MAKING A SIMPLE ACCUMULATOR CHARGER

RADIO "RODS"—A NEW DEPARTURE IN VALVES

Amateur Wireless

and Radiovision

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The CONTINENTAL PORTABLE

FULL DETAILS

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Amateur Wireless and Radiovision

The Leading Radio Weekly for the Constructor, Listener and Experimenter

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How Broadcasting House Grows—The Northern Regional—Rockefellow Radio—The King's Set—This Spiritualism Business—Summer-time Talks

How Broadcasting House Grows—Rapid progress is now being made with Broadcasting House in Portland Place, London. The excavations and foundations, together with the great retaining wall enclosing the three floors below ground level, were completed during last autumn and winter. In February last, work was begun on the superstructure. The outer steel framework is well advanced and a good deal of the exterior Portland stone has been fixed. Thousands of feet of concrete flooring have already been laid and the central brick tower, which is to contain the studios and their suites, is taking shape. Two studios below ground level are, indeed, already completed in the rough.

B.B.C. ingenuity! This tree stump with a false centre concealed the microphone used at the recent Warwick Pageant broadcast, and here two B.B.C. "O.B." engineers are seen attending to the wiring

The Northern Regional—Another thing which is progressing, too, is the new Moorside Edge station which, thanks to the good weather we have had lately, has been growing rapidly under the builder's hands. A B.B.C. official hinted to our correspondent that the new Northern Regional may be sending out a one-wavelength programme before December. Then the second transmitter will be brought into action after tests, in just the same way that the B.P.'s were "introduced." The transmitters in Manchester, Liverpool, Leeds, Stoke, Bradford and Sheffield will be closed down when Moorside is in full working order, and then the North will have a real knowledge of what regional conditions are like.

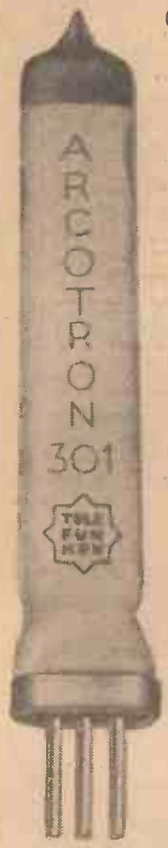
Rockefellow Radio—The enterprising millionaire, Mr. R. J. Rockefellow, jnr., has started on a scheme (which will cost £50,000,000) for building a gigantic entertainment house, including a cinema and theatre, from which broadcasts will be made on a large scale. As a matter of fact, he had intended building a huge opera house in the heart of New York City, but now he has turned to lower-brow ideas and many big people, such as Mr. David Sarnoff, Mr. M. H. Aylesbury (chief of the N.B.C.) and Mr. Owen D. Young of the American G.E.C., are to be connected with it. There will be space in the new building for television transmitters.

The King's Set—Nobody yet knows how the new portable set at Buckingham Palace is working, although it was stated when the set was presented that both the King and Queen were delighted with it. As a matter of fact there are several wireless sets used by the Royal Family, some of them differing very much from that which was designed by some B.B.C. engineers in the early days when the B.B.C. was a company.

This Spiritualism Business—The present fuss about spiritualistic performances makes one wish that the B.B.C. would not always turn a deaf ear to the possibility of spirit broadcasts. One does not wish to be biased, but surely there are few people who really are in a position to carry out scientific spirit investigation, and the possibility of broadcasting in connection with this should not be ignored. Too much time could be devoted to anything of this kind, but even at present there are many more futile things broadcast than "spirit rapping" experiments.

Summer-time Talks—Here is a plaint from a Crewe reader, with which, during the present hot spell, we can't help feeling in agreement. "Summer has come and still the B.B.C. continues with its winter-time programme scheme and with the same amount of educational and dreary talking matter. Now that we have two stations, why can't one of them be used for a large amount of dance-music.

PRINCIPAL CONTENTS



The Telefunken "Radio Rod"

"RADIO RODS"


Note the size compared with an ordinary valve

A WELL-KNOWN firm of German wireless engineers expects to exhibit for the first time at the forthcoming Berlin Radio Exhibition a new wireless valve. This valve, both as regards its outside appearance and its internal make-up, is radically different from all those at present in use I am given to understand that the grid, which, of course, in the case of other valves is inside is, with the new valve, outside in the form of a metallic coating on the bulb. Though similar arrangements have formerly been tested in the laboratory, they have not been found practicable.

The design, as the accompanying photographs show, is entirely novel and it was evolved to ensure the output required as well as an extraordinarily high degree of stability In view of the flat and compact shape the new valve has been given the name of Telefunken "Rod."

While not being intended to oust existing types of valves, Telefunken "Rods" are the outcome of a methodical search for new possibilities in the way of cheaper small receivers operated from the mains. These "rods" are not only much cheaper in themselves, but because of their special qualities of great insensibility to mains irregularities, they allow of the use of a novel type of inexpensive receiver. One of these special receivers worked with Telefunken "Rods" is to be first shown at the Berlin Radio Exhibition.

This year the German Radio Exhibition is to be held from August 22 to August 31, and for the first time will be in connection with the Talking Machine and Record Exhibition. Both exhibitions will be held in the newly constructed halls grouped in a square around the Radio Tower in Berlin. In these six halls will be shown the latest achievements of the whole German radio industry, the work that is being done by the German broadcasting authorities and the broadcasting companies and the products of the gramophone industry.

FIRST DETAILS OF A NEW DEPARTURE IN VALVES

By Our German Correspondent

Dr. ALFRED GRADENWITZ

"BUILT-UP" FORMERS

INDUCTANCE values have a very pronounced effect on the selectivity and strength of the received signals. It is with this fact in mind that many constructors carry out experiments and so attempt to find just the right values suitable for their particular circuits.

The difficulty is increased when a coil suitable for long and short waves is under consideration. At such times it is an advantage to have a number of formers handy on which coils may be wound. By using more than one coil, comparative tests may be made rapidly and with a greater degree of accuracy. The formers described here can be simply and quickly made up; the materials used will be found in almost any experimenter's junk-box. The sizes can be varied to individual fancy.


Fig. 1. A completed former

A coil former (Fig. 1) could have the sizes set out below. Fig. 2 shows a portion of one of the spacers. It is constructed of ebonite ¼ in. thick, 3 in. long, and ½ in. wide. Six of these spacers will be required for each former. It will be seen that slots are cut across each ebonite strip; each slot measures ⅛ in. wide and ⅛ in. deep. The slots are ⅛ in. apart. If a coil with eight sections is required a plain portion will result at each end: one ½ in., the other ⅝ in.

If 4-B.A. clearance holes are drilled through these blank pieces the spacers may be attached to the cylindrical former with nuts and bolts at one end, and at the other end terminals may be used. By this means a six-pin base is unnecessary, as the windings may be brought direct to the terminals, and the necessary connections made to the various components of the set. Such security of fastening, however, is scarcely necessary, as the subsequent windings tend to hold the ebonite in position. The spacers may be stuck to the former with Seccotine and held in position with elastic bands until the adhesive has set.

A suitable former would be 3 in. long and 2¼ in. diameter; it may be of the "treated" cardboard type, though ebonite tube will provide a firmer foundation and is unlikely to warp, due to the stress of the windings.

Greater Air Space

So far, spacers have been described which allow the windings to sink towards the former and the turns rest partially on it. Many experimenters will possibly prefer coils with the maximum air space around the windings. This can be achieved quite simply by using spacers which are placed edgewise on the formers. Again ½-in by ¼-in. ebonite may be used, but for this work the slots must be cut in the edge of the ebonite—across the ¼-in. face, and not across the ½-in face. These spacers should be mounted with adhesive, as suggested before. When constructing space-wound coils it is an advantage to use eight spacers to each coil, as this will hold the windings clear of the curved surface of the formers.


Fig. 2. Portion of spacer

Single-layer Coils

Single-layer air-spaced coils may also be made, if desired. For this type of coil the ebonite strips should have evenly spaced saw-cuts made on the ¼-in face. This can be simply done if the whole of the strips are placed in the vice and the saw-cuts made across them. The regular spacing can be readily marked off if an old clock wheel is run along the surface, the cogs leaving indentations which may clearly be seen.

H. P. WILSON.

HOW O.B.'s ARE DONE

The B.B.C. Outside Broadcast Van

By W. H. O. SWEENY. Formerly of the B.B.C. Engineering Staff

"AND now we are taking you over to the Rushmoor Arena, Aldershot—" The announcer's voice is silent, and in the distance are heard the skirl of the pipes, the rattle of drums, and the rythmic beat of an army on the march. And for the next two hours our familiar home surroundings have melted away, and we are out under a starry sky along with the flower of Britain's manhood, and live again in those stirring times when men gallantly fought and died with pike and sabre for the country's weal. And then . . . "The Last Post" rings over the now silent plain . . . stillness once more . . . and the familiar voice of our favourite announcer wishing us "good-night."

How many of us, as we regretfully switch off our receivers, stop to think of the many hours of preparation spent by, not only the Savoy Hill staff, but many others also, in order that the two hours' broadcast should "go over" without a hitch. The initial preparation of an outside broadcast is much more comprehensive than might be supposed. Let us, for instance, follow up the preliminary arrangements of the "Tattoo O.B." that have to be made.

We must go back several months prior to the O.B. The director of O.B.'s is considering the fact that in the near future the Aldershot Tattoo is taking place and, as usual, it must be broadcast. Formal permission has first to be obtained from the military authorities at Aldershot. This having been secured, the matter is referred to the O.B. Engineers' Department.

Generally speaking, the Aldershot O.B., being an annual event and therefore more or less cut and dried, is not at this stage going to be the cause of any lost beauty sleep in the O.B. Department. There is plenty of time for that later. However, the lines have to be arranged. This necessitates an agreement between the B.B.C. and the P.M.G. for the erection and rental of certain lines between the arena and the nearest telephone exchange, also the use of two between Aldershot and London. When the engineers have decided on the actual place of termination of the lines at the arena (this is usually the same each year), the P.O. prepares an estimate. This is O.K.'d by Savoy Hill, and the P.O. proceeds to run the lines about a fortnight before the broadcast. The lines are run overhead from the Aldershot Trunk Exchange to a point close to the arena, by ordinary telegraph poles. At this point, they become lead covered cables and are brought through the trees by devious routes to the terminal point. This is a hole dug in the ground, and covered for protection by a galvanised iron sheet. Having done that, and having assured themselves that the lines have passed the necessary rather stiff tests for insulation, etc., the P.O. men, except for maintaining them in this condition, have finished their share in the preparation.

