is a very simple matter to connect an extra pair of 'phones or loud-speaker. The sketch is practically self explanatory, an ordinary plug being substituted for the plus terminal on the set, and a socket for the other terminal. The existing tags are then removed from the 'phone leads, and the plus lead connected to a socket. The other 'phone lead is joined to a plug. Additional 'phone or loud-speaker leads may be treated in a similar manner.—F. N. P. (Ruislip).

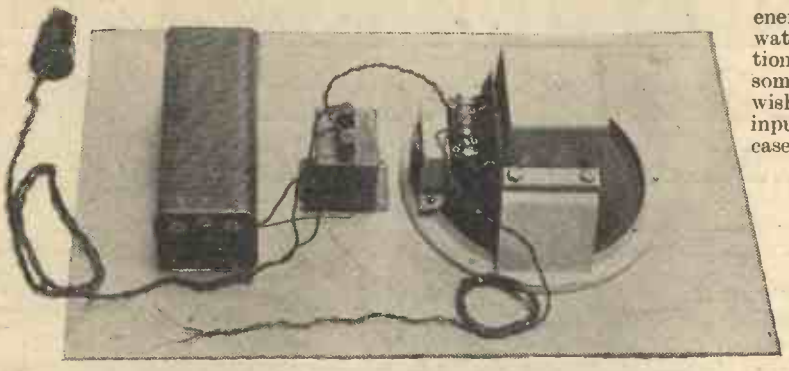



*Simple connectors for 'phone or loud-speaker, made with plugs and sockets.*

# ENERGIZING MOVING-COIL LOUD-SPEAKERS FROM A.C. MAINS

With Particular Reference to Westinghouse Metal Rectifiers. By A. P. ROGERS.

THE question of providing a suitable source of supply for operating moving-coil loud-speakers from A.C. mains, is one of some importance, as it will generally be found when purchasing this type of loud-speaker where no rectifier is provided. The reason for this, of course, is that in some cases the speaker field winding will be required for use in receiver circuits as an extra smoothing choke, in which case the rectifier is unnecessary.



From the foregoing remarks it will be realised that when it is required to excite a moving-coil speaker separately from A.C. mains, some form of rectification must be employed.

The Westinghouse metal rectifier will be found to be particularly suitable for this work, as apart from giving a permanent output, it provides a very economical method of obtaining the required D.C. supply, as in the majority of cases no mains transformer is required. Excluding the permanent type of speaker which requires no field excitation, the models on the market at present may be

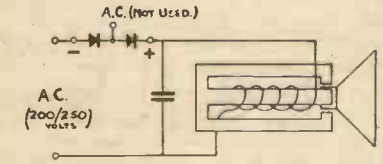



*Fig. 1.—Half-wave rectification without a mains transformer.*

roughly classified into two divisions, *i.e.*, high and low resistance field windings. We will consider the high resistance type first—this class covers those having resistances of 2,500 ohms to 7,500 ohms or more.

It will be noted that the majority of speakers in this class are wound for voltages between 110 and 190. This enables half-wave rectification to be employed direct from the mains, without the use of a mains transformer, the speaker being energized at its maximum wattage even after the voltage drop through the rectifier has been accounted for. This, of course, only applies to cases where the speaker is operated from 200-250 volt mains.

The circuit is shown in Fig. 1, the H.T.8 rectifier being recommended for field windings, of resistance between 2,000 and 5,000 ohms while the H.T.7 rectifier may be used for values above 5,000 ohms.

It must be noted that in all cases where a transformer is not used, it is imperative to avoid any earth connection on the D.C. side. The reason for this is that in many cases one side of the mains supply is earthed, it is therefore possible to short-circuit the live side of the supply to earth, resulting in serious damage.

### The Voltage Doubler Circuit

Where the loud-speaker is to operate on mains of 110-120 volts A.C., the voltage doubler circuit should be used. This circuit is shown in Fig. 2, and may also be used for speakers requiring a greater watts input, *i.e.*, consuming 100 milliamps at 200-250. In the latter case a transformer must be used to provide the correct input voltage to the rectifier.

It is sometimes advisable to use the voltage-doubler circuit for field-windings of the high resistance class. For example, a field winding of 6,500 ohms or 7,500 ohms may be wound for a voltage of 200-250. It is obvious that if half-wave rectification is used, and that the mains voltage is 200, the speaker will not be energized at more than 3 watts. Although this excitation should be sufficient for some speakers, users may wish to use a greater watts input to the field, in which case the voltage-doubler circuit should be employed in conjunction with a suitable mains transformer. This will increase the field excitation to 6 watts.

| Field-winding Resistance. | Recommended Rectifier. | Circuit. | Speaker excitation in volt-amps. |
|---|---|---|---|
| 2,000 or 2,500 ohms. | H.T.8. | Half-wave, with 4 mfd. Reservoir Condenser. | 5—9 |
| 4,700 ohms. | H.T.8. | Half-wave with 4 mfd. Reservoir Condenser. | 4—8 |
| 5,500 ohms. | H.T.7. | Half-wave, with 8 mfd. Reservoir Condenser. | 3—6 |
| 7,500 ohms. | H.T.7. | Voltage-Doubler with two Resr. Condensers of 4 mfd. each, and suitable mains transformer. | 5 |
| 6 to 8 ohms. | L.T.4 | Rectifier and Mains Transformer as in Fig. 3. | 6 |
| 12 | L.T.5. | Rectifier and Transformer as in Fig. 3. | 12 |

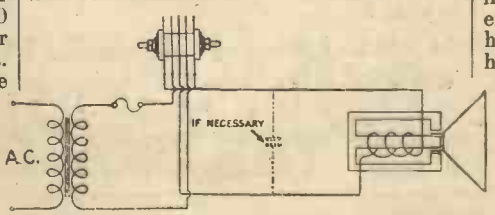



*Fig. 3.—Low voltage energized speaker field.*

### Low Resistance Field Windings

We now come to the low resistance types of speaker, these usually have field windings between 6 and 12 ohms. The rectifiers recommended are styles L.T.4, L.T.5, L.T.6, A.4 and A.6. These rectifiers operate in the bridge circuit, which gives full-wave rectification, and usually no reservoir condenser is required, as the inductance of the field winding is found to give sufficient smoothing.

It may occur, however, that a low inductance winding is used, in which case an electrolytic condenser of 1,000 to 2,000 microfarads should be connected across

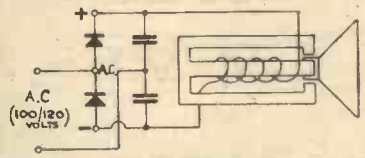



*Fig. 2.—A voltage doubler used with an energized field.*

the field-winding. It will be essential to use a mains transformer with all the low-tension rectifiers in order to provide the correct input voltage. The circuit is shown in Fig. 3.

It may be of interest to constructors to have a table giving the recommended rectifier for use with the field-windings most commonly met with. It is obvious that it would be impossible to compile a table giving the required particulars for every combination of field-winding, mains voltage and input watts required.

The tabulated data shown, therefore, applies only to mains voltages between 200 and 250, and for field-windings encountered in general practice.

It should be remembered that the installation of a moving-coil speaker, with its greater sensitivity to low frequencies, may reveal faults in the receiver which in the past have been unnoticed. For example, it may be found that a slight hum is present after a moving-coil speaker has been installed, with the result that the excitation of the magnet is blamed. It must be realised that if the eliminator circuit is insufficiently smoothed, this would be apparent by the greater sensitivity of the speaker. It is recommended that if hum is experienced, the search should first be made in the smoothing and decoupling circuits.

# ANOTHER GUARANTEED RECEIVER!


## An Outstanding Receiver which b... Leading Wirel...

THE first part of this receiver to be constructed is the baseboard, and this should be carefully carried out in order to ensure that the mounting of the components, the wiring, and the final stability of the receiver are made easy and certain. It will be seen from the illustrations that the baseboard is supported on side runners in accordance with the system which has now been adopted by us as standard. This enables the majority of the smaller components to be mounted below the surface of the baseboard and makes for neatness, and short and efficient wiring. The side runners in this particular receiver are one and a half inches deep, and two of these will be required, ten inches long. The baseboard is supplied with the cabinet and is fourteen inches long by ten inches wide. For the runners it is preferable to use three-eighths or half-inch batten and not ordinary plywood, as this can be obtained ready cut to width, and it is therefore only necessary to saw off the two lengths and true edges are available for attaching to the baseboard. Two screws, one at either end, will hold these runners in position, but they should not be affixed until all the holes have been drilled. From the wiring diagram (or the blue print, if you obtain one) place all the components on the baseboard and carefully pencil round them lightly. This will enable you to position screw holes, clearance holes for the valveholders, and the small holes used to pass the wiring from one side of the baseboard to the other. When marking the position of the valveholders, use a 4-pin holder, and mark the centre through the hole which is left in the centre of this component. It should, of course, be stood upside down for the purpose. When this preliminary marking out has been accomplished, cut out the large holes and drill an eighth of an inch hole for wiring purposes, with a small hole to start all the screws at the requisite positions. Now affix the side runners, and proceed to mount the individual components.

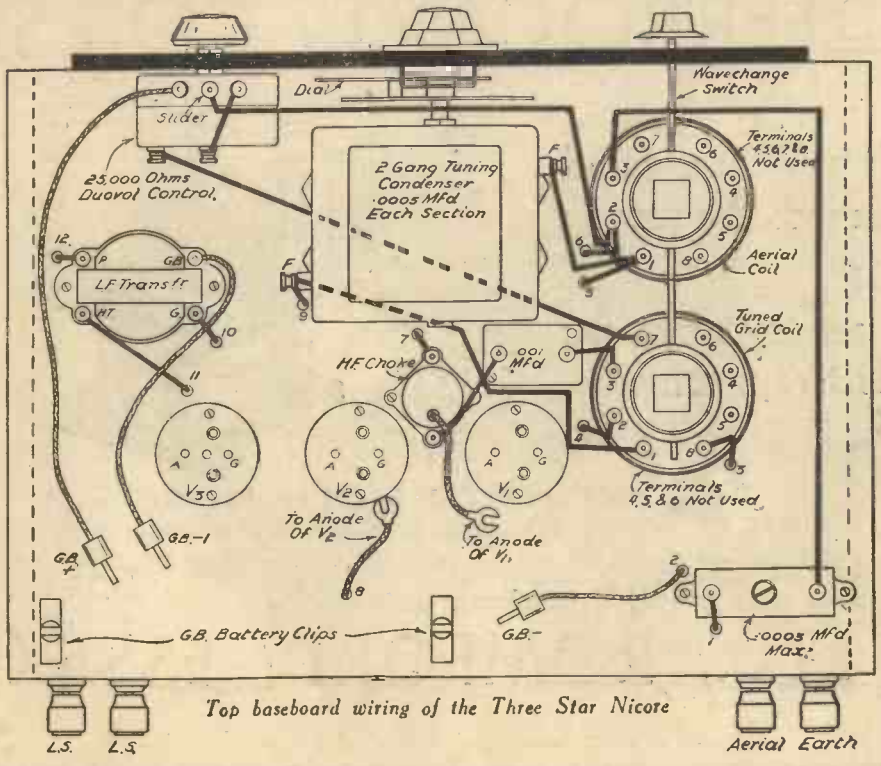
*Side view of the Three Star Nicore*

### Mounting the Components

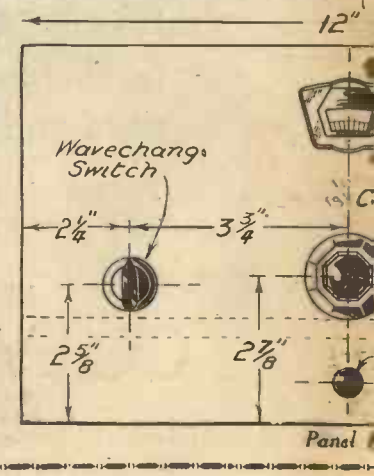
The valveholders should be mounted first, noting carefully the arrangement of the valve pins. Next turn the baseboard upside down and mount all the sub-baseboard components. When this has been completed turn the base over and mount the remaining components, remembering to replace the coil and condenser screens as soon as