An interior view of the O.B. Van

Microphone Positions

Some time previous to this the microphone positions have to be determined upon. Rough points are chosen, though the actual positions cannot be fixed until the rehearsal. The next step is to have lines run round the arena connecting the microphone points to the P.O. terminal point. This will be the site of the O.B. van, the B.B.C.'s portable studio and control room. One year these lines were run by a company of Royal Engineers, and a very good job they made of it, too. They were taken right round the arena in trenches, afterwards being covered over, the work taking over a week to complete.

In the meantime, the control van has been overhauled after its previous job, all batteries in it having been charged (the charging apparatus being in the van, of course). Then comes the day when the first tests are to be made. Savoy Hill gets into touch with the P.O., and ensures that the lines are connected through the Aldershot exchange, and can be put through O.K. via Gerrard, to the B.B.C. control room that day. The B.B.C. O.B. lines engineer, whose sole work it is to look after O.B. lines, has previously tested the lines thoroughly, and is satisfied that they are good enough for the job. The van now sets out for Aldershot, filled with a varied assortment of gear, and with three engineers in attendance.

On arriving at the arena (and having by virtue of its special pass, got past the sentries), it is parked close to the P.O. terminal point. The first thing the engineers do is to test the lines. Having spoken to Savoy Hill over each of them, a series of tests is carried out with the control room,

(*Continued at foot of next page*)

For the Newcomer to Wireless: CHOOSING A DETECTOR

WILL you help me to choose a detector valve for my set? Which do you think is the best?

There is no best detector valve, generally speaking, for everything depends upon how you mean to use it and what you want it to do.

Please explain.

Well, first of all, are you going to use grid-leak-and-condenser rectification, or do you want it for the anode-bend method?

Actually I have two sets, one of which has a leaky grid-condenser rectifier and the other an anode bend.

In the old days I would have told you that it was good practice to follow a grid-leak-and-condenser detector with transformer coupling and to use resistance-capacity after a "bottom-bender." To-day, though, you can use a transformer with either, since such enormous improvements have been made in these components. Now, you employ your grid-leak-and-condenser detector, I suppose, in the set that you use mainly for long-distance work?

Yes, that's so.

You do so because it is rather more sensitive than the other method to weak signals. Then what you really want is a valve with a fairly high amplification factor, which is as non-microphonic as possible.

What about impedance?

This should certainly be on the low side as transformer coupling follows, for this will give you better quality. High magnification and low impedance mean a big mutual conductance figure. You won't go far wrong, then, if you choose a valve of the medium-impedance class with a good mutual conductance.

Well, what about anode-bend detectors?

In the "quality" set it is essential that the detector shall not be overloaded. Now our four high-power stations all use pretty deep modulation. One has therefore to cater for rather big voltage swings on the grid of the detector. This means that with an anode-bend detector in such a set a pretty heavy grid bias must be used. Choose, therefore a valve again with a good mutual conductance figure, the curves of which show that the working point can be adjusted near the top of the lower bend by the use of a plate voltage of from 100 to 150 and quite a considerable negative grid bias.

Is an H.F. or medium-impedance valve suitable for the purpose?

Generally speaking, yes, though I would recommend something of smaller impedance—say a first L.F. valve—to those who live within fifteen or twenty miles of a high-power transmitter and want first-rate quality.

Just why?

Well, the average medium-impedance valve even with 150 volts on the plate will not take a grid bias of more than 2 or 3 volts when used as an anode-bend detector. This means that it can cope properly only with grid swings of double these amounts. A first low-frequency valve, though, will work with a very much stronger negative bias and can therefore handle much bigger loads.

Doesn't one lose amplification in this way?

To a certain extent, though the loss is not really very serious. A good valve with an impedance of about 7,500 ohms should have a mutual conductance in the neighbourhood of two. That is to say, its amplification factor will be round about fifteen. Typical H.F. or medium-impedance valves show an amplification factor of 20 or a little over and a mutual conductance of only about one. In actual use you will hardly notice the difference in the amplification obtainable, though you may find quality much improved with the lower impedance valve.

FRAMING OR PHASING?

MANY reports are appearing in various quarters concerning the reception of television transmissions by the Baird process through the Brookmans Park stations. Individual difficulties have been encountered, as one would expect, but ingenuity has been brought to bear in order to overcome them and make the received image as perfect as possible. In reading the reports, however, it is most striking to see how the terminology of the subject of television has been differently interpreted by each individual. One of the most marked cases is that dealing with the vertical positioning of the image within the mask provided at the back of the lens assembly frame.

That is, if the picture is split about a horizontal line it has to be moved up or down so that it is viewed in a central position. This process, which is effected by moving the synchronising coils bodily around the motor frame, is similar in character to what is done at the cinema when, say, an artiste's feet appear at the top of the screen and the head at the bottom. The usual parlance is to say that the picture has to be "framed," and it would appear that this is the correct term to apply for the controlling process involved with the television image. The expression "phasing," which is used by some writers, surely applies to a right- or left-hand movement of the image when the picture has reached a steady condition owing to isochronism being established, but is out of phase with the transmitting end, and hence cannot be truly synchronised.

H. B. C.

"HOW O.B.'s ARE DONE"

(*Continued from preceding page*)

to determine the characteristic of the lines. These tests show the relative value of frequencies, from the lowest to the highest, which the lines will transmit.

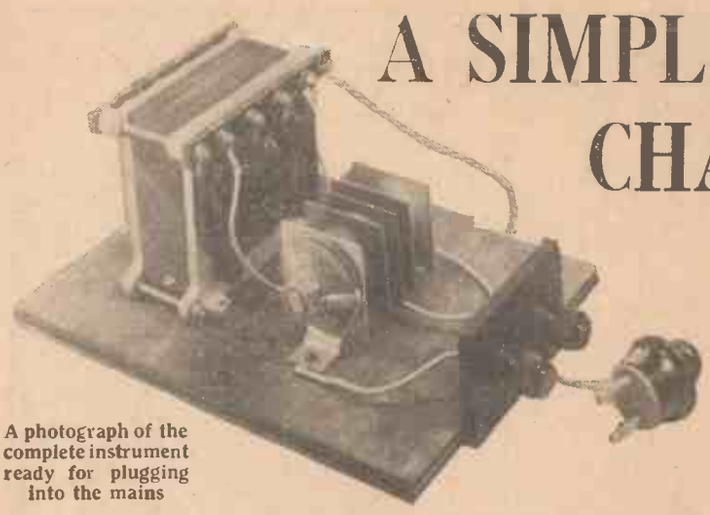
As readers know, Post Office telephone lines vary in their suitability for transmitting the different musical frequencies in use, the usual effect being that the low and high notes are suppressed, while the middle tones are allowed to get through almost untouched. This state of affairs can be corrected, and once the characteristics of the lines have been determined, suitable values of inductance, capacity and resistance are added which cause the characteristic curves of the lines to assume a more horizontal position.

Once the "music" and "control" lines are proved satisfactory, attention is turned to the microphone lines. Each one is tested (there may be any number up to six), and a microphone connected on each one. All being satisfactory, a number of microphones are slung up, the positions possibly being altered later during rehearsal. Two microphones are placed at the side of the arena opposite to that on which the van stands, and owing to the lengths of line separating the points, local amplifiers and batteries have to be used. The gear here is a replica of that used at the more ordinary O.B.'s—that is, microphone, amplifier, H.T. and L.T., inter-communication telephone, headphones, and change-over switches. Everything is duplicated for safety.

Lastly, the final "mike" positions having been determined during the rehearsals, and the complete programme and order of procedure thoroughly memorised, the engineers can take a breather, and hope that the weather will be fine. Incidentally, if it rains at the Tattoo, the man who is most unlucky is the one attending the distant microphone point. A small portable tent is used to protect the gear, and as it is scarcely large enough for anything else, the poor engineer would be unlucky in a shower.

A SIMPLE ACCUMULATOR CHARGER FOR USE ON A.C. MAINS

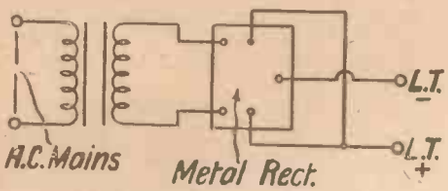
A useful device that you can assemble in an hour and will obviate those journeys to the charging station



A photograph of the complete instrument ready for plugging into the mains

NOWADAYS everybody is saying pleasing things about the advantages of alternating current mains for working wireless sets, and, of course, for the derivation of high tension from the mains and the working of A.C. valves alternating current mains have everything in their favour over D.C. supplies.

One thing that is rather hard on possessors of A.C. mains who do not wish to go to the expense of fitting A.C. valves is that, comparatively speaking, it is more



The circuit of the charger

difficult to charge an accumulator from A.C. than it is from D.C. This difficulty is often greatly exaggerated, however, and there are certain advantages, one of which is economy. There is not so much power wasted with A.C.

A Cheap Apparatus

What deters many people from accumulator-charging from A.C. mains is the fact that a special rectifier is needed, whereas with D.C. mains a lamp in series with the supply suffices; but the necessary parts for an A.C. charger need not be expensive and they can easily be wired together. Nothing could be simpler than the little charger described and illustrated herewith, which consists essentially of only a mains transformer and a metal rectifier as shown in the photographs.

The connections are very simple and the theory of the circuit is that by means of the transformer, the voltage of the mains —200, 220, 240, or whatever it may be— is stepped down to a more convenient voltage for charging, 14.5, and owing to the ordinary transformer laws the high voltage and small current in the primary induce a low voltage and correspondingly higher current in the smaller secondary winding.

Thus from the secondary one has a charging current of two or three amperes, although the current taken from the mains is but a fraction of an ampere. That is where the saving with A.C. mains is evident.

The secondary output is still alternating current, however, and it must be rectified before it is suitable for accumulator-charging. For this the new Igranic-Elkon type X16 metal rectifier is used. These rectifiers operate on a novel principle, are very efficient in action, and have the merit of low cost.

The circuit employed is a straightforward one, and as the charger must not be used when the set is in action no smoothing condensers are needed.

Few Components

A few small incidental components are needed to make the charger convenient in handling, and all the parts needed to build up the charger exactly as shown by the photographs are given in the following list :—

Baseboard, 9 in. by 6 in. (Pickett).
Special mains transformer (Parmeko, type M16).
Metal rectifier (Igranic-Elkon, type X16).
Ebonite strip, 3 in. by 2 in. (Becol).
Two terminals, marked : L.T.— and L.T.+ (Belling-Lee, Clix, Eelex, Igranic).
Length of twin flex (Lewcoflex).

The rectifier is connected across the terminals "common" and "14.5" on the secondary of the transformer. The primary connections must be altered to suit the mains supply. One mains lead of the twin flex should be connected to the "common" terminal and the other should be connected to the 200, 220, or 240 terminal, as required.