### LIST OF COMPONENTS FOR

One pair Varley Nicore Coils.
One J.B. Two Gang Unitune Condenser (.0005 mfd.).
One British Radiophone Duovol Control with 25,000 ohm resistance.
One Igranic Midget 3-1 L.F. Transformer.
One Wright and Weaire H.F. P.A. Screened Choke.
One Lissen H.F. Choke (L.N. 5092).
Four Graham Farish Ohmite Resistances—5,000, 10,000, 20,000 and 150,000 ohms.
One Graham Farish 1 megohm Grid Leak.
One T.C.C. "S" Type Condenser, .01 mfd.
One T.C.C. Type "S" Condenser, .0001 mfd.
One T.C.C. 50 Type Condenser, .25 mfd.
Three T.C.C. Type 50 Condensers, 1 mfd.
One T.C.C. Type "S" Condenser, .001 mfd.
Two Clix 4-pin valveholders.
One Clix 5-pin valveholder.
One Bulgin Junior 3-spring switch.
One Sovereign pre-set condenser, .0003 max.
One Belling-Lee 5-way Battery Cord.
Two Belling-Lee Terminal Mounts.
Four Belling-Lee Type B Terminals (Aerial, Earth, L.S.— and L.S.+).




*Top baseboard wiring of the Three Star Nicore*



# Three Star NICORE

**Full-Size Blueprint may be obtained for 1/- from the Offices of this Journal.**

## mbodies the Ideas of Three of the less Designers

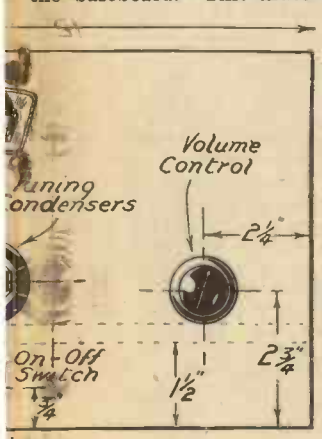
the mounting is completed. By doing this there will be little risk of damage occurring to these components. Now take the panel and mark a centre line from top to bottom, and with the baseboard and wiring diagram as your guide, mark a line along the panel

### THE THREE STAR NICORE

- One pair Bulgin Type 3 Grid Bias battery clips.
- Three Belling-Lee Wander Plugs—G.B.+, G.B.1 and G.B.2.
- Two coils Glazite, odd length flex, screws, etc.
- One Becol Ebonite Panel, 12in. by 7in.
- One Carrington "Aston" Senior Cabinet, with baseboard, 14in. by 10in.
- Two Side Runners, 10in. by 1½in.
- One Cossor 220 V.S.G. (metallized).
- One Cossor 220 S.G. (metallized).
- One Cossor 220 H.P.T.
- One Smith's "Anodex" 120 volt H.T. Battery.
- One Smith's "Anodex" 16 volt G.B. Battery.
- One Smith's 2 volt, 40 amp. L.T. accumulator.
- One Blue Spot 29 P.M. Loud-speaker.
- One British Radiophone Receptru Lead-in.
- One Graham Farish Filt for earth.
- One Bulgin Indicator Q.M.B. Lightning Switch.

Approximate cost of all the above parts, £12 15s.

corresponding with the upper surface of the baseboard. This must be done very carefully or the condenser escutcheon will be found difficult to set in its correct position. The template supplied with the condenser should then be trimmed up and laid on the back of the panel with the baseboard line and centre line in their respective positions, when the escutcheon window and spindle clearance hole may be marked. The window may be cut out by drilling a number of small holes, or a fretsaw may be employed for the purpose. The clearance hole for the spindle may be slightly smaller than recommended by the makers, provided it is accurately positioned. If you are at all uncertain regarding the accuracy of your marking out, use the drill size recommended, and there will be no risk of the spindle binding on the side of the hole. Now place the panel up against the baseboard with the spindle coming centrally through its clearance hole, and make certain that the table, workbench, or object upon which the baseboard is standing is perfectly level. Make a mark corresponding to the level of the spindle which controls the switching in the Varley coils, and check this by the wiring diagram. This should be 3¾ in. from the centre line, and three-quarters of an inch above the level of the baseboard. On the opposite side of the centre line mark a similar hole to accommodate the Duovol control, and three-quarters of an inch from the lower edge of the panel, and on the centre line, make a hole to accommodate the Bulgin switch. Two or three small screw holes, countersunk, should finally be drilled in order to attach the panel to the baseboard.



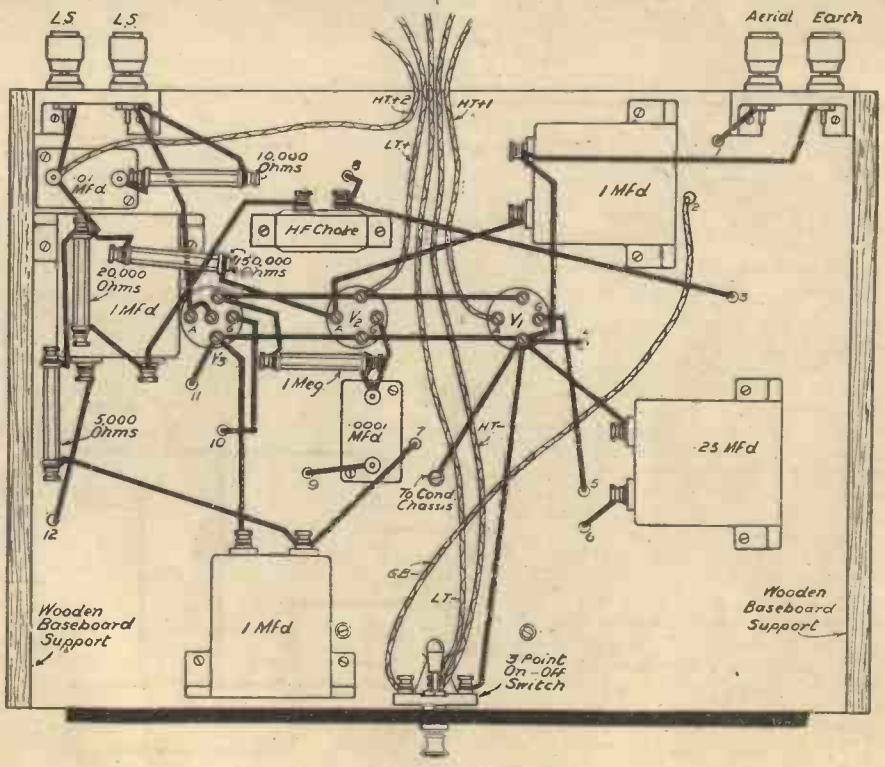
*layout*


*The finished Three Star Nicore in the Carrington Aston Senior Cabinet*

### Wiring Up

Mount the switch on the panel, and then the Duovol control, noting its correct way round from the wiring diagram, and attach the panel to the edge of the baseboard. Three-quarter-inch screws will be found quite suitable for this purpose, as there is no weight to be carried by the panel, and the condenser control knob and switch knob of the coils help to hold it in position.

(Continued on page 500)



*Sub-baseboard wiring*

# The Why & Wherefore of GRID-BIAS

In this Concluding Article, FRANK PRESTON, F.R.A., Explains the effect of Grid Current and Voltage and its Relation to Selectivity

**The Effect of Grid Current.**

Now let us go to the other extreme and suppose the valve is given a normal bias of 1 volt negative. The result is shown in Figure 6. Although the grid is made negative to the extent of 1 volt, each positive half-cycle of signal voltage "wipes out" the negative bias and actually makes the grid positive. When this happens some of the electrons shot off by the filament are attracted to the grid itself and therefore current will flow between the grid and filament through the transformer secondary or grid leak (depending upon the form of inter-valve coupling employed). It is rather difficult to explain fully in simple language, but the grid current causes a voltage drop across the coupling component, and results in a lower voltage being passed on to the grid. Thus all the positive half-cycles will be reduced in intensity so that the anode current variation will be as represented by the broken line to the right of Figure 6. Again the wave-form has been changed, and in consequence, distortion is the inevitable outcome.

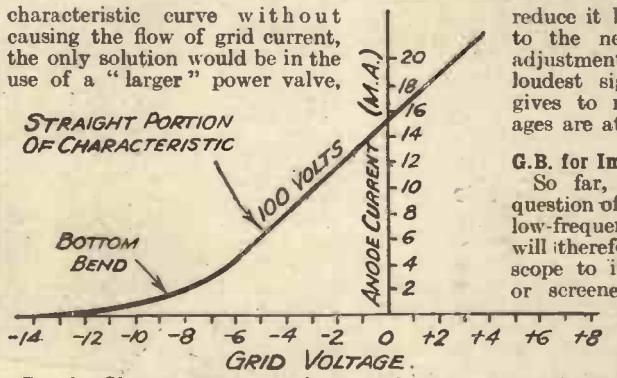



*Fig. 6.—Characteristic curve for typical small power valve. This shows how anode current varies with grid voltage.*

**Correct G.B. Voltage**

We have observed that the result of too much or too little grid bias, so it is not difficult to appreciate how it should be adjusted to be "just right." Obviously it must be somewhere between the two extremes we have considered. It must be so arranged that the signal voltages cannot drive the valve past its "bottom bend" or at any moment cause the grid to become positive (Fig. 7). The valve in question could be biased to any voltage between about 5 and 2 volts negative, but for the sake of economy we should naturally employ the higher voltage in practice, so as to keep down the current consumption to its lowest limit.

The figure we have just decided on would, of course, only apply when the signal voltage applied to the grid was 4. If it was less than this, slightly more bias could safely be employed, but if it was more, the bias voltage would have to be reduced. Should the signal voltage be so great that it could not be accommodated on the straight part of the characteristic curve without causing the flow of grid current, the only solution would be in the use of a "larger" power valve, that is one having a longer straight part in its characteristic curve (Fig. 8).

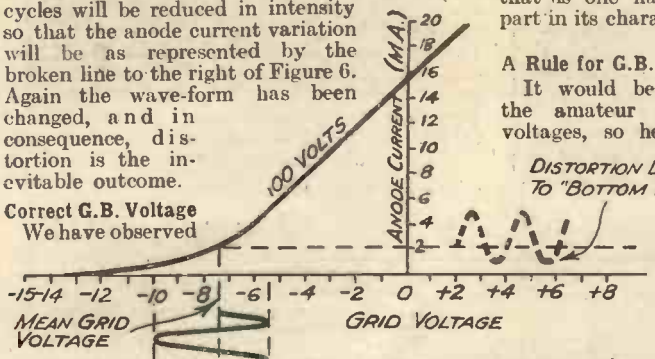



*Fig. 7.—Showing the effect of signal voltages on the valve when it is biased to 7½ volts negative. "Bottom bend" distortion occurs.*

**A Rule for G.B. Adjustment.**

It would be quite impossible for the amateur to measure the signal voltages, so he must adjust his grid bias by "ear." The simplest rule to follow is to increase the bias step by step until (bottom bend) distortion is just perceptible; then reduce it by moving the wander plug to the next lower tapping. This adjustment should be made on the loudest signals which the set ever gives to make sure that their voltages are at maximum.

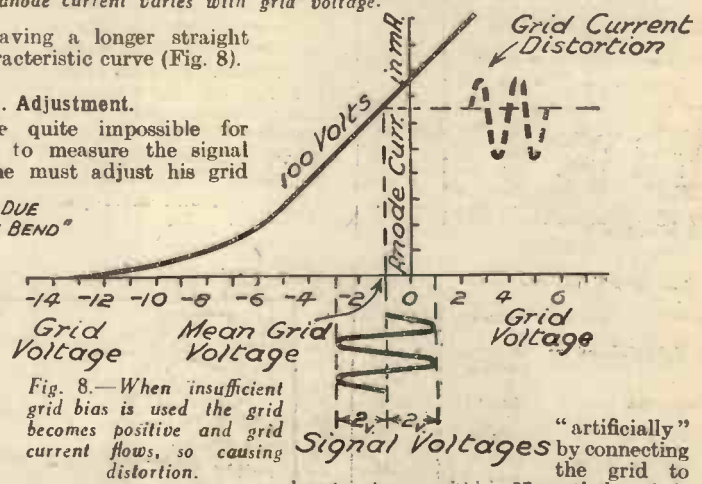



*Fig. 8.—When insufficient grid bias is used the grid becomes positive and grid current flows, so causing distortion.*

**G.B. for Improving Selectivity.**

So far, we have considered the question of grid bias only as applied to low-frequency amplifying valves. It will therefore be well to extend our scope to include the high-frequency or screened-grid types. It is not customary to employ "direct" negative bias with such valves since a sufficiently high potential can generally be provided "artificially" by connecting the grid to low-tension negative. Nevertheless, it is a fact that much better selectivity can frequently be obtained by the use of a small additional bias up to about 1½ volts. The reason is that on powerful signals the grid is likely to be made slightly positive. When this occurs there is a flow of grid current, as we saw before, which "damps" the tuned circuit and produces a noticeable lack of selectivity. To anyone who finds that his S.G. receiver does not tune sharply enough I would strongly recommend the use of grid bias for the H.F. valve. The modification required is very slight and is shown graphically in Figure 9; the connection between the end of the aerial tuning coil and earth is broken and a .25 mfd. non-inductive fixed condenser inserted; a lead is then taken from the coil to a tapping on the G.B. battery.

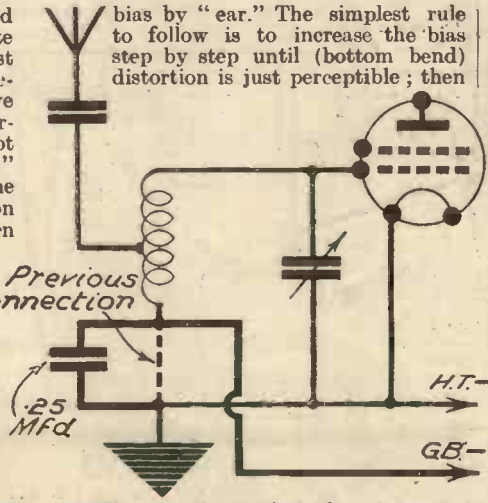



*Fig. 9.—Showing the method of applying grid bias to a high-frequency valve.*

Test the voltage of your grid bias battery every few months and replace if it has fallen by any appreciable amount.

One other point; do not forget that the G.B. voltage might have to be reduced periodically, as the H.T. battery runs down.

# The BEGINNER'S SUPPLEMENT

THE EASY ROAD TO RADIO

*Conducted by F.J. CAMM*

**Kathode** *See CATHODE.*

**Kilocycle**
A thousand cycles. See *CYCLE* and *FREQUENCY.*

**Laminated Core**
Transformers, chokes, etc., used in the low-frequency part of a set have iron or iron alloy cores around which the wire is wound. The object of the iron core is to increase the number of lines of force which pass through the coil or coils of wire. The iron concentrates the magnetic field. If, however, it is made of solid iron it has one great disadvantage. Electric currents known as eddy currents are set up in the iron and this leads to a waste of power and so makes the transformer or choke less efficient than it might be. To stop these currents, the core is broken up by constructing it from a large number of separate sheets of iron as in Fig. 1. These are usually varnished on one side or else separated by thin sheets of paper. The separate sheets are known as *laminæ* and the core is called a *laminated core.*

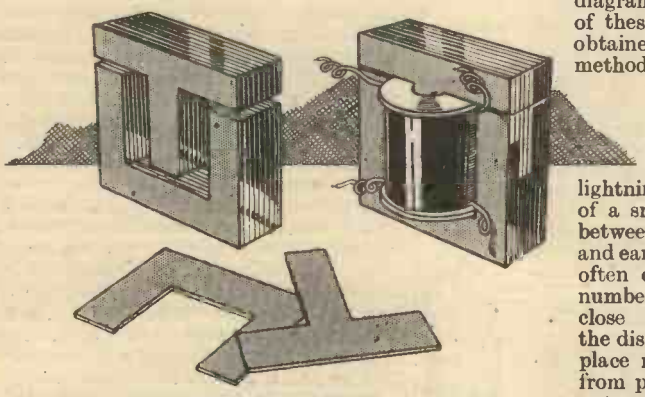


*Fig. 1.—How a laminated core is built up showing its use in a transformer.*

**Lines of Force**
A magnetic or electric field (see *FIELD*) is supposed to consist of definite lines along which the force acts. These are called *lines of force.* If the lines are close together then the field is strong, and if they are wide apart then it is weak. The concentration and distribution of the lines of force around a coil or a magnet can be controlled to a certain extent by means of shielding with metal screens or by the introduction of iron cores, etc. A simple experiment illustrating the position of the lines of force around a magnet is shown in Fig. 3. A piece of paper is placed over the magnet and iron filings are sprinkled on the paper. The filings will arrange themselves as shown. In the same illustration is given a clearer diagram of the disposition of these lines than can be obtained with the filings method.

## THE BEGINNER'S A B C OF WIRELESS TERMS

(*Continued from June 17th issue, page 459.*)

**Lightning Arrester**
A device for protecting the aerial from damage by lightning. It usually consists of a small spark gap placed between the aerial and earth. This gap often consists of a number of points close together as the discharge takes place more readily from points. It is not necessary for a spark to actually jump the points for the device to work, since a heavy charge will ionise the air between the points and leak across in that manner. Examples of lightning arresters and how they are connected is given in Fig. 2. The use of a lightning arrester does not in any way affect the working of a receiver since there is no actual connection between the aerial and the earth.

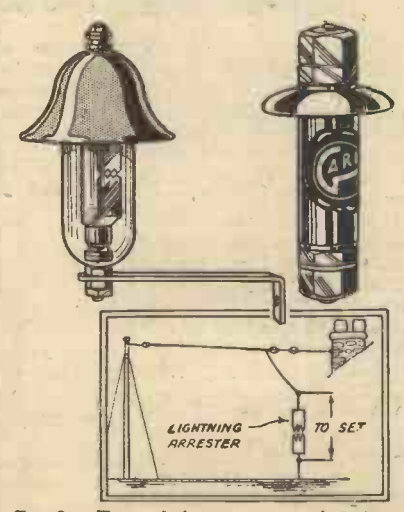



*Fig. 2.—Two different types of lightning arrester. Inset shows how an arrester is connected.*

**Loading Coil**
A coil connected in series with the aerial coil to increase its range.

**Log-law Condenser**
A variable condenser with vanes of a certain shape. With nearly all the early types of variable condenser the plates were semi-circular. This, of course, made the change in capacity for a given degree of movement of the vanes the same over any part of the scale. With the log-law, or logarithmic to give it its proper name, the vanes are shaped differently. As the knob or dial is turned the increase in capacity for each degree on the dial becomes greater as the upper end of the scale is approached. Actually, the term "logarithmic" is derived from the fact that the angle of movement of the vanes is proportional to the logarithm of the change in capacity.

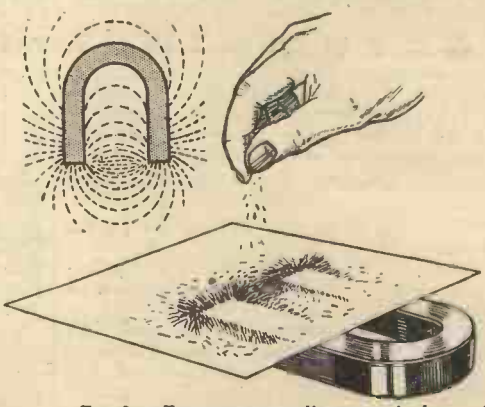


*Fig. 3.—Experiment to illustrate the lines of force around a permanent magnet.*

The advantage of the logarithmic type of condenser is that the various stations being received are more evenly spaced over the dial. With the old type condenser stations spaced equally apart as regards wavelength or frequency tune-in bunched together at the lower end of the dial and spread out at the upper end. Thus, as the knob or dial is turned, starting from the minimum setting of the condenser, stations appear in quick succession for the first few degrees of movement and then gradually spread out until they are quite wide apart towards the upper end of the scale.

# WORKSHOP HINTS FOR THE RADIO EXPERIMENTER

## DRILLS AND DRILLING

By W. H. DELLER.

THE best known type of drill is that of the twist or spiral flute type, but there are several other types, notably the straight flute type, such as are included and contained in the hollow handle of some of the better makes of hand drills, and the flat or harpoon drills. For general purposes the twist drill is the best, as it permits being reground until worn out, has a constant cutting rake during its life, maintains its size, and is self clearing. Straight flute drills are handy, particularly for drilling brass and aluminium. Flat drills are useful for drilling small holes in fairly thin material, but for hand work are very liable to run when drilling deep holes.