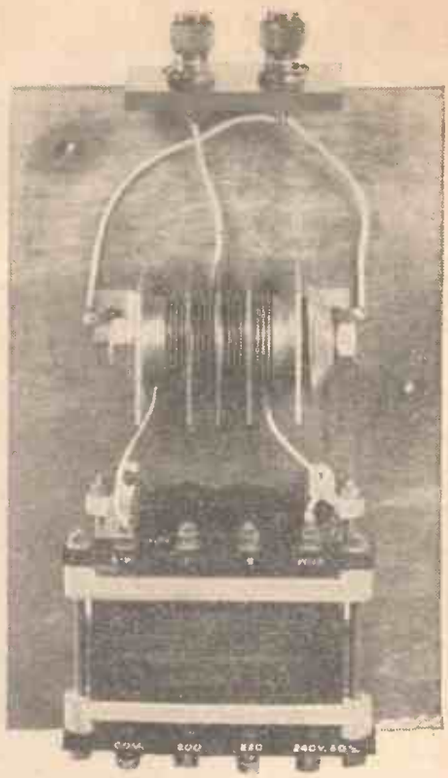
The output will be suitable for charging any normal two-, four-, or six-volt accumulator, but when the smaller sizes are being charged it may be advisable to insert a resistance in either the "common" or "14.5" transformer lead.

This resistance should have a maximum value of 10 ohms and should be a well-constructed wire-wound component capable of carrying the full charging current without overheating.

The two terminals on the small ebonite strip at one end of the baseboard are marked positive and negative respectively, and care must be taken when making the connections in the set to get the leads to these and to the metal rectifier the right way round. An error in this would, of course, mean that the accumulator would be charged round the wrong way, the charging current being reversed.

Connections

The twin cable used on the primary side of the mains transformer, for connection to the mains, should be of good quality, and cheap flex should be shunned, for it often is found that in the poorer qualities the insulation is faulty, and internal short-



A plan view : note the very simple construction

NEXT WEEK :
AN EASY-TUNE
2-VALVE SHORT-WAVER

circuits between the wires may be set up when the full mains voltage is applied, although the flex may give a safe reading on test with a low voltage.

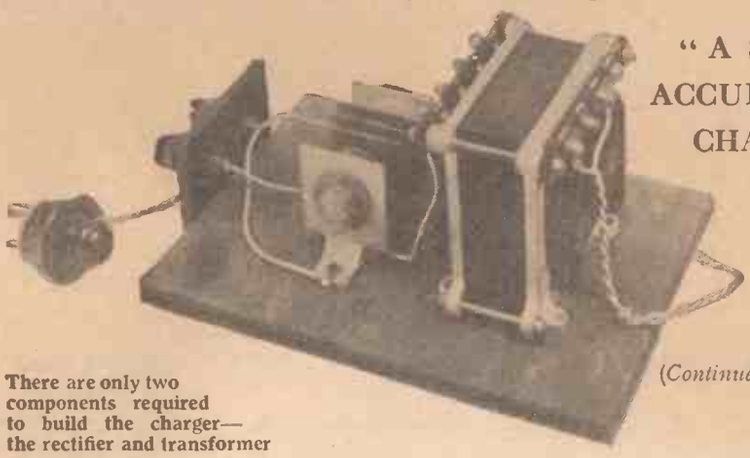
A mains plug of the right size and type for the socket should be used, and if this connection is made properly there is really no need for a fuse in the supply lead. No switch is necessary.

Two or more accumulators may be charged in series at the same time, provided the total voltage is well under the maximum delivered at the charging terminals, which should be tested with a voltmeter. If the series resistance already mentioned is used to control the charging rate, then it would be advisable to connect an ammeter in series with the accumulator whenever the output is regulated.

The positive terminal of the accumulator should be connected to the positive output terminal, and negative to negative. This may seem obvious, but there are many people who have ruined batteries by connecting positive to negative, as is done when connecting batteries in series.

In the interests of safety, never charge an accumulator while the set is working, and when it is still connected to the set's L.T. terminals. Completely disconnect the battery from the set, and attach it to the charger output terminals.

"A SIMPLE ACCUMULATOR CHARGER"



There are only two components required to build the charger—the rectifier and transformer

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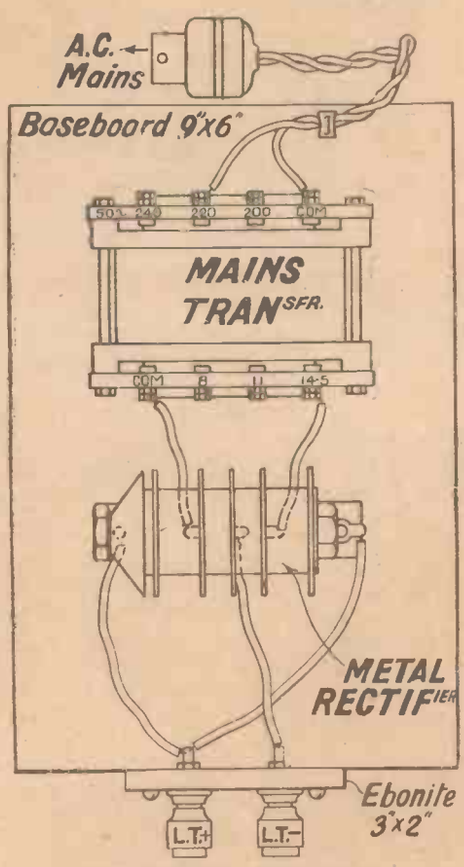


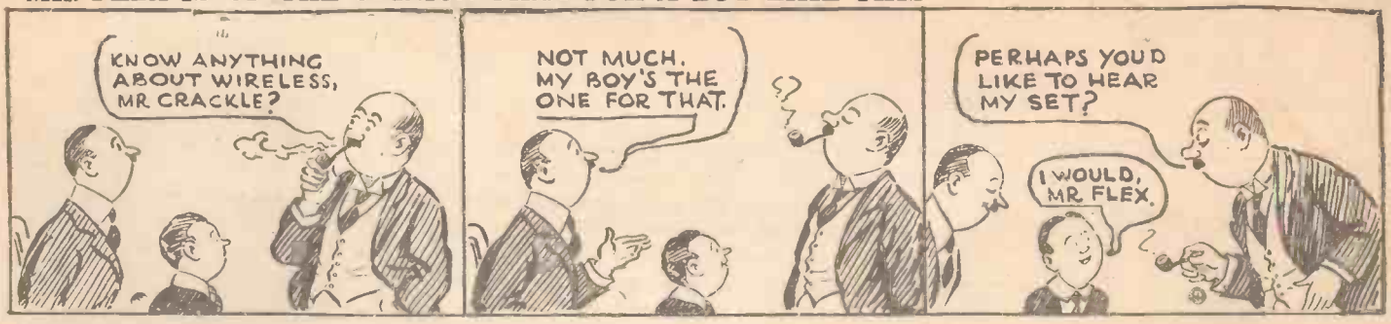
The layout and wiring diagram

AIRCRAFT WIRELESS

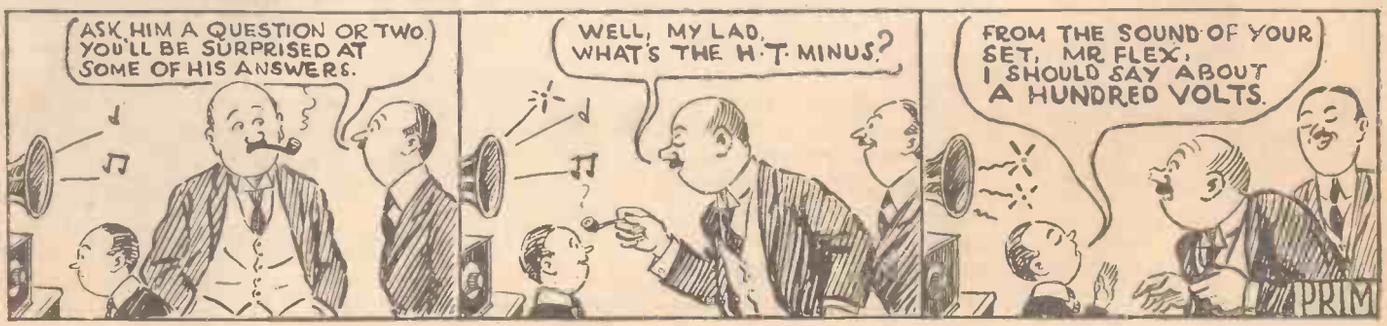
SHORT-WAVE transmission is particularly advantageous when signalling from the air to a ground station. Recent experiments have shown that it is possible to receive aircraft signals on a 40-metre wavelength up to a distance of 500 miles, using a power output of only two watts. The transmitter is controlled by a piezo-electric crystal which prevents fluctuation in wavelength in spite of unavoidable engine-vibration.

Reception in the air of signals transmitted from the ground is a more difficult matter. In the first place efficient screening is necessary to cut out disturbances from the ignition system of the engine, and in the second place mechanical vibration gives rise to "microphonic" noise and distortion. The latter effect has recently been overcome by using a quartz-controlled local oscillator in the receiving-set adjusted so as to give a constant frequency beat note with the incoming signals. B. A R.

MR. FLEX IS OF THE OPINION THAT FOR A BOY LIKE THIS—



—ONE QUESTION IS QUITE ENOUGH.



On Your Wavelength!

Testing for Distortion

WOBBLING milliammeter pointers are not the only kind of test for distortion, as most readers will have discovered. Audible tests are perhaps of greater importance, but they require careful attention and memorising of tone and volume if the results of adjustment are to be appreciated fully. In carrying out tests on distortion, some types of music are of considerably more value than others. For example, one can hardly expect to trace the effects of a delicate adjustment when listening to a banjo solo. Distortion does not readily show in the reproduction of many wind instruments, such as clarionets, oboes, and cornets, also not in violin solos or 'cellos. But when you come to a string quartet, well, one can understand why so many listeners are averse to chamber music. I believe that only the smallest fraction of people, having heard good music played by a good string quartet in a hall, would say that the sounds were uncouth and horrible; yet when a great many of these people hear broadcast reproduction they are, to use their own words, horrified by the cacophonous sounds.

Small Points to Observe

Here, I think, the reproduction is really to blame, for instead of hearing the fine blending tones of four stringed instruments, the reproduction often sounds very harsh and quite unmusical. I have made a study of this matter in a small way, and believe that the unfortunate effects are to some extent controlled by the roughness of the play, the difference being that in reproduction, unless the amplifier and detector are working under ideal conditions, the worst qualities are greatly magnified. In the concert room, the beauties of tone are foremost and the roughness of less importance. Even the best reproduction of string music that I have heard is far from perfect in this respect, but by paying special attention to small points such as detector loading, it is often possible to make a marked improvement in the result. That is why I find a string quartet or a string orchestra so valuable for adjustments.