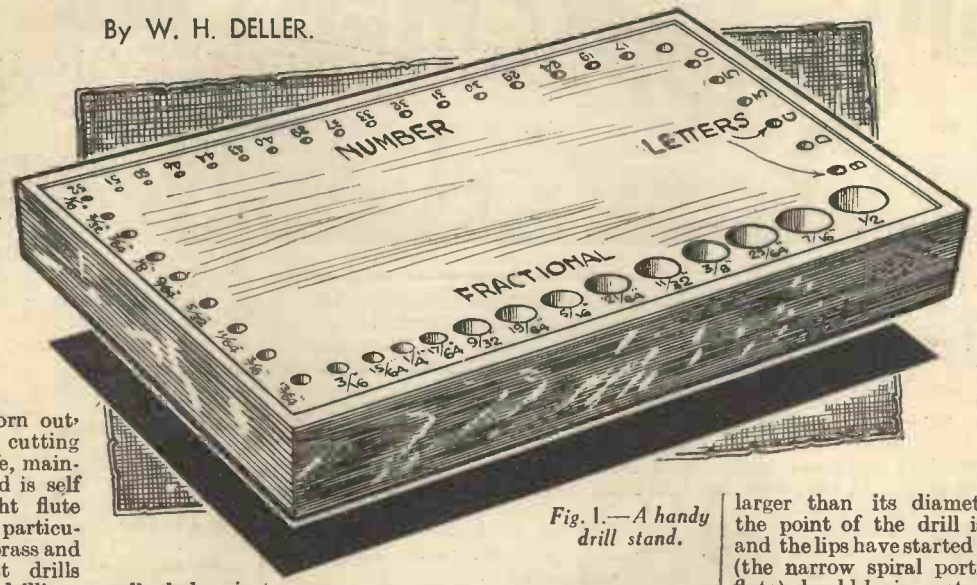



*Fig. 1.—A handy drill stand.*

Standard twist drills are commercially obtainable in fractional sizes ranging from 1-64in. diameter to 1in. diameter by increments of 1-64in., in wire sizes from No. 80 (.0135in. diameter) to No. 1 (.2280 in. diameter)—80 different sizes in all, and in letter sizes from Letter A (.2340in. diameter) to Letter Z (.4130in. diameter).

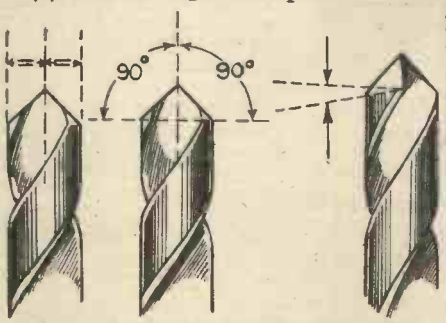
These drills may be purchased separately, or are to be had made up in sets and mounted in wood or aluminium stands provided with holes to suit the drill shanks. Each hole is distinctly marked with its respective drill size, so the task of selecting a correct drill is made easy.

For wireless work, however, most requirements are covered in the tables given in our Free Gift Data Sheets.

These drills, and a 7-16in. and ½in. diameter and possibly a few extra fractional sizes below ½in., should complete the range required. To keep them together and instantly found, a drill stand might be made as shown in Fig. 1.

When resharpening becomes necessary this should be done by grinding. Drills that do not get a lot of use may be sharpened with an oil stone to restore a keen edge. When regrinding, follow the original ground faces as close as possible, grinding from the back and finishing at the cutting edge of each face. After grinding examine the drill for the following points :—

(1) That the point is central.
(2) That the angles are equal.




*Figs. 2 and 3.—Make certain, after grinding, that the backing off and angles are equal*

(3) That the backing off is equal (see Figs. 2 and 3).

Where any appreciable thickness of metal has to be drilled it is a good practice to thin the point of the drill, that is, where the same is unduly thick. This will make the drill cut faster, and also less pressure will be required on the drill. Fig. 4 shows how to do this.

It is very noticeable, when drilling brass, aluminium, or ebonite, how the drill is inclined to "bite" into the material. A remedy for this is to grind the face at the cutting edges slightly to reduce the cutting rake (Fig. 4).

When using an ordinary twist drill for countersinking, to prevent chattering occurring during cutting, the cutting clearance on the drill lips should be reduced to a minimum, so that the drill is almost rubbing. This will produce a clean-cut countersink in any material.

To produce flat-bottomed holes, such as are required to accommodate the heads of cheese-headed screws, the hole or holes are first drilled to take the shanks of the screws and opened out with another drill to take the head. This drill is then ground off flat and backed off, as seen in Fig. 5, and the drilling continued with it to the correct depth.

When a drill is incorrectly ground it will cut a hole larger than its diameter. As soon as the point of the drill is into the material and the lips have started cutting, both lands (the narrow spiral portions against each flute) should be in contact with the edge of the hole (Fig. 6); if as shown in Fig. 7, it indicates that either the point is out of centre or that the angles are unequal.

Holes requiring to be drilled at an angle with a square face or through the edge of a piece of round material as shown in Fig. 8 should be started by commencing to drill square with the work until a hole about 1-16in. deep (full diameter) has been drilled, and then gradually bring the drill over to the desired angle, keeping the drill cutting slightly whilst so doing. Holes that have started slightly out of position may be pulled over in this manner.

Rose cutters, such as that illustrated in Fig. 9, are used for countersinking; resharpening when necessary is done with a small oil stone.

Two types of counterbores for larger holes are shown in Fig. 10. These are used by first drilling a small hole for the pilot to work in, and afterwards using as an ordinary drill until the desired depth is obtained. Large holes may be drilled out in this manner, but when dealing with ebonite, to prevent any raggedness when breaking through, the material is best drilled from either side.

*(Continued on page 498)*

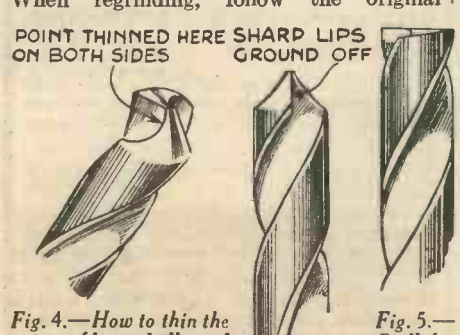



*Fig. 4.—How to thin the points of large drills and how to avoid "greediness" when drilling soft metals.*

*Fig. 5.—Drill for flat-bottomed holes.*

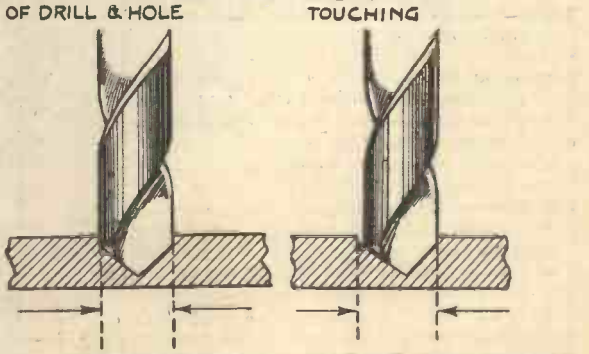



*Fig. 6.—A correctly ground drill.*

*Fig. 7.—A drill incorrectly ground will cut a hole larger than its diameter.*

# TELE-TALKIE TOPICS

By H. J. BARTON CHAPPLE, Wh.Sch., B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

HAVING seen how our single turn spiral of holes punched in the disc (which is made to rotate anti-clockwise) causes the scanning at the receiving end to take place, so that hole movement is from bottom to top, and we see an experimental television receiving apparatus built up for reproducing such images of long, thin shape.

No doubt as the science progresses, international uniformity will ensue, otherwise it will be impossible to tune in the different transmissions on one machine alone and watch intelligible images.

Let us, however, confine our initial remarks to the present B.B.C. transmissions which conform to the Baird standard. With our disc scanning we shall have a resultant area of light exposed which resembles somewhat the shape shown in Fig. 3. There are two concentric arcs, AB and DC, with two radial lines, DA and CB, inclined to one another at an angle of twelve degrees for the thirty line image, the hole shown as a square at B being the first hole of our spiral, while that at D is the last one.

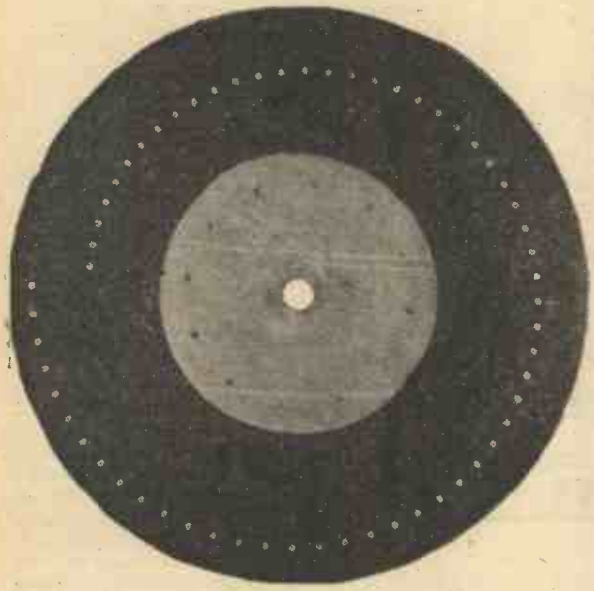


*Fig. 1.—Showing how a disc can be marked out to give a long narrow picture.*

### Proper Relationships

First of all the true *height* of the picture according to present reckoning is the chord AB and not, as one might generally expect, the arc AB. The actual measurement should be made on the circle traced out by the outer edge of the first disc hole. Coming to the *width*, this is the radial distance CB, or the difference in radii between the inner edge of the last hole and the outer edge of the first hole. With strip movement from right to left, we must examine our disc problem a little closer. It is not simply a case of saying that one requires a picture width of, say, one inch, and then dividing this distance by thirty (for the present B.B.C.'s transmissions) and marking off these lengths along consecutive radii.

(*Continued overleaf*)

### Picture Ratio

The first thing is to ascertain what "picture ratio" is employed for the particular television transmission it is desired to watch. Unfortunately at the moment there is no uniformity in this connection. In this country we have an image field which is seven units high and three units wide, in Germany they have four units wide and three units high, while in America the bulk of the television transmissions are worked on a square picture.

To give the reader some idea of how this picture ratio business works out, Fig 1 should be studied. Here we have a disc with sixty holes (actually it is a transmitting disc) and the resultant picture secured with this is a long oblong one. It is very suitable for the transmission of printed messages, such as one sees in the form of a moving news bulletin above big stores. This particular use for television is referred to as Telelogoscopy, and in Fig. 2

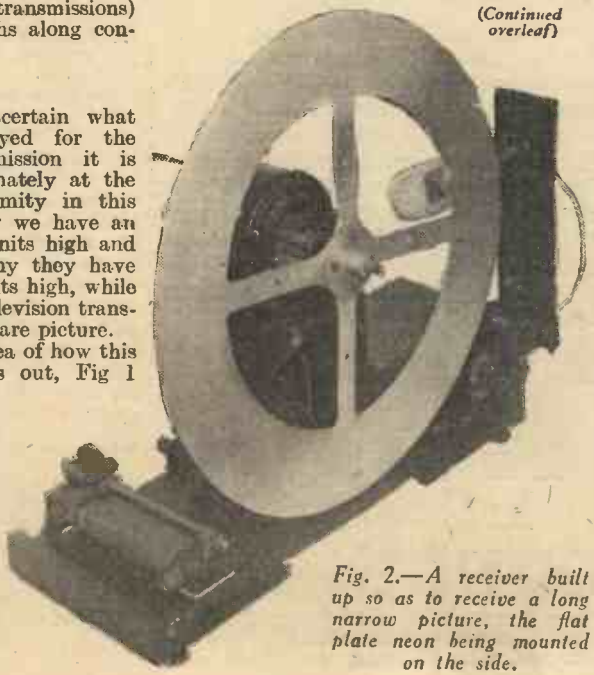


*Fig. 2.—A receiver built up so as to receive a long narrow picture, the flat plate neon being mounted on the side.*

*(Continued from previous page)*

the present standard we are, therefore, able to establish the very simple relationship that :—

$$\frac{\text{Chord AB}}{\text{CB}} = \frac{7}{3}$$

Now both these quantities can be calculated very simply, but unless readers expressly ask for it I will not worry them with the slight amount of mathematics involved in the derivation of the equation below. Generally, what we desire to know in our disc construction is the width or distance CB for any given disc radius. As a rule the outer edge of the first hole is punched so that it is half an inch inside the outside periphery of the disc, so if we let the letter R be the distance from the disc centre to this first hole's outer edge, we have the equation:

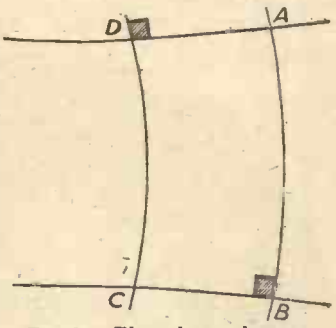



*Fig. 3.—The relation between width and height of the television picture.*

$$\text{Width CB} = 0.08959\ R$$

Now our disc hole must have a given area and the most economical way of using this area is to make it up in the form of a square. If we had a circular hole of diameter equal to the square side, then we should lose light equivalent to the shaded area shown in Fig. 4. Hence, if you desire to secure the *best* possible results, have square holes in your scanning disc and the size can be calculated very simply from the equation given for the width CB. In the case under review, namely, thirty line scanning, it is necessary merely to divide this distance by the figure 30.

*Fig. 4.—The dark areas which appear when using a round hole in the scanning disc.*

**Hole Sizes**

To help readers I have compiled the table shown below (all dimensions in inches). The first column gives sizes for the radius R, which is the distance of the *outer* edge of the first hole from the disc centre, the second column gives the actual picture width, while the last column is the size of the square hole which must be punched in the disc. The most popular size of disc is one with an external radius of ten inches, having the first hole starting-half an inch in from the edge. R in this case, therefore, becomes 9.5 inches and our hole size 0.0284 inch. In my next article I will give a you few hints on marking out and punching the disc holes.

| *Radius R.* | *Picture Width.* | *Hole Size.* |
|---|---|---|
| 12.0 | 1.0751 | .0358 |
| 11.5 | 1.0303 | .0343 |
| 11.0 | .9855 | .0328 |
| 10.5 | .9407 | .0313 |
| 10.0 | .8959 | .0299 |
| 9.5 | .8511 | .0284 |
| 9.0 | .8063 | .0269 |
| 8.5 | .7615 | .0254 |
| 8.0 | .7167 | .0239 |

# RADIO RAMBLINGS

By JACE

## Jottings from my Notebook

### G.B. and Class "B."

ALTHOUGH I feel ashamed to admit it I recently fell into a very foolish trap whilst making myself a Class "B" set. Everything was to be really up-to-date so I used one of the new short grid base variable-mu valves, Ferrocart coils, automatic volume control, tone compensation and—as mentioned—a Class "B" output stage. Following the idea of making everything foolproof it was decided to use automatic grid bias for the "driver" valve. Being a battery set, the only way to do this was to include a resistance in the H.T. negative lead. Well, the correct value was calculated, taking the average H.T. current as a basis, but on trying out the set there was hopeless distortion. Why?

This is not given as our weekly "Problem," but you have probably solved it already. It took me quite a few minutes to realise what I had done wrong. Of course, it is impossible to use automatic G.B. with a Class "B" set because of the constant variation in high tension current. Assuming the use of a 500 ohm bias resistance the grid bias applied to the "driver" valve would vary from 5 volts at minimum (say 10 mA.) H.T. current to 25 volts at maximum (about 50 mA). Consequently the "driver" valve would quickly be changing between the completely "choked" to the "grid current" state, and only at rare intervals would it be correctly biased.

### A New V.-M. Valve

IN the last paragraph I referred to the new short grid base variable-mu valve. Perhaps you have not yet heard of this, for it has only just come on to the market. As the name implies, this valve requires only a small change in G.B. voltage to regulate its amplification from maximum to zero. Actually, the valve is capable of reducing the volume of a nearby station down to a mere whisper when given 4½ volts negative grid bias. It should become very popular for Class "B" sets which only require a small bias voltage for the "driver" stage, since it will remove the necessity for an unduly large G.B. battery.

It is still more useful when A.V.C. is employed, and will make possible the incorporation of quite effective automatic volume control even with comparatively insensitive battery sets in which the signal voltage on the grid of the detector is small. As yet the short grid base V.-M. is only made by one firm, but others will doubtless follow suit in the near future.

### Catkins

VARIOUS reasons have been given in the Press for the naming of the recently-introduced "Catkin" valves which have previously received mention in PRACTICAL WIRELESS. I saw it stated in one journal that the name bore reference to the shape of the copper anode, but I must say that I can see very little resemblance between this valve and the "pendulous inflorescence of the willow birch" (*vide* my dictionary). Actually the word "Catkin" is evolved from the letters C.A.T. which mean "cooled anode transmitter," and are applied to certain transmitting valves which dissipate an enormous anode wattage, and require to be cooled by passing a constant stream of water round them. You know, of course, that huge radiators on the principle of those used on cars, are employed for this purpose at all the B.B.C. transmitting stations.

Catkin valves are for receivers only, and do not require to be water cooled. But at the same time their anodes are cooled by being exposed to the air; the valves are, therefore, of the cooled anode type. This is an undoubted advantage for mains valves and should result in longer valve life.

### Non-Microphonic

ANOTHER advantage of Catkins is that they are entirely non-microphonic due to the use of a rubber bush between the electrode system and the cap. Besides this, however, the electrodes are very rigidly supported by mica washers so that they are very nearly immune from vibration.

For those readers who intend to try out the new valves it should be mentioned that they have characteristics identical with those of existing types, so that absolutely no circuit alterations are required. Due to the larger anode area efficient screening is essential, but this is adequately provided for in the V.-M. and detector patterns by the fitting of an efficient perforated screening can.

### The Waveband Question

ONE is constantly rubbing up against the difficulty of waveband nomenclature. We speak of long, medium, short and ultra-short waves, but whilst some regard those wavelengths between 200 and 600 metres as "short," they are "medium" to others. The same difficulty occurs lower down the scale; ultra-short waves are sometimes regarded as those below 50 metres, sometimes as below 20 metres and yet again as below 10 metres.

The trouble has been brought about by the increasing use made of shorter and shorter wavelengths for broadcasting purposes, but it should soon be overcome if a definite ruling on the question is given at the Lucerne Conference. The proposal to be submitted there is that the various wavebands should be split up as follows:—long waves, from 3,000 metres upwards; medium waves from 200 to 3,000 metres; medium short waves, from 50 to 200 metres; short waves, from 10 to 50 metres and ultra-short waves, below 10 metres.

# Facts and Figures

## Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

### BRITISH RADIOPHONE SLOW-MOTION DIALS

THE new geared dials which are being produced by The British Radiophone Company are rather more elaborate than those already obtainable. As may be seen from the illustration below, they take the form of a straight-line dial or the usual semi-circular scale, and the pointer is the chief part of interest. In place of the customary rotating scale and fixed hair-line, the scale in these models is fixed, and a thin pointer moves across the dial. The method by which this is driven may clearly be seen from the right-hand dial, and it proves a much more efficient arrangement than the moving scale drive as the whole scale is exposed to view, and the direction of rotation is clearly seen for any desired station. Although the condenser plates, and consequently the control-spindle has to rotate through 180 degrees, the scale does not occupy such a large section owing to the method of driving the pointer. This results in a really neat escutcheon and window, the latter being already attached to the scale. Fitting is very simple, as the base of the drive is fitted with feet drilled to accommodate fixing screws. The movement is very smooth and free from backlash, and the appearance of the escutcheon is really handsome. It will be found worthy of a place in the very best of receivers and may be thoroughly recommended to our readers. The price is 8s. for the straight-scale model and 8s. 6d. for the curved, and either model may be obtained with frosted glass to facilitate the marking of individual stations.

*New British Radiophone slow-motion dials.*

### WATBRO ACCUMULATOR CHARGER

FROM Messrs. Watkins Bros. we have received an interesting trickle charger designed to enable the listener to charge his own accumulators from A.C. mains. This particular model is rated at 1 amp., and is designed for 2 or 6 volt cells. A small plug is fitted underneath the case and two sockets are provided on an insulated strip. These sockets are clearly marked 2 volts and 6 volts, and the plug is inserted into the appropriate socket before connecting the accumulator to the red and black sockets on one end of the case. The latter is finished in a neat blue crystaline, and the rectification is carried out by means of a Westinghouse Metal Rectifier. The price of this model is 25s. 6d., and a further model is available at 22s. 6d., giving .5 amps. Where larger accumulators are in use, up to 12 volts, a special 1 amp model is obtainable at 29s. 6d. A robust transformer is fitted, and adequate ventilation is provided. The charger proves a sound investment, especially where the normal charging rate is excessive or the charging station is situated some way off.

*Watbro accumulator charger.*

### CLIX AMERICAN-TYPE VALVEHOLDERS

TO the interesting range of Clix Chassis-type valve-holders, three new models have now been added. These are illustrated on the centre of this page and it will be seen that the valve-leg spacing is rather different from that to which we are normally accustomed. This is on account of the fact that they have been designed to accommodate the American valves, which, as most of our readers are aware, do not employ the British method of spacing. The particular models shown employ 4, 5 and 6-pins and the prices are 7d., 8d. and 9d. respectively. American valves are obtainable from several firms in this country, and although at the present moment an action is pending regarding the sale of these valves in England, there are no doubt many readers who are desirous of trying receivers employing the chassis method of construction and American valves. To these experimenters the holders will no doubt prove invaluable. They are of the same type as the standard Clix holder, having self centring legs and adapted to accommodate solid pins. The ends of the legs are slotted for enabling the connecting wires to be soldered into position.

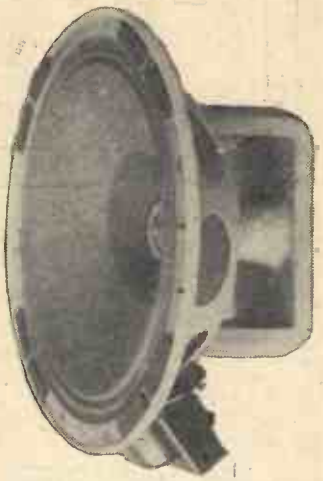
*Clix American valve chassis-type holders.*

### THE MARCO AERIAL ELIMINATOR

THIS is a simple little device selling at 2s. It consists of a small cylindrical box with two coloured leads projecting from one end and a single long lead from the other end. The instructions are to connect the coloured wires to the aerial and earth terminals of the receiver, and the long single lead to any good earth connection, when the device functions in place of the usual aerial and eliminates static, lightning risk, etc. Upon examination the device was found to consist of a small cylindrical type of fixed condenser which was included in series between the long lead and one of the short leads, whilst the remaining short lead was wrapped round the fixed condenser and sealed in place. On test it certainly gave very good results, and although not so good as a really efficient outside aerial, it provided a good choice of stations on the receiver with which it was used. It is guaranteed against any manufacturing defect for twelve months, and cannot wear out or break down in any way. To those who are situated in such a position that they are unable to erect a good outdoor aerial this device will be found most useful. The arrangement is, of course, much favoured in America.