Reduce the Volume

It is more easy to discern distortion if the volume is turned well down, and the ear placed near the loud-speaker. My procedure with regard to the detector stage is to adjust carefully both pre-detector and post-detector volume controls until the roughness is least noticeable, then turn up the volume to a normal value by alteration of the post-detector control.

These inequalities in reproduction appear far more noticeable in a moving-coil speaker of good design, due, no doubt, to the absence of marked resonance. In many normal cone or horn loud-speakers the resonance is of sufficient magnitude to cloud over the minutest details of distortion, and in good types of cone loud-speaker one can obtain pleasant reproduction.

What Being Televised is Like

I walk into a studio of comparative darkness. Over the piano a reddish-orange light shines on the music. From behind a screen there is reflected a white glare, though not so intense as I had expected.

The announcer touches my elbow and urges me forward so that I can see what is going on behind that screen. A pretty girl is singing, her face and shoulders illuminated by a strong beam of light which is constantly moving. The announcer nudges me, and points to a box-like thing fixed to the wall through which the light is coming. The photo-electric cells, the wonderful electric eye that has made television possible.

How does the girl face that light without blinking? Shall I be able to keep my eyes open in front of the glare? I go hot and cold by turns. An attack of "televisor nerves," own brother to my old enemy "mike fright." The girl stops. The announcer steps into the light and says his little say. Now I am for it.

I have already been told that once I step into the light my every movement will be visible to all those who are "looking." Is my tie straight? Have I passed my fingers through my hair and made it stand on end?

No Discomfort

There is no glare, or nothing to worry about. As a matter of fact the light beam is terrific; but it is so small and travels so fast over my face that it is never on my eyes for a sufficient time to cause any discomfort. Feeling that I can be seen, as well as heard, makes the whole thing far more intimate than ordinary broadcasting. Dash it all, what does my nose want to itch for? If this was ordinary broadcasting I could scratch it. Suppose I mustn't, in front of the "eye." Doubtless in the studio of the future there will be a big notice put up, like that one about coughing: "Don't scratch your nose or thousands will laugh."

Well, that's that. I look towards the announcer who gives an approving little nod and beckons me to come out of the light.

Thank heaven! Now I can scratch my nose!

Better Conditions

Conditions for long-distance reception are extraordinarily good at present for the time of year, which may possibly be due to the series of rather cloudy days and nights that we have had. Stations that I am hearing well at the present time are Rome, Milan (at times), Kattowitz, Frankfurt, Toulouse, Breslau, Nürnburg, Cologne, Turin, Bratislava, and often Bordeaux, of those on the medium waves. Higher up, Huizen, Kalundborg, Warsaw (at times), Motala (distinctly improving), the Eiffel Tower, Zeesen, Radio-Paris, and Hilversum have all been good. Readers, by the way, should note that Hilversum and Huizen have just effected one of their periodical change-overs, which means that Hilversum is now working on 1,875 metres and Huizen on 1,071 metres.

The Short Waves

The short waves continue to be below par, on the whole, though certain stations are generally to be pretty well received unless violent fading is in evidence. Still, I do not think that atmospheric and ether conditions are entirely to blame for our not receiving the American short-wavers so well as we did a year or two ago. It is, as I pointed out, extraordinarily difficult to obtain reliable information about them, and, so far as I can make out, the various relays of KDKA and WGY, as well as some other of the more important wavelet stations, are using only a small amount of their available output except on certain special occasions. When they do turn on the juice they come through excellently, and many people jump to the conclusion that there has been a sudden change for the better in conditions.

A Simple Test

You can satisfy yourself that the receiving set will work well, provided that the sending station is pushing out the aerial amps, by listening to the transatlantic and other commercial telephony stations for a bit. A whole host of them are to be found between 14 and 18 metres. The Dutch stations in Java, too, are often strong enough to give full loud-speaker strength with a two-valve set during the afternoons. By the way, don't be surprised if you fail to find quite a number of the short-wave stations given in some of the lists when you come to try for them. Though the hours in which they are in operation are often stated quite definitely, these are in many cases wrong, and in not a few instances stations shown as being in regular operation closed down some time ago, either temporarily or permanently.

Washing Out Capacity Effects

You may have noticed that with the best of two-valve short-wave sets, consisting of

On Your Wavelength! (continued)

a detector and a note-magnifier, queer capacity effects manifest themselves when you drop down below about 20 metres. If you touch, for example, the earth wire, the metal panel or any other earthed part of the set, you will either get howls or a complete change in the tuning. This makes the picking up of very short wave stations rather difficult, for metal panels and reasonably long extension handles to the condensers are of little avail. The telephones, too, seem to be alive, for if when wearing them you pinch their leads you will have direct evidence of their capacity effects. The only way that I know of getting rid of these unpleasant manifestations is to employ a screen-grid H.F. amplifier in front of the detector valve. I have not quite thought out why it should do the trick, but practical tests show that it certainly does. It need not be very efficient—in fact, it can hardly be—as a high-frequency amplifier, but it does make a considerable difference to one's comfort in working the set.

Supposing that you live at a reasonable range from one of our high-power transmitters, you need not tune the grid of this valve at all; instead of the tuned circuit, simply use a resistance between aerial and earth. This method, though, may not answer if there is a high-power station at close quarters, for then powerful harmonics and shock excitation of the aerial make the local programme audible all over the dials of even the short-wave set. The S.G. can be coupled to the detector by the parallel-feed method, and efficient screening is, of course, necessary.

Another S.G. Tip

Here is a tip about screen-grid valves that may be found very useful by all who want to get the best possible amplification in their long-distance work on the medium and long-wave bands. Some of the battery-operated valves available to-day have astonishingly high magnification factors. Certain limiting factors in coil design make it impossible for us to obtain the full benefit of these, but we may as well get out of the valve as much as we can. This we can do by a little simple experimental work in matching it to our coils. We cannot alter the coils, but we can alter the impedance and the amplification factor of the valve very easily. Don't starve its plate of volts. Nothing less than 120 is advisable, and much better results are generally obtained with the full 150 that most makers allow.

The Correct Adjustment

The valve is adjusted to give its best results with ordinary coils by juggling with the screen voltage. The higher the screen volts for a given anode voltage, the lower is the impedance of the valve and the smaller its magnification factor. By reducing the screen volts a big increase in both impedance and amplification can be obtained, though, of course, at the expense of mutual conductance. If you have only one screen-grid stage you may find it well worth while to tune in the most distant station that you can get without the use of more than a touch of reaction and then to try the effect of varying the screen-grid voltage. Often a voltage can be found which renders the valve's characteristics a good match for the coils. In some makes the differences in the performances under various screen-grid voltages are much more clearly marked than in others.

For Two Stages

When you have two screen-grid stages it is desirable, as I pointed out some time ago, that if there is any difference between the two valves the more sensitive should be in the first holder. Now, the method of adjusting screen-grid voltages just referred to can be applied with the view of obtaining this very desirable end, so long as you have a separate H.T. positive lead for the screen-grid of each of the pair. We can use a high-amplification factor in the first stage very well indeed, and the fact that by lowering the screen-grid volts we make the valve able to deal with only small swings on the control grid need not worry us, for in long-distance work the voltages applied to the grid of the first valve are very tiny. But in the second stage much bigger grid swings have to be dealt with, and we must see that we do not get any overloading of this valve when the first is producing really big amplification. We can ensure this by using for it a higher screen-grid voltage. One other point: Don't forget the grid bias of screen-grid valves, particularly if you are working with rather a low screen voltage. Even with the full screen voltage, 1½ volts seems to be rather too much for some types.

'Ware Callers

A rather neat trick is being worked just now in some places by the scallywags who make a living by stealing wireless sets. One of these fellows arrives at the house one day, choosing as a rule a time when he knows that the lord and master will be away from home. Having previously ascertained the make of the set in use, he explains that the company has just brought out a remarkable improvement which it proposes to fit free of charge, or for a very small charge, to all existing sets. May he therefore take the set away now to have the addition made? He promises to return it in a couple of days improved out of all recognition. Bamboozled by the skilful tongue of the caller, certain people have parted with their sets; never, of course, to see them again, for the obliging fellow has no more connection with the company that he mentions than you and I have with the man in the moon. Remember this, and warn your better half and members of your family that if any chappie comes along with a desire to inspect or to remove your wireless set he should at once be asked to produce an identification card, no matter whom he may claim to represent. All Post Office officials carry these and any manufacturing company which sends round callers to render service to customers provides them with similar cards. The stealing of wireless sets is quite a thriving business just now.

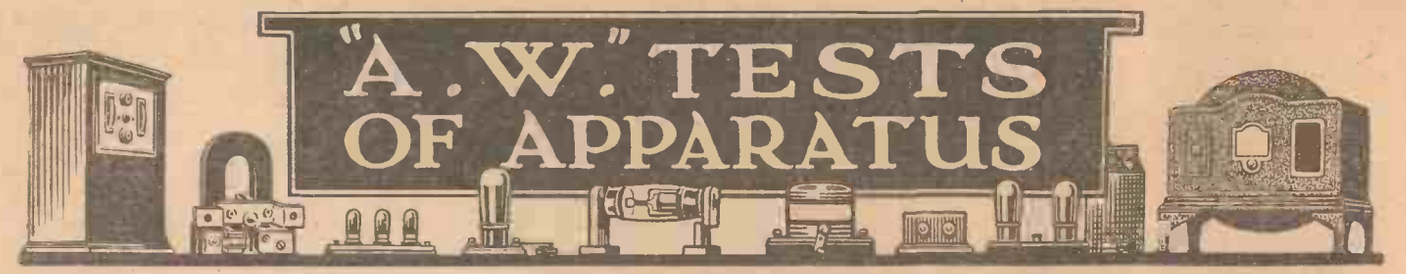
Fewer Duds

I make bold to say that I have not come across a really dud component for some little time now. In the old days, when manufacturing processes had not reached their present perfection and when the purchasing public had not such high discriminating power, thoroughly bad components were by no means uncommon. We used to have, for instance, as some of you may remember, the fixed condenser whose capacity was anything but the figures stamped upon its case, or one with no plates inside it, or, again, one with plenty of plates and no mica between them. We used to have the transformer one end of whose windings somebody had forgotten to solder to its terminal, the coil with a break in the middle of it, the grid-leak which didn't leak as it should, and the valve-holder with conducting paths between the sockets. There is no question that the present standard of components is a very high one, indeed, and that the public is being admirably served by the makers. I am speaking, of course, of components of reputable make. Those of unknown make on which a few pence may be "saved" are probably still as bad as ever, though a distinctly cheering sign is that one sees far less of them even in the cheap-jack wireless shops.