### BULGIN 7-PIN HOLDERS

A NEAT 7-pin valve-holder is announced to be released to the home-constructor by Messrs. Bulgin. It will be available in two types, one selling at 6d. and the other at 9d. The cheaper model is fitted with split contacts, and the other model has resilient wiping contacts. These were primarily designed for manufacturers' use, but it has now been decided to release them for the use of the home-constructor.



*R.K. Model P.M. major loud-speaker.*

### NEW R.K. SPEAKER

THE Edison Swan Electric Company announce a new addition to the range of R.K. loud-speakers. This is the P.M. major, and is illustrated on this page. A special 8in. moulded cone is employed in conjunction with a high-grade permanent magnet. A 3-ratio output transformer is fitted suitable for use with triode, pentode or class B valves. The impedance of the speech coil is 2 ohms, and the power which can be handled is 4 watts undistorted. The primary resistance of the transformer is approximately 360 ohms with an inductance of 20 to 30 henries. The makers of this speaker recommend the following values for a filter when using a pentode valve. Condenser .01 and resistance 25,000 ohms. The speaker is finished in a cadmium plating

### BLUE SPOT MODEL 45 P.M.

THE loud-speaker illustrated below is the Model 45 P.M., manufactured by the Blue Spot Company, and this retails at 45s. It is a very well-made model and embodies several interesting refinements. This is the speaker which is incorporated in the cabinet model which was described on this page in our issue dated June 3rd, and the reproduction is naturally of the same order. A simple and ingenious method of mounting the transformer is utilized, where the rear of the foot upon which the speaker stands is provided with sockets very clearly marked. There are four sockets, and combinations of these enable any type of valve to be matched correctly to the speaker. The magnets are enclosed by dust-proof plates so that there is no risk of metal fillings or other foreign matter getting into the air gap and so giving rise to distressing noises or mechanical damage. It is a very good speaker and may be thoroughly recommended.

*The Blue Spot 45 P.M.*

### COSSOR MODEL 533A—CORRECTION.

IN our issue of June 17th, the price of the Cossor All-Electric Model 533A (A.C. Mains) Receiver was given as £17 17s., complete, or with pedestal, £1 1s. extra. These prices should be £13 15s. and £1 respectively

# Practical Letters from Readers.

**The Editor does not necessarily agree with opinions expressed by his correspondents.**

### "Really Invaluable"

SIR,—I must thank you for the prompt attention my letter, asking for the encyclopædia, has received. I am delighted with it; it is indeed a splendid piece of work, and Mr. Camm and the staff of PRACTICAL WIRELESS are to be heartily congratulated. Also the data sheet binder is amongst my treasured possessions, and I might add that the data sheets have already solved many a problem for me. In your volume and data sheets I have something really invaluable. —P. C. VIVIAN (Johannesburg).

### "Sez Us!"

SIR,—I thoroughly agree with the thought you express on page 351, column 3, of your issue for May 27th. I refer to the paragraph "Tele-Controlled Radio" (lines 2 to 5), and to which I might add an Americanism, "sez you!"—W. R. CUMMINGS (Dumfries).

### "Always First"

SIR,—I should like to thank you for PRACTICAL WIRELESS. It is a paper we have wanted for a long time, and it is a pity it was not brought out earlier. You are wrong when you say PRACTICAL WIRELESS became first; it already was first when the first issue was published, and still is first, and at its present high standard always will be.—A. COOK (Manchester).

### Congratulations from South Africa

SIR,—I would like to add my congratulations to those of your other numerous correspondents. I have been an experimenter in wireless before broadcasting as such commenced in South Africa. Apart, however, from the entertainment side of wireless, I am interested in the subject, (as well as its associated branches) of thermionic valve telephone and telegraph repeaters and carrier current systems, as part of my profession. In order to keep abreast of the latest developments I have constantly perused the various publications and periodicals, only to find that in almost every case the information contained was either out of date or of little or no value to me. One day I noticed that a new publication, PRACTICAL WIRELESS, was about to be produced. I obtained the first number, and was so pleased with it that I immediately placed an order with my bookseller. I am glad to say that PRACTICAL WIRELESS is keeping abreast of the latest developments, and that I have been able to derive great pleasure from the perusal of each issue. If I may make a suggestion, I think that articles on the mathematics of wireless, dealing with such subjects as aerial resistance and radiation, etc., would be welcomed by thousands of your readers. I would also like to see a really good constructional article for an A.C. all-wave set.—Wishing your journal every success.—H. G. BERTHOLD, B.A.(Sce), (Johannesburg).

### Rectifier Valve Economy: A Correction

SIR,—With reference to a Radio Wrinkle by "Practicus" in May 20th issue of PRACTICAL WIRELESS, I should like to

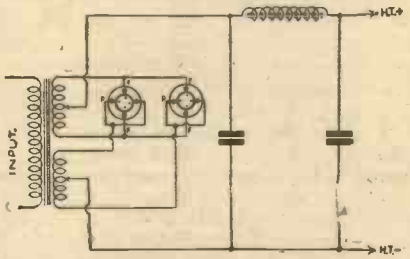



*Diagram illustrating Mr. R. Sharman's letter.*

point out that a mistake has occurred in the wiring diagram. There is a short-circuit of H.T. plus to negative through the filament of the valve-holder on the left.—R. SHARMAN (Wickford).

[*The accompanying diagram shows the correct connections.*—ED.].

**CUT THIS OUT EACH WEEK**

## DO YOU KNOW?

—THAT a broken valve-base makes a very good plug-in attachment for coils, chokes and other home-made accessories.

—THAT a square of ebonite with four plugs may be made up to use when trying L.F. transformers. By fitting four sockets to the receiver the transformer may be easily removed and another substituted without disturbing the wiring.

—THAT the aerial wire, lead-in, and wire to the aerial terminal of the receiver should preferably be one unbroken length of wire.

—THAT small crocodile clips are invaluable for rapid circuit connections when experimenting.

—THAT serious experimenting is best carried out by building a receiver in separate stages, or units. In this way the effects of different couplings, etc., may more readily be appreciated.

—THAT a new form of tuning is being developed, where the loud-speaker is silent until the station is accurately tuned in. It may be fitted to any receiver.

—THAT to enable you to know when the station is actually tuned in a light behind the scale lights up.

—THAT the above idea is very popular in America and is known as "Shadow Tuning," "Flash Tuning," and sundry other names.

**NOTICE.**

*The Editor will be pleased to consider articles of a practical nature suitable for publication in* PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

*Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.*

(Continued from page 492)

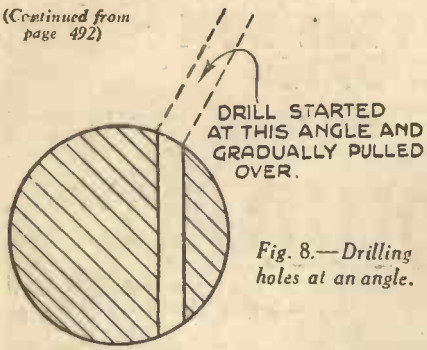



*Fig. 8.—Drilling holes at an angle.*

Large holes in sheet metal, or circles from ebonite for formers, can be cut out with the fly cutter shown in Fig. 12. A centre hole is also necessary in this case to accommodate the pilot, and the cutter is adjustable to suit different diameters.

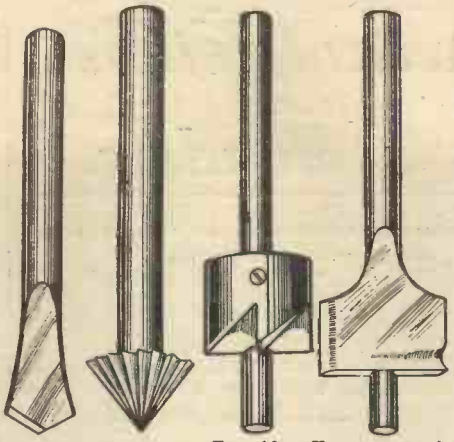


*Fig. 11. Fig. 9.—Countersink and rose cutter.* *Fig. 10.—Two types of counterbores.*

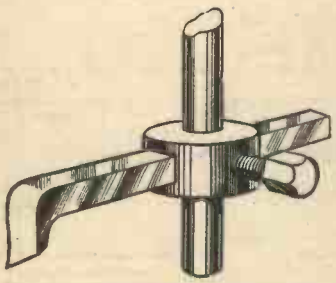


*Fig. 12.—Expanding or trepanning cutter for large holes.*

To deal with a hole of a special size, and the right sized drill is not available, a flat drill may be made to overcome the difficulty. A piece of silver steel smaller in diameter than the hole required (if the hole is ¼in. diameter 3-16in. dia. silver steel will be about right) is heated at the end in the gas to a dull red, and flattened out with a hammer. After allowing it to cool slowly the steel is carefully filed up to the shape shown in Fig. 11, the width of the point being made equal to the diameter of the required hole. The end of the drill is reheated to a dull red and cooled quickly in water. After polishing with emery cloth it is tempered in the gas until the polished portion assumes a yellowish brown tint; very little heating is required to accomplish this.



# RADIO CLUBS & SOCIETIES

*Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.*

**SLADE RADIO**

It was a members' night at the last meeting of this Society, and was set aside for "questions and answers." A number of interesting questions were raised and were very satisfactorily dealt with by Messrs. A. S. Freeman, G. T. Peck, and N. B. Simmonds. A short "Junk Sale" of parts suitable for D.F. (direction finding) sets was held, at which a quantity of components were disposed of. Hon. Sec., 110, Hillaries Road, Gravelly Hill, Birmingham.

**BURTON-ON-TRENT AMATEUR RADIO SOCIETY**

At the meeting of the above Society, held on May 30th, a debate was held on Class B and Q.P.-P. v. All A.C. Receivers. Mr. J. Ballinger opened the proceedings for A.C. receivers and he was ably partnered by Mr. B. Cooper. At the conclusion of the case for all A.C., Mr. A. Brittan, for Class B and Q.P.-P., proceeded to pull to pieces the statements made by the other side, and in this he was assisted by Mr. W. Mead, G5YY, who went a stage further and explained how Class B could be used off quite a small H.T. eliminator, and still give the same output as an A.C. receiver costing two or three times as much. The Society has room for new members, and all interested should write to the Hon. Sec., 180, Burton Road, Burton-on-Trent, who will be pleased to forward particulars.

**THE BLACKPOOL AND FYLDE RADIO SOCIETY**

There was a good attendance at a meeting of the above Society, which was held on Tuesday, May 23rd, at Booths Café, when Mr. C. H. Jones gave an address on "The New Metal Catkin Valve," which has recently been put on the market. Of the many advantages of this revolutionary new valve, he mentioned: 1, Uniformity of characteristics; 2, All microphonic troubles at an end; 3, Danger of breakage minimised; 4, Ease of packing for transport and considerably less room required for stockage. After he had concluded, many questions were asked, and there was a short discussion until the meeting closed. Hon. Sec., G. F. Howard, 43, Cumberland Avenue, Blackpool.

**INTERNATIONAL SHORT WAVE CLUB (LONDON CHAPTER)**

A very enthusiastic audience attended a meeting of the above Club, held at the R.A.C.S. Hall, Wandsworth Road, S.W.8, on Friday, June 9th, when Mr. A. S. Radford gave a lecture on the "Catkin Valve." Mr. Radford spoke about the construction of these valves and also of the many advantages they have over the ordinary glass valve. Reception was compared with a receiver using both catkin and the ordinary glass valves. The performance of the receiver using catkin valves was equally as good, if not better than, the receiver using ordinary valves. It was agreed by all present that the "Catkin" is a great step forward in valve construction, and it was hoped that battery types will soon be available. These meetings, which are becoming very popular with listeners, are open to anyone interested in wireless. Not only can they witness demonstrations and hear lectures, but they can meet others who have the same interests as themselves. Further particulars can be obtained from the Secretary, A. E. Bear, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

# REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on this page must be attached to every query.

*If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.*

## SPECIAL NOTE.

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also, that all sketches and drawings which are sent to us, should bear the name and address of the sender.

### MICROPHONIC VALVE

**"My set keeps on breaking into a loud whistle. When the music is coming through signals are quite clear sometimes for the whole evening, but suddenly the noise gradually comes in, getting louder and louder until I have to switch off. After a few minutes I can switch on again and it is all right. Can I stop this?"—(W. K. S. F., Stepney.)**

The trouble is no doubt due to a microphonic valve and the cure rests in protecting the valve from all sound waves. Some of the methods of doing this are as follow: sticking lumps of plasticine or similar substance on the glass; wrapping the valve with thick flannel or cotton wool; mounting the valve in an anti-microphonic valveholder; fitting a cardboard box over the valve, or a combination of some of the above arrangements. No doubt you will find one of these which will effect a cure.

### INDUCTION COIL FOR H.T.

**"I should like to know the correct windings for a coil to work direct off a 25 volt D.C. circuit to give 220 volts with sufficient milliamps to work any of the commercial all-mains sets. I should expect a little interruption from the make-and-break, but I think if it were screened and earthed the trouble could be overcome."—(E. S., Athboy, Co. Meath.)**

The primary of the coil should consist of 300 turns of No. 18 D.C.C. and the secondary 2,000 turns of No. 22 D.C.C. The core should be 1in. in diameter. When testing-out the coil use a variable resistance in the primary circuit to cut the current down to a minimum.

### USING METAL VALVES.

**"I have recently seen in my dealer's shop window a placard advertising some new valves which are made of metal. It seems that these have great possibilities, and I now see an advertisement in your pages regarding these valves. I should be glad if you could let me have a three-valve circuit of a set suitable for these valves, as I would prefer them to the old breakable ones which I have got at present."—(W. J., Clapham.)**

As has already been pointed out in our pages, no special circuit is required for these valves. They may be plugged into any mains receiver where the existing valve has characteristics similar to the new valves. Obviously, the metal pentode could not be plugged into a simple output socket without slight circuit alterations, but the new valves have identical characteristics to the glass valves which bear the same reference numbers, and provided this is borne in mind they may be used in a similar circuit.

### SHOCKS FROM D.C. RECEIVER.

**"My receiver is a commercial make three-valve D.C. set. It has functioned for a long time quite satisfactorily, although on one or two occasions my wife has complained that she got a shock whilst tuning in. I have not experienced this until yesterday, when I distinctly felt a tingling when tuning in. Can you help me to trace the cause of this and make it safe, as we are rather afraid that there may be some growing leak which might eventually lead to serious results."—(N. D. S., Redcar.)**

There may be nothing wrong with your receiver at all, and the fact that the slight shocks have only been felt occasionally, coupled with the fact that the receiver is commercially made, leads us to the following conclusion. Firstly, no firm of repute would turn out a receiver which was not entirely safe. Secondly, the tuning control should not be connected to any source of high-voltage. Therefore, we think the following is the solution to the problem. The small grub-screw which is used to lock the control knob to the spindle is sunk only slightly below the surface of the knob. When you take hold of the knob for tuning you naturally always touch the knob in a different position. Occasions arise when your finger or thumb comes direct over the grub-screw and the flesh sinks into the slight depression and makes contact with the screw. If your flesh is dry nothing is felt, but on occasions when slightly moist a slight tingling would be experienced. You can try out this and ascertain whether or not we are correct. We shall be pleased to know the result of your test.

## DATA SHEET No. 40

*Cut this out each week and paste it in a notebook.*

### WOOD SCREW PROPORTIONS.

| No. (or size of screw) | Diameter of neck or shank | Twist Drill size for wood or metal. |
|---|---|---|
| 1 | .066 | S.W.G. Drills 51 |
| 2 | .080 | 46 |
| 3 | .094 | 41 |
| 4 | .108 | 35 |
| 5 | .122 | 30 |
| 6 | .136 | 28 |
| 7 | .150 | 23 |
| 8 | .164 | 18 |
| 9 | .178 | 14 |
| 10 | .192 | 9 |
| 11 | .206 | 4 |
| 12 | .220 | 1 |
| 13 | .234 | Letter Gauge Drills B |
| 14 | .248 | E |
| 15 | .262 | H |
| 16 | .276 | K |
| 17 | .290 | M |
| 18 | .304 | O |
| 19 | .318 | P |
| 20 | .332 | R |
| 21 | .346 | S |
| 22 | .360 | U |
| 23 | .374 | V |
| 24 | .388 | X |
| 25 | .402 | Z |
| 26 | .416 | 27/64 |
| 27 | .430 | 7/16 |
| 28 | .444 | 29/64 |
| 29 | .458 | 15/32 |
| 30 | .472 | 31/64 |
| 31 | .486 | ½ |
| 32 | .500 | 33/64 |

### FOUR-RANGE COIL.

**"I wish to build up a plug-in coil with a four-pin base to cover the ordinary broadcast band as well as the very short waves round about 5 to 10 metres. Could you please let me have details of the gauge of wire, size of former and method of connection, please?"—(T. Y., Winchester.)**

We do not recommend you to attempt to make up this type of coil. Apart from the normal difficulties of correctly arranging the different windings, there is the added trouble of arranging satisfactory switching. The losses on the 5-10 metre band must be kept at the very minimum, and if you introduce any of the normal types of switch you will get very poor results indeed on this band. A much better idea is to build a complete detector stage for the lower band, and arrange this on your baseboard with flexible leads and plugs from the anode of the detector valve-holder. Arranged at the same end of the baseboard, but adequately screened, build a detector portion for the normal broadcast band with a similar flexible lead from the anode. You may then use either section at will by plugging in the valve and connecting the anode lead to the L.F. stages.

### LOOSE VALVE.

**"My valve has been in use for some time now and the glass has become loose round the ebonite base. As it is rather dangerous in its present condition, what cement should I use to repair it? I suppose it will not affect its working in any way by letting the air in?"—(R. N., Long Eaton.)**

The air cannot get in through the loose base, as the glass bulb is closed round the lower end, and the wires from the electrodes brought through the foot of the glass. The looseness may, however, give rise to microphonic noises, and you should therefore mend it by using some adhesive which is not affected by heat. Chatterton's Compound is as good as anything, or one of the cellulose cements may be used if preferred.

### LOUDSPEAKER POSITION.

**"Whilst experimenting with my loudspeaker, I made some important discoveries. Originally, I had the speaker on top of the cabinet, but as the majority of radio-gram cabinets use the speaker in the bottom near the floor I thought this might be a better position, so I tried it. I found it gave very poor results, and could not be heard so loudly. Some of the instruments in the orchestra also seemed to be missing. I then tried it high up on the wall, and found that when it was near the ceiling it gave the best results of all. Can you explain the reasons for this and tell me the ideal position?"—(G. C. E. R., Barking.)**

There is no ideal position, as the shape of the room, the contents of the room, the position of the listener, the draperies in the room, and many other factors contribute to the result. For instance, when you placed the speaker low down the sound waves were broken up by chair legs, table legs, etc., as well as absorbed by carpets, etc. In addition, you were no doubt standing up and your ears were well above the centre of the speaker. When you placed the speaker up near the ceiling the sound waves were able to travel to the opposite wall uninterrupted and were in addition reflected back. Therefore, you should try different positions, as well as pointing the speaker in different directions, towards curtains, away from curtains, etc.

### UNSTABLE S.G. STAGE.

**"I have built up a mains receiver using a variable-mu H.F. stage, power grid detector and pentode output. I cannot get the volume control full on."—(T. B., Kentish Town, N.W.)**

The trouble is rather difficult to locate from the above brief notes, but there is a possibility that it is caused by the fact that the output from the mains unit is such that variation in the H.F. bias alters the total current drain on the unit and so affects the voltage applied to the S.G. anode and screening grid. We do not know what method of voltage dropping you are using, but this is a possible solution. To ensure that the H.T. positive line remains sensibly constant, irrespective of the variable volume control, you should connect a resistance (of suitable wattage rating) across the H.T. positive and negative terminals so that a more or less constant H.T. drain is imposed. By working out the value of your present H.T. consumption, and the rating of the mains unit you should be able to find a resistance which will give you this "artificial load" and so stabilise your set.

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### BELLING-LEE CLIP-ON UNIT PICK-UP

ANY possessor of a radio receiver and a portable gramophone can enjoy radio-gram results by fitting the new Belling-Lee clip-on unit. This consists of a standard type pick-up, tone arm and volume control on a special mount which can be clipped instantly on and off the side of any portable gramophone. Full particulars, and price of the unit, are given in a booklet, a copy of which can be obtained from Belling and Lee, Ltd., Cambridge Arterial Road, Enfield, Middlesex.

### IGRANIC COMPONENTS

A FINE range of components is listed in an attractive booklet issued by Igranic Electric Co., Ltd. Amongst the various items shown are plug-in short-wave coils, H.F. chokes, fixed and variable condensers, slow-motion dials, L.F. transformers, mains transformers, potentiometers and a series of push-pull and other switches. For radiogram work there is also the "Igranovox" pick-up and a response corrector, which is designed to afford the requisite compensation for the deficiencies of the record at the lower frequencies. Constructors who look for high-class workmanship in their components should make a point of obtaining a copy of this booklet. The address is 149, Queen Victoria Street, London, E.C.

### WEARITE H.F. CHOKES

FULL particulars of a new range of their high-frequency chokes are given in a leaflet issued by Wright and Weaire, Ltd. There are nine different types altogether, and all the characteristics and data concerning each is given, together with some circuit diagrams. Messrs. Wright and Weaire are well known for the care given to detail in the manufacture of their components, and the stringent tests to which they are put. Each choke listed is tested for resistance, inductance, and self capacity, etc. Readers interested can obtain a copy of this leaflet (H.F. 3133), on application to 740, High Road, Tottenham, London, N.17.

### THE COMMERCIAL DEVELOPMENT OF THE FERROCART IN GREAT BRITAIN.

READERS will be interested to learn that the Ferrocart raw material in future will be manufactured by the General Electric Company. Considering the progress in radio-coil design involved in the use of this material, the English radio trade will appreciate being able to buy British material, thus saving the import duty.

The commercial development of the Ferrocart matter in England has now come to a definite stage, the situation being as follows :—

*Colvern Ltd.*, Mawney's Road, Romford, Essex, acquired the sole right of making and selling Ferrocart components and kits.