The Concert of Europe

I don't mean by the heading what the writers of history books and things do. It refers, of course, to the daily and nightly medley of broadcasting sent out by stations in all the countries in Europe. The concert is, on the whole, a good one, though certain little incidents occur every now and then to mar it. Germany is having a little bother just now with Russia, who, it appears, has erected a powerful station close to the German frontier, which lures listeners to tune in its programmes by providing them with gorgeous musical entertainment. The entertainment, though, is the jam in which the powder is concealed. Every now and then there is an interval in the music and a propaganda talk takes place in German. This is the kind of thing that International law finds rather a puzzler.

THERMION.



Conducted by our Technical Editor : J. H. REYNER, B.Sc. (Hons.), A.M.I.E.E.

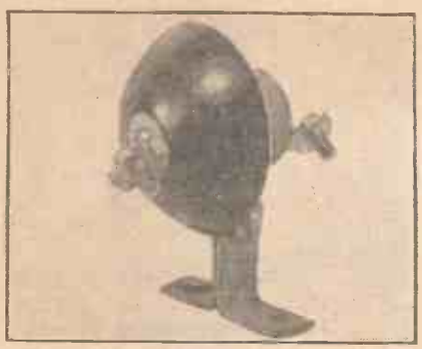
Wirt Lightning Arrestor

IT cannot be denied but that cases of damage to sets as a result of a lightning discharge are rare; but, at the same time, the danger is always imminent, and if only for a sense of security it is advisable to have some means of earthing the aerial or forming a low impedance by-pass from aerial to earth.

We have had submitted for test a neat and practical Wirt lightning arrestor fitted with a bracket for attaching to the window ledge outside a house. The aerial on its way to the wireless set is connected at one end of the arrestor and the earth at the other. The electrodes inside the arrestor are brought extremely close together, actually within .004 in., and in consequence any lightning discharge finds a very easy path across the gap to earth, and will therefore not damage the set. The smaller of the two internal electrodes has a diameter of $\frac{1}{8}$ in., and, therefore, the additional capacity between aerial and earth is sufficiently small to be negligible.

All the internal metal parts of this arrestor are securely enclosed in a damp-proof moulded casing.

The component can be recommended to readers. It is marketed by E. R. Morton & Co., 22, Bartlett's Buildings, Holborn, E.C.4.



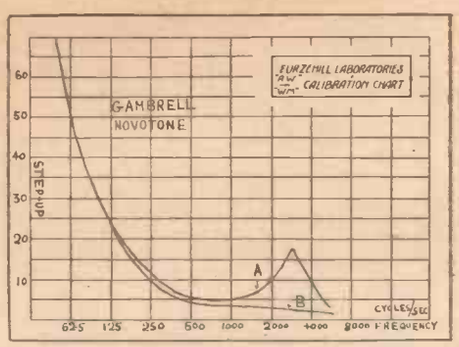
A new outdoor lightning arrestor—the Wirt

The Novotone

MOST readers will be aware of the fact that bass reproduction on a gramophone record is definitely limited by the narrowness of the groove in the record. The amplitude of the lower frequencies, such as the pedal notes of an organ, should in reality be many times greater than it is possible to make them on a record, and consequently in order to obtain faithful reproduction some form of compensation is necessary. Unfortunately, the majority of amplifiers are inefficient reproducers of the lower frequencies and so one has to rely on the pick-up system to provide a balance.

Most pick-ups have a slightly rising characteristic in the bass, but this is seldom sufficient to compensate for the inevitable loss, which must be redeemed by an additional device such as the Novotone marketed by the Gambrell Radio Co., Ltd.

We have recently tested one of the latest patterns of this instrument and have proved for ourselves that it does all that which is claimed. Tested in conjunction with a number of well-known pick-ups, the voltage output was quite appreciably increased in all cases, and the bass amplified to a remarkable extent. In addition, a further amplification of the treble frequencies in the neighbourhood of 3,000 cycles served to compensate for an early cut-off in the case of certain pick-ups. If required, this amplification in the treble can be controlled by using a small variable resistance across two of the terminals.



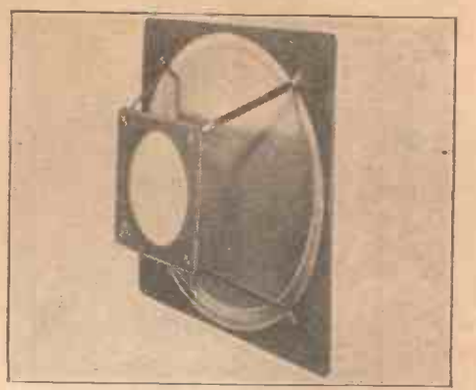
Two curves obtained with the Novotone described in the accompanying paragraph

Our tests were carried out in conjunction with a moving-coil loud-speaker and amplifier of known merits and characteristics. Due to a tendency on the part of our particular speaker to accentuate the low frequencies, the bass was, perhaps, too much in evidence; but this was cut down to the required extent by inserting a small condenser in the circuit, following the printed instructions accompanying the instrument.

The characteristics shown on this page were taken in these laboratories on the Novotone. Curve A is taken with 50 ohms resistance in circuit, and curve B with this resistance short-circuited. All we can add is that the theoretical results are fully borne out in practice, and such a device may be relied upon to improve the electrical reproduction of any gramophone record.

New Wates Chassis

THE speaker chassis is much in demand now that self-contained wireless sets



A new large-diameter Wates double-cone chassis

are becoming popular. Constructors need only build their set in normal form with panel and baseboard, purchase a suitable loud-speaker chassis, and then mount the whole in one cabinet. By this means it is possible to make an attractive self-contained set with the loud-speaker.

The Standard Wet H.T. Battery Co. have specialised for some time in double-diaphragm speaker chassis, samples of which have previously been reviewed in these columns. The makers have recently added to their range by bringing out an exceptionally large type double-diaphragm chassis similar in design to the smaller models. The cones, which are made of a strong treated paper, are mounted with their apexes together and are held at the periphery by a novel method of suspension. The cone is so cut and folded as to form a "hinge," the outer edge of which is attached to a wooden framework. The diameter of the larger diaphragm is 20 in.

Double diaphragms of large size operate well in practice owing to the rigidity which is a feature of this system.

Our tests were carried out with a good balanced-armature unit and a suitable baffle, both of which are desirable for obtaining the best results. The quality of reproduction under these conditions was particularly true to life on both speech and music. The speaker has a fuller tone than the smaller type, and will take a large input.

This chassis costs 17s. 6d., and can be recommended.

SOME PHOTO-CELL CIRCUITS AND THEIR USES

By T. THORNE BAKER, F.Inst.P.

THERE are two distinct types of circuit that can be used with a photo-electric cell. One of these gives a purely positive effect, i.e. "light on or off," while the other enables us to measure just how much light as a quantity is received by the cell. The latter is, of course, the fundamental work of the cell in the scanning operation of television.

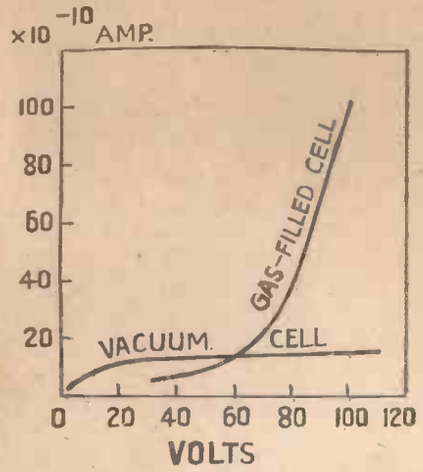


Fig. 1. Curves of gas-filled and vacuum cells

The first circuit, including a mechanical relay, makes it possible to cause anyone entering a room to set an alarm ringing; or anyone shining a motor lamp on a garage door to cause the door to swing open; for the first streak of dawn to cause an illuminated buoy at sea to switch off its warning lamp; and so on. Circuits of this type are being applied now to the control of textile machines by means of printed stencils.

Knowing beforehand the maximum current that a photo cell will give, it is not difficult to work out a suitable amplification circuit for the operation of a relay. The great difference between the gas-filled and the vacuum cell is that shown in Fig. 1. Here we see that in the vacuum cell the output rises quickly on illumination as the applied voltage is raised, but only to a point, after which it remains practically constant. With the gas-filled cell, on the other hand, the output rises very considerably as the applied voltage is increased, and is of an altogether greater dimension than that of the vacuum cell.

A very simple circuit, showing what happens when a photo cell is illuminated, is indicated in Fig. 2. The cathode of the cell is connected to the leaves of an electroscope and the anode to earth. If the electroscope be negatively charged, the leaves will diverge. Light is then allowed to fall on the cell, causing electrons to leave the sensitive surface of the cathode and cross to the anode, providing a conducting path. Across this path the charge on the leaves escapes, and the leaves collapse. The rate of collapse is inversely proportional to the intensity of the light.

The circuit shown in Fig. 3, which is given by W. Edwards & Co. in connection with their G.M. Visitron cells, is stated to be applicable to optical counters,

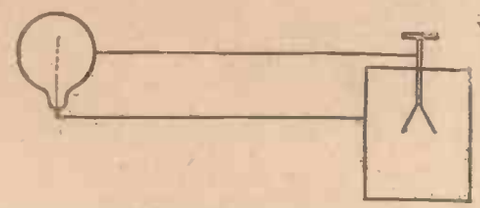


Fig. 2. Simple experiment showing action of photo cell

timing devices, alarm systems, and so on. It includes one stage amplification and the relay R.

This type of circuit can be used to

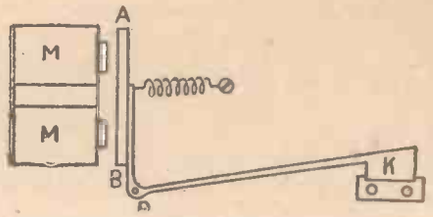


Fig. 4. Details of light-operated lock

operate an electro-magnetic lock. If the amplified current be insufficient to work a heavy enough relay, a light relay can be used in the circuit, and this made to operate a second relay of a coarser type. The latter should be suitable for dealing with a few amperes at four or six volts.

The lock is shown in Fig. 4, where a fixed electro-magnet MM is seen, in front of the poles being an iron armature AB attached to a bent arm which turns about a pivot P. The check K engages with a small plate on the door, the two forming the actual locking device. The door must be fitted with a just sufficiently powerful spring (or cord and falling weight) to cause it to swing open when released. It will then open immediately light falls on the cell, which may be fitted somewhere on a

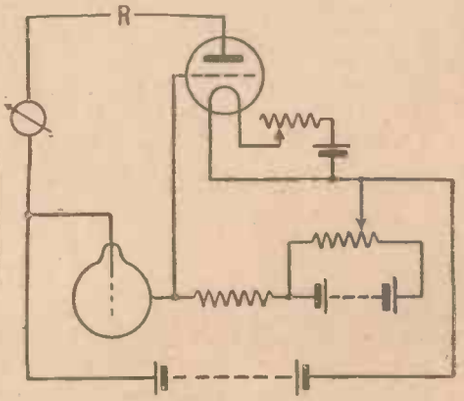


Fig. 3. An "electric-eye" circuit

line with the headlamps of a car, etc.

If the cell circuit is sufficiently accurately balanced, and connected so that a decrease of light operates the relay, and it be placed on one side of a doorway, with a permanently lighted lamp on the opposite side of the doorway arranged so as to illuminate the cell and cause the relay to remain open, then when a person comes through the door and his body shields some of the light from the cell, an alarm can be set in motion by the relay. Photo cells are so extraordinarily sensitive to *minute changes of light* that this type of arrangement can be made quite certain in operation. One of the Wheatstone-bridge types of circuits, using two valves balanced so that any change of light intensity, up or down, will operate the relay, is really the best to use for alarm work.

A new unit which simplifies this kind of work is the glow relay recently introduced by Isenthal & Co. This vacuum relay, actuated by an impulse of only 10^{-10} ampere, will pass as much as 40 milliamperes, and makes it possible to work a mechanical relay without other amplification.

In the case of picture telegraphy, or of talking films, where alternating currents are dealt with, resistance-capacity coupling between the photo cell and the valve is generally used.

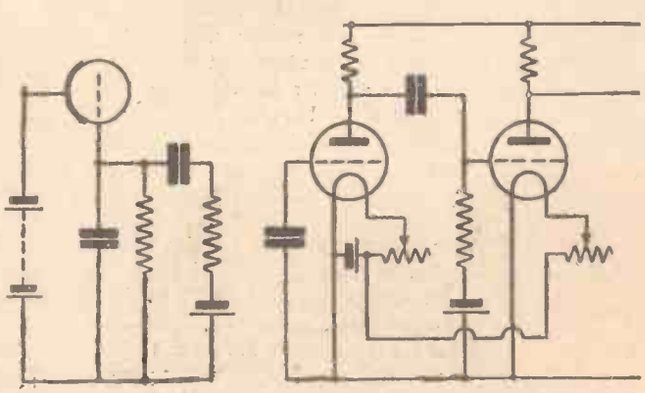


Fig. 5. Photo-cell circuit and (right) 2-stage amplifier

(*Continued on page 94*)

SYDNEY MOSELEY'S WEEKLY PROGRAMME CRITICISM

WITHOUT FEAR OR FAVOUR

The Televised Play

Poor Commentaries

The "Brass Bottle"

John Henry Again

FIRST, the newest of all programme items—the television play Some confusion appears to have arisen, judging from the written reports. This is the inner history. Sieveking, of the B.B.C., asked me some time ago about television, and I invited him to see what it was all about. He immediately became keen, and after a second visit asked if he might bring Gielgud, the productions chief of the B.B.C.

Between the three of us, possibilities were explored. The suggestions of the actual play itself came from Sieveking, and I agreed. The choice, I think, was a good one. I see my fellow-critic, Eric Dunstan, dislikes the play because *The Man with the Flower in his Mouth* suffered from a loathsome disease. Well, all disease is loathsome; so that you would have to bar a pretty wide theme.

However, it is a matter of taste. The whole play is so skilfully written that the nature of the disease—cancer—is secondary to the play.

As for the production, I think it was of remarkable interest. It came over much better than I had hoped. At the dress rehearsal I looked in enthralled, and the difficulties of the earlier rehearsals were so overcome that I had only three minor suggestions to make to Sieveking, who worked exceptionally hard, with a most willing staff, to make it a success.

◆ ◆ ◆

Very indifferent was the running commentary on the 'Varsities and American sports. There were too many cooks, too many asides, too much mumbling. In the exciting two-mile race, in which the British athletes brought off a fine and unexpected victory, you would have thought, judging from the commentary, that it was a practice run. A little more dash, picturesqueness, and enthusiasm as that displayed by the gentleman who gave us the dirt-track description would not have been amiss.

◆ ◆ ◆

It was interesting to hear John Henry back again, just for old time's sake. I see, however, he was with a new partner. I wonder why?

◆ ◆ ◆

Edgar Fairchild and Robert Lindholm are good pianists, but it was a pity to "muck about" with the beloved "Liebestraum."

As for the others in the same programme, I still find it difficult to understand why such totally un-British stuff as the nasal items manage to remain in the programmes. Again I emphasise that I am all in favour of a great English-speaking union. Yet it seems to me that, not only in regard to variety, but elsewhere, America has this country in her pocket.

◆ ◆ ◆

"Under Neopolitan Skies" was given again, and I am glad. It is something out of the ordinary. Sometimes, however, there seemed to be a competition between the tenor, Herbert Thorpe, and the Dalton Instrumental Quartet. The tenor desired to hold his notes, sometimes unnecessarily, and the orchestra was sometimes impatient to get on with the job. However, an item that can certainly be repeated at intervals.

◆ ◆ ◆

The music of Liza Lehmann gave us an hour and ten minutes of enjoyment. And now for Amy Woodford-Finden.

◆ ◆ ◆

A fine brass band is the Horwich R.M.I. Band. I do not appear to have heard it before. Not a bad idea to give prize bands an opportunity of showing the rest of the country what they are capable of doing.

An Impression of S. J. Warmington

I heard the performance of *The Brass Bottle* in two parts, one from London and the other from the National programme. I thought the second performance better. Strange how these Aladdin themes still entertain grown-ups.

Since it was all great fun, I hate to find fault. But why did the Professor sound like a foreign gentleman with a thick, unpleasant voice? Was he meant to be foreign? His wife and daughter sounded very English. The waiter sounded more like Soho than the Savoy. And does a rich gentleman, like Pringle—well, a bit of a prig, but *so* cultured—congratulate the lady on her engagement. Minor matters, if you like, but it shows how attentively I have been listening!

◆ ◆ ◆

As for "Limehouse Night," it might have been a Limerick night or any other night.

◆ ◆ ◆

While one could hardly call Florrie Forde's old songs intellectual, there is no getting away from the fact that they have rousing choruses and considerably liven up a vaudeville programme.

◆ ◆ ◆

It seems that that beautiful violin solo of Kreisler's, "Viennese Caprice," is rapidly becoming adapted to all sorts of instruments. Not long ago I remarked upon Harriet Cohen's splendid treatment of it as a pianoforte solo, and now Mario de Pietro features it on his mandoline—and very well, too.

◆ ◆ ◆

On my portable set I have got as many as twenty-two stations. I *have* to reach out in order to get something in the morning when I am dressing! My radio dealer tells me that most people now have given up reaching out and are concentrating on purity of tone nearer home. At any rate, as a lover of opera I must go to Rome some time.

◆ ◆ ◆

A correspondent writes: "On first hearing the Pearson Brothers I was inclined to classify them as just an addition to the ever-increasing ranks of exponents of the Layton and Johnstone style. However, as their turn proceeded a marked originality in style became noticeable; their concluding medley of old-time songs rounded off the turn nicely."

The C

SPEC

With a portable out of doors, and a Thornycroft 40-ft. launch to take the radio enthusiasts to secluded river sites

A COMPLAINT that has always existed anent the Regional Scheme is that the increase in the power of medium-wave stations has made it more difficult to pick out any one station free from interference from those adjacent.

Any set-owner knows that while it is, naturally, easier to get good reception from a station which has more than tripled its power, as have the Brookmans Park twins and many foreigners, if other stations transmitting on frequencies not widely separated also increase their power, then heterodyning is almost inevitable and the all-round power increase is not justified at the listener's end.

Portable users are just finding this out. The Brookmans Park stations are "easy meat," because of their 30 kw., but the frame aerial's directional properties do not help very much when the B.B.C.'s idea of an alternative programme is not what is wanted.

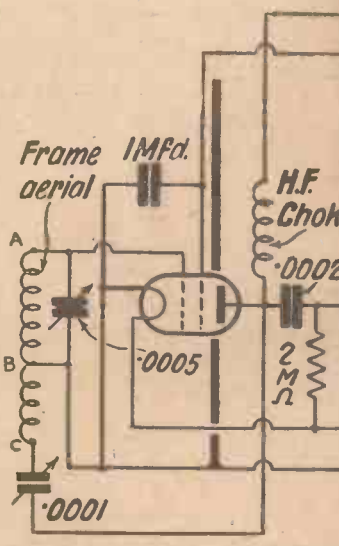
Try the Long Waves

There is a remedy, but it is one of which portable users have been slow to take advantage. The panacea is to switch over to the long waves, whereon can be had 5XX (receivable all over the country), Radio Paris, Hilversum, the Eiffel Tower, and other long-wavers of high power. Indeed, there is so much greater reception scope on the long waves, between 1,000 and about 1,800 metres, that in a portable set there is quite a deal to be gained by omitting medium-wave switching and concentrating the whole of the efficiency of the set on the wave-band desired.

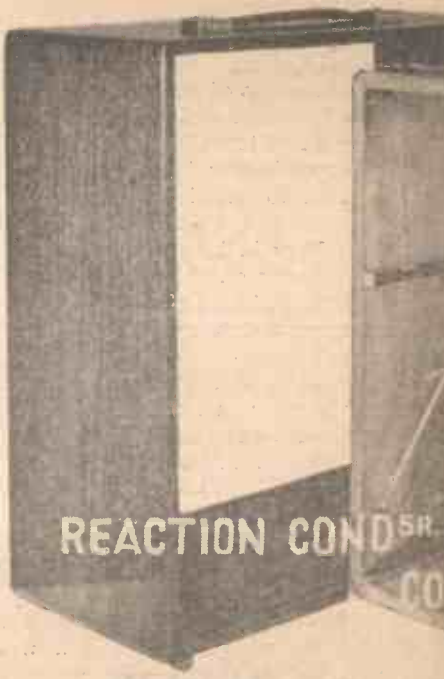
This is what has been done in the portable set here described, which receives only on the long waves, and which, for this reason, can always be relied upon to give music "on tap," no matter what reception conditions may be like.