*General Electric Company Ltd.*, Magnet House, Kingsway, London, W.C.2, acquired

(*a*) the sole right of making the Ferrocart material,

(*b*) the sole right for the use of Ferrocart material for electric communication on wire,

(*c*) a licence for making Ferrocart coils for their own receivers and kits.

*Electric and Musical Industries, Ltd* (The Gramophone Co., Columbia Graphophone Co., Marconiphone Co.), Blyth Road, Hayes, Middlesex, acquired a licence for making Ferrocart coils for their own receivers.

*Marconi's Wireless Telegraph Co. Ltd.*, Marconi House, Strand, London, W.C.2, acquired a licence for the use of Ferrocart material for radio transmitting purposes and commercial receivers.

Licence agreements with other prominent firms for Ferrocart receiver coils will shortly be made.

## Replies to Broadcast Queries

W. F. M. (Blackwood) : W8CTE, W. Boyer, Box 709, Johnstown, Penna ; VE3HE, G. V. Priestly, 87, Douglas Av., Toronto 12 ; VE2AH, W. H. Oke, 105, Irvine Av., Hampstead, Montreal, P.Q. ; W5CCB, F. L. Mason, 1108, S. Atlanto Av., Tulsa, Ok. ; regret, cannot trace VE1HC. W. W. WOODMAN (Willesden) : (1) Rocky Point, New York (20.311 m.) ; R.C.A. Communications Incorporated ; (2) possibly WEA, Rocky Point (28.275 m.) ; R.C.A. also ; (3) cannot trace unless call letters are given.

The following amateur transmitters cannot be traced in the latest published lists : for F8PU write to *Réseau des Émetteurs Français*, 17, rue Mayet, Paris VIe. ; for CT1SO, Rede do Emissores Portugueses, Rua Primeiro de Dezembro 33-3, Lisbon ; for OK2EA, C.A.V. Box 69, Praha 11, Czechoslovakia ; for EARLN, Asociacion EAR, Apartado de Telegrafos, Santander, Spain ; for ON4MOK and ON4ROD, *Reseau Belge*, 33 rue Alphonse Renard, Bruxelles, XI, Belgium.


**Interesting items relating to the latest developments announced as we go to press. Where desirable further details will be given later.**

### WEARITE IRON-CORE COILS

APROPOS our recent note concerning the Wearite Nucleon Iron-core Tuning Coils, we are advised by Messrs. Wright and Weaire, Ltd., 740 High Road, Tottenham, London, N.7, that these will be manufactured in four types, namely, A.D., B.P.1, B.P.2, and T.G. These are the senior models, and are priced at 12s. 6d. each. They are also producing two junior models at 8s. 6d.—J.D.A. and J.T.D. The senior model has the excellent Wearite gilt finish, and the junior model is finished in the popular battleship grey. The senior model is a closed circuit coil, and the junior model is open circuit. Mr. J. G. Wright tells me that they have built several experimental sets employing these coils and the performance is exceptionally brilliant. We hope to describe and illustrate them in an early issue.

### BULGIN TRANSCOUPLER

WE have received a sample of the Bulgin L.F.10 transcoupler, in which an improvement has lately been effected, in that the turns ratio of the small feed transformer included in the bakelite case has been raised from the original 3-1 to 4-1, thus giving an increase step-up and higher voltage amplification. Quite naturally, inductance varies according to the strength of the signal received, but in the sample submitted we found it varied between 75 henries and 96 henries. The price of the transcoupler is unaffected and remains at 11s. 6d. retail.

### NEW OSRAM VALVE—THE MHD4

WE have received for test one of the new Osram MHD4 valves, which will retail at 15s. 6d. It is, of course, a double Diode Triode employing the standard 7-pin base and operates from A.C. mains only. The valve is employed primarily as a detector to offset the disadvantages of the usual methods of detection when triodes are employed. It, of course, also provides a simple means to effect automatic volume control. Further information regarding this valve will be given later.

The valve has the following characteristics :

| Triode Nominal Rating. | |
|---|---|
| Filament Volts | 4.0 A.C. |
| Filament Current | 1.0 amp. (approx.) |
| Anode Volts | 200 max. |
| Amplification Factor | 40 |
| Impedance | 18,200 |
| Mutual Conductance | 2.2 |
| Optimum Load Resistance | 30,000 ohms. |

## BUILDING THE THREE STAR NICORE—(*Continued from page* 487)

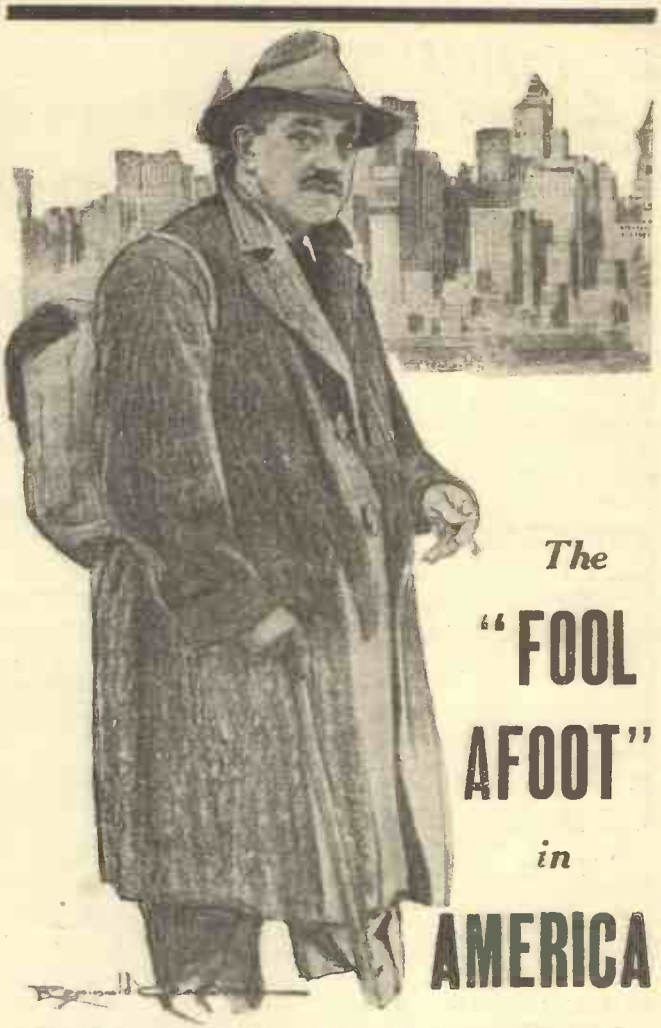
The receiver is now ready for wiring, and this should be carried out in the following order. Cut off a length of Glazite about two feet long, and stretch it slightly by gripping one end in a vice (or standing on it) and pulling on the opposite end with a pair of pliers. As soon as you feel a slight give, stop pulling and you will find that the wire will remain very straight and rigid. Measure the length between the first and third valve-holder, and cut off sufficient Glazite to reach from the filament legs of No. 1 to those of No. 3. Join up the three pairs of filament legs first. Next connect up the fixed condensers, and then proceed, with the wiring diagram as your guide, to complete the wiring, leaving the battery leads until last. Notice that the screw which is used to bolt the variable condenser to the baseboard is utilized as the earthing screw for the condenser, by attaching one end of a piece of wire underneath the head of the screw, and connecting this to the filament negative lead.

### The Battery Leads

When all the wiring has been completed with the Glazite, the flexible battery leads should be fitted. The ends of the H.T. — and L.T. — leads are attached to one contact on the three-point switch, and H.T.1 is attached to the normal anode leg of the first valve. H.T.2 is joined to one of the L.S. terminals (or the .01 fixed condenser if preferred, and the L.T. positive is attached to the filament connecting wire as shown. The grid bias leads are cut from ordinary twin flex, and if the red and black variety is purchased the leads are more readily identifiable. Cut off the required lengths, and attach red and black plugs, suitably marked to the ends. The positive lead (red) should be attached to one terminal of the set of three on the Duovol control, and this should be long enough to reach to the positive end of the grid bias battery. The G.B. negative terminal of the L.F. transformer is fitted with the remaining bias lead, and this should be black and brought through the hole in the baseboard with sufficient length to reach to the 9-volt socket on the battery.



## ADVERTISEMENT INDEX



*The*

## "FOOL AFOOT" *in* AMERICA

HAVING wandered over the greater part of Europe, our Travelling Commissioner decided that he would like to have a look at the United States. It would be a welcome change, he thought, to visit a country where he could at least understand the language; and he aspired to discover an America different from that depicted in travel books and films. Arriving in New York he took the train to New Orleans, and then began a haphazard pilgrimage of some sixteen hundred miles, traversing a dozen different States. As usual, Mr. Gibbons met with some curious experiences, which he describes in his own quaint fashion. The first instalment deals with his voyage across the Atlantic and the long Journey South to New Orleans.

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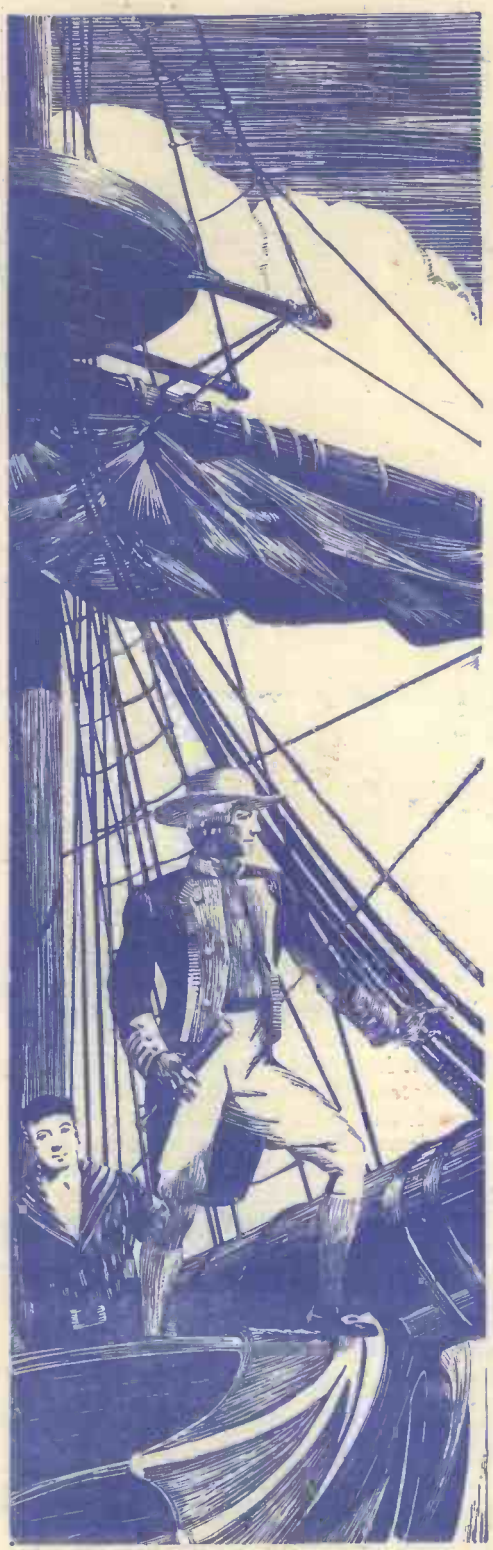

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