The short and medium waves are fickle things compared with the lower frequencies, and while there is a certain amount of fun to be had out of freak results on the medium waves, there is a much greater satisfaction in consistent results from powerful long-wave stations—at least, so far as the portable user is concerned.

This novel portable set does not need any critical tuning to get 5XX and the chief Continental long-wave stations at full speaker strength. The AMATEUR WIRELESS Technical Staff decided to make up such a set as this owing to the success which was met by the original "Daventry Loud-speaker Portable," described nearly two years ago, and which is still popular. This was a five-valve set



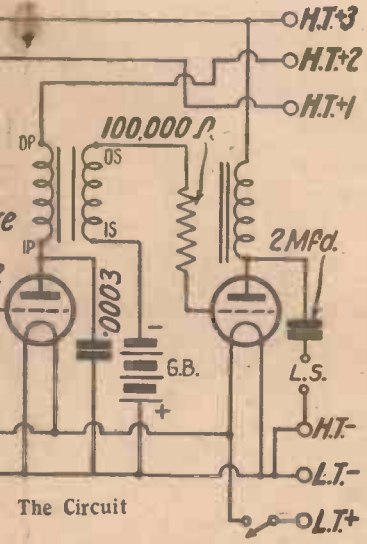
The "Continental Portable" is equally suitable for either indoor or outdoor use



The entire tuning arrangements are separate from the actual receiver. Note the frame aerial winding

CONTINENTAL PORTABLE

CIALLY DESIGNED FOR LONG-WAVE DISTANT RECEPTION



The Circuit

this new portable it was realised that five valves would certainly not be needed and that a saving in cost, weight and running expenses would be the direct result of cutting down the number of valves to, say, three.

This has been done, but the performance has been improved.

What the Set Will Do

A screen-grid valve used in a special coupling arrangement provides a greater facility of control than with at least equal strength to that provided by triode H.F. valves. The H.T. current consumption is not greater and, of course, the saving in space, weight and initial cost entailed by the use of only one high-frequency stage, is most important in a portable receiver.

Before exploring the technical workings, consider what the set will do in the hands of the average man. Owing to the easy tuning on the long waves, where hand capacity is not noticeable, and where reaction is not so critical nor so difficult to render smooth, this set is as simple to work as a portable gramophone, and it is a great deal more convenient. Once it is tuned-in it does not demand attention every three or four minutes to change records, which is the bugbear of gramophones.

It is not intended to decry the advantages of dual-wave working, but there is a big need for a set which is above all simple to control and capable of getting three or four stations consistently, no matter what the distance or reception conditions may be at the time. And this the present set will do.

The Circuit

The set is entirely self-contained; all batteries, the frame aerial, and speaker are in the cabinet.

The circuit is quite straightforward, but embodies several novel features and these are worth noting by intending constructors. The main frame winding is tuned by a .0005-microfarad variable condenser, while a small portion of the winding provides reaction and is in series with a .0001-microfarad variable condenser.

Reaction is provided by the anode circuit of the screen-grid valve and not by the detector as is customary in conventional indoor sets, because a little oscillation when tuning in does not cause interference with other receivers, owing to the poor radiating properties of the frame aerial.

The condenser across the frame winding is the only tuning control, for the H.F. coupling is an aperiodic winding, an H.F. choke in the anode circuit serving as an H.F. stopper.

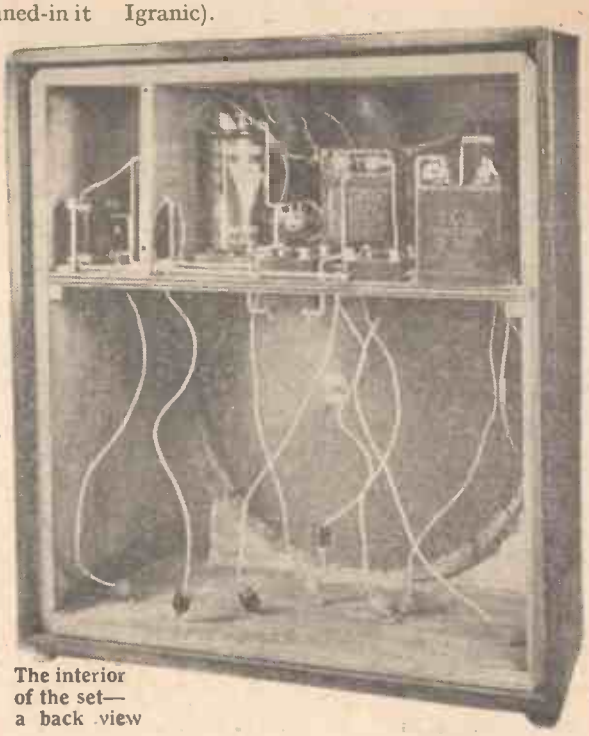
To prevent any instability which may arise from any stray H.F. currents passing on to the power valve, a stopper resistance, having a value of 10,000-ohms, is included in the grid circuit in series with the secondary of the transformer. This is a good idea, because it ensures complete elimination of the "strays" which are by-passed by a .0002-microfarad condenser.

How careful design has limited unnecessary parts and, therefore, reduced the cost of construction, will be more clearly appreciated after a reference has been made to the list of components which is as follows :—

.0005-microfarad variable condenser (Graham-Farish).

.0001-microfarad reaction condenser (J.B., Lissen, Dubilier, Ready Radio, Igranic, Lotus, Bulgin, Burton, Formo, Polar).

Push-pull filament switch (Bulgin, Lissen, Ready Radio, Junit, Lotus, Benjamin, Igranic).



The interior of the set—a back view

"THE CONTINENTAL PORTABLE"

(*Continued from page 85*)

Two valve-holders (Formo, Lotus, Benjamin, Burton, Wearite, Trix).

Upright valve holder (Junit, W.B., Parex, H. & B.).

.0002-microfarad fixed condenser with series clips (T.C.C., Dubilier, Lissen, Graham-Farish, Atlas).

.0003-microfarad fixed condenser (T.C.C., type S, Watmel, Trix, Dubilier, Lissen).

1-microfarad fixed condenser (T.C.C., Lissen, Dubilier, Hydra).

2-microfarad fixed condenser (T.C.C., Lissen, Dubilier, Hydra).

1-megohm grid leak (Lissen, Dubilier, Watmel, Graham-Farish).

High-frequency choke (Varley, Lissen, Lewcos, Wearite, Tunewell, Sovereign, Igranic, Dubilier, Bulgin, R.I., Ready Radio, Polar).

Low-frequency transformer (Telsen "Radiogrand," Varley, Ferranti, Igranic, Burton, Lissen, R.I.).

Output choke (Lissen, Wearite, Lotus, Ferranti, Varley, Bulgin, Atlas, Parmeko).

Aluminium screen, 5 in. by 4 in., with hole for S.G. valve (Parex, Wearite, H. and B., Ready Radio).

Connecting wire (Glazite).

Two yards of thin flex (Lewcoflex).

Six wander plugs marked H.T.−, H.T.+1, H.T.+2, H.T.+3, G.B.+, G.B.− (Belling-Lee, Clix, Eelex, Igranic).

Two spade terminals marked L.T.+, L.T.− (Belling-Lee, Clix, Eelex, Igranic).

Loud-speaker unit (Blue-Spot type 66K, Tunewell, Watmel, Grassman).

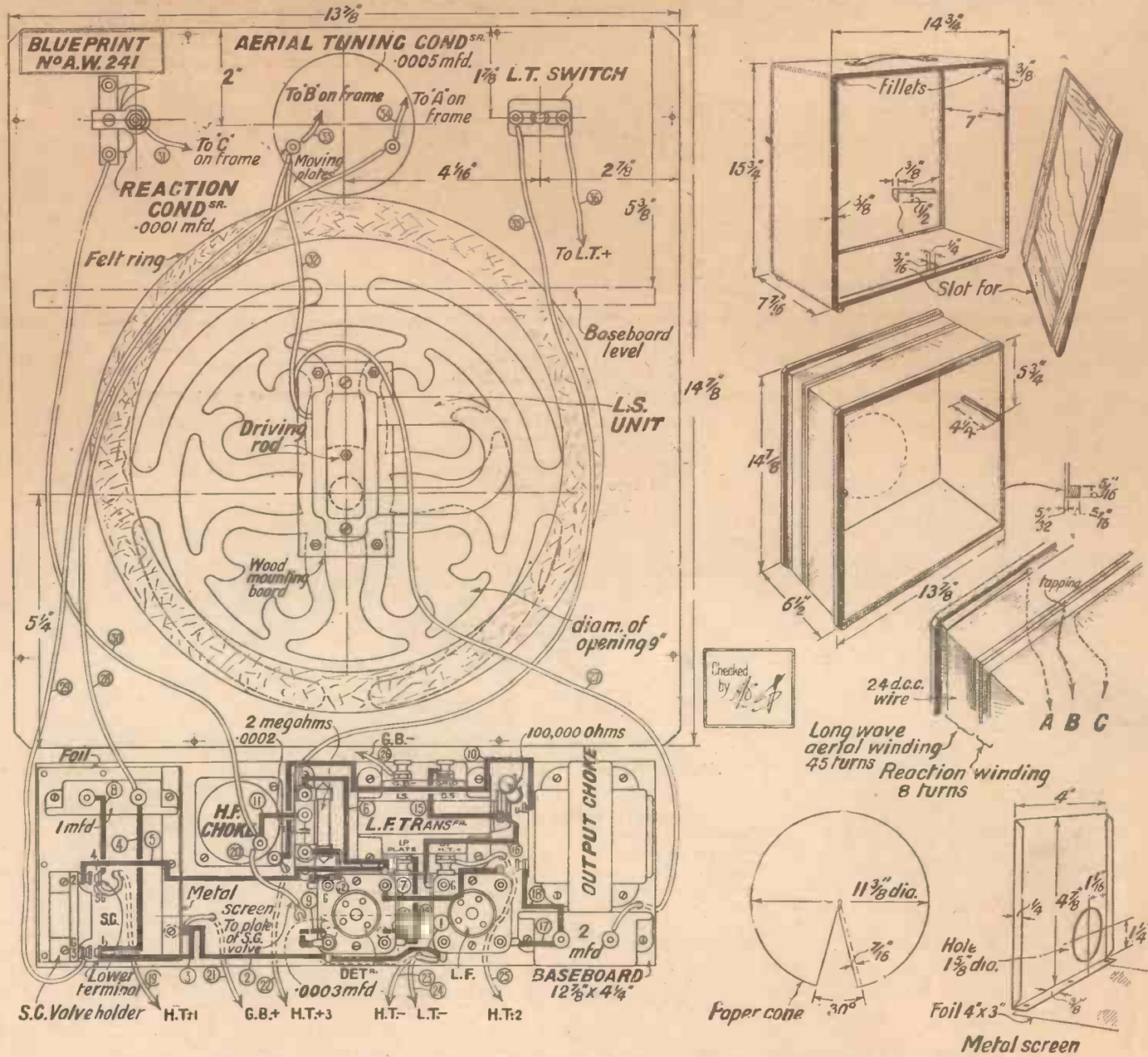
Piece of cone-paper and felt (Six-Sixty).

¼ lb. reel of 24 d c.c. wire (Lewcos)

Portable cabinet (Camco "Carrier").

(*Continued in 1st col. on page 88*)

A rear view showing the arrangement of the batteries



The wiring diagram and details of cabinet and speaker. A full-size blueprint of this is available, price 1/-

MY WIRELESS DEN

By W. JAMES

Weekly Tips, Constructional and Theoretical—

For the Wireless Amateur

A Detector Point

ANODE-BEND detection appears to be less popular in these days than the grid-condenser-and-leak method. There is a point not to be overlooked, however.

Selectivity is always better when an anode-bend detector is used. For some sets this extra selectivity is worth having, even though the detector is not as sensitive as a leaky grid.

The increased voltage developed in the grid circuit when the detector is of the anode-bend type compensates to an extent for the reduced sensitivity, so that in certain instances the actual fall in signal strength is not very marked. With a good rectifying valve, properly adjusted, excellent results are to be obtained.

Lighting a Dial

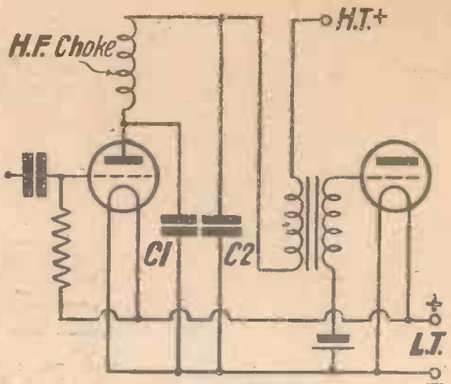
The attractiveness of a mains receiver is often materially increased by the addition of a small lamp which illuminates the dial.

Some dials have scales of celluloid material and may, therefore, be lighted by a lamp fitted a short distance behind them. With other arrangements the lamp must be fitted to throw a light upon the surface of the scale. A flash-lamp bulb of suitable voltage may be used, being connected to the heater circuit.

An H.F. Filter

The ordinary high-frequency by-pass fitted to a detector is not usually satisfactory when the set is a powerful one having two high-frequency stages. Some form of filter is needed, and a simple example is given in the accompanying diagram.

There are two fixed condensers and a high-frequency choke. Condenser C1 carries most of the high-frequency currents from the anode to the filament. The choke offers a high-impedance to them, but some high frequency will pass through the choke, and for this reason the second condenser C2 is provided.



A good H.F. filter

With a simple filter of this description very little high-frequency current will reach the low-frequency coupling. In some sets a further condenser should be fitted between the anode of the last valve and its filament, as even the smallest amount of H.F. in the loud-speaker wires is troublesome. Usual values for the condensers C1 and C2 in the diagram are .0003 microfarad each.

"Hot" Parts

Troubles arising mainly because parts are overloaded are of fairly frequent occurrence. A good rule is that no part of a set ought to be so used that it becomes hot.

The valves are an exception, as they normally work warm in mains sets, owing to the heater. Anode resistances, chokes, and transformers ought, however, to remain cool. A slight rise in temperature will usually do no harm, but a resistance or choke which runs hot is being overloaded and will, sooner or later, break down.

Mains valves pass a fair amount of anode current and sometimes special resistances must be used, as the ordinary patterns are not able to carry the current with safety. Incidentally, heating is proportional to the square of the current.

Smoothness Essential

A powerful set having a volume control which is the least little bit harsh is difficult to handle. The slightest variations in resistance of the control are enough to cause loud noises to be produced, with the result that the set is not pleasant to handle.

A very smooth control is needed, one that provides the necessary range of resistance without intermittent contacts.

Cheap Grid Bias

I find that the cheapest way of providing bias for high-frequency stages, and also the least troublesome, is to fit a separate battery in each stage. No grid circuit couplings can exist when there is a separate battery in each circuit and long wiring with the use of decoupling resistances, is avoided.

Cells of .9 volt are available and may be used in screen-grid stages, as a bias of this amount is usually adequate.

A Potentiometer Tip

When a directly-heated power valve is used in an alternating-current mains set, it is a good plan to fit a low-resistance potentiometer across the filament instead of using a centre-tapped transformer.

It is then possible to remove a trace of hum by adjusting the slider of the potentiometer. A low-resistance one should be used in order to avoid a large fall in voltage across it.

Often the anode current is fairly heavy, such as 30 milliamperes. If, now, this passes through 200 ohms, we lose 6 volts. A potentiometer of low resistance is, therefore, to be recommended.

"The CONTINENTAL PORTABLE"

(*Continued from page* 86)

When purchasing components it is a good plan to send for the full-size "A.W." blueprint which has been prepared for this set and which can be obtained, price 1s., post free, from the Blueprint Department, AMATEUR WIRELESS, 58-61 Fetter Lane, London, E.C.4. This gives all the details of construction of the set and is an invaluable guide, particularly to those who have had slight previous experience at making up the set.

The set is on show this week in the Radio Department of Messrs. Selfridge & Co., Ltd., of Oxford Street, London, W. London readers are advised to take the opportunity of seeing for themselves how simple is the layout of this new portable and how convenient it is in operation.

Construction may at once be started when all the parts are at hand and possessors of the blueprint will be able to get the major part of the work done without need for detailed instructions. Beginners, and those working without the aid of the blueprint, will need a few constructional hints. These, together with full instructions for operation, will be given in next week's issue.

Will the High-mu Valve Stay?

In this article J. H. Reyner suggests that the near future is likely to see a return to the use of the less ambitious type of output valve and advances some interesting reasons.

THERE has been a marked improvement in valve characteristics during the past few years, more particularly as regards output valves. Some years ago the standard output valve for any reasonably large power was the LS5A or the DFA7. The resistance of this latter valve is 2,850 ohms, the amplification factor 2.4, and its mutual conductance of 0.85.

Viewed in the light of present-day standards, we should not think very much of a valve with this performance. Let us compare it, for example, with the DO20, which has an internal resistance of 2,000 ohms, an amplification factor of 5, and a mutual inductance of 2.5, figures which are distinctly better on paper.

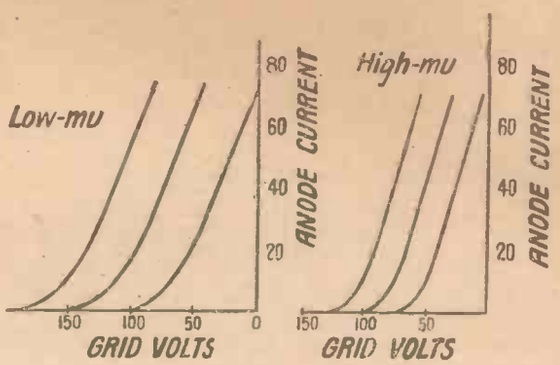
Yet many designers and users find the DFA7 a steady-going reliable valve, capable of giving good service without trouble, while experiments with the later forms of valve having a high magnification factor are not so successful. Is the high-mu valve really an advantage?

The use of the high-mu valve—I am referring here only to output valves—is certainly of convenience in enabling one to reduce the number of stages. Let us take a hypothetical case of a circuit required to give an output of about 2 watts, the input voltage being of a general order of 0.2 of a volt. We could do this in two ways.

1. An A.C. HL valve impedance-coupled to an A.C. P, coupled in turn through a 2-to-1 transformer on to a DFA7. The magnification of the first valve will give us a grid swing of between 5 and 6 volts on the grid of the second valve. This in turn will give us between 100 and 120 volts on the DFA7, which will be sufficient to load it up to its maximum output of 2 to 2½ watts.

2. Alternatively, we can apply the input to an A.C. HL, as before, transformer couple this, through an instrument having a ratio of 5-to-1 or so, on to the grid of a DO20. This will give us about 30 volts grid swing, which will not be quite sufficient to load the valve up to its full output of 2½ watts. We can overcome this difficulty, however, by putting in a small 2-to-1 transformer between the pick-up and the input of the amplifier, which will just apply the necessary extra voltage required to load the amplifier fully. Thus we have obtained our results with one stage less.

There are certain other factors to be borne in mind. In the first amplifier we have two coupling stages, each of low gain. Such circuits can be made with relative ease, to be constant in their frequency response. Moreover, if any one part of the frequency register is accentuated, one can often correct this in the second stage, or vice versa, obtaining a very level characteristic by playing the faults of, say, the impedance-coupled system off against those of the transformer-coupled system. One obtains a very flexible arrangement on which the overall gain is possible of adjustment.



Illustrating the difference between the two types of valve

Changed Conditions

This, however, is not such a serious objection as it was some time ago. With the second amplifier one is using high gain, involving the employment of a high-ratio transformer. By parallel feeding this, however, and using an instrument having a high primary inductance, such as the Lewcos transformer, it is possible to obtain a surprisingly good response characteristic. Then, again, any frequency correction necessary can be arranged to occur in the pick-up transformer. We are only just beginning to realise what can be done in the way of specially constructed step-up transformers to allow for certain defects. The bass may be accentuated to allow for the deficiencies of the record, while any part of the characteristic may be suppressed to compensate for defects in the remainder of the amplifier or the loud-speaker. Therefore, all told, we may conclude that a two-stage amplifier can, with correct precautions, be made equally good from the frequency response point of view, as the original three-stage instrument.

For and Against

Added to this we have the important advantage that the decoupling arrangements necessary are less. Since there are only two stages, we have only two decoupling systems to introduce instead of three (for in a real quality amplifier decoupling must be adopted in every stage). Perhaps the final advantage lies in the valve itself. The high-mu output valve has an inherently straighter characteristic. This point is demonstrated in the figure, where typical curves are shown for the ordinary low-mu output valve, such as DFA7 and the high-mu valve, such as the DO20. It will be seen that there is a distinct tail or curved portion to the characteristic in the former case, whereas this is of relatively small proportions in the second instance. This means that the valve may be loaded to a greater extent without distortion and the maximum permissible power output is increased. By working backwards this means that we can obtain the same power output with a smaller grid swing.

On the face of it everything seems to be in favour of the high-mu valve, but, unfortunately, such valves are more difficult to handle. Owing to the greater mutual conductance and to the higher stage gain all round, difficulties due to external sources are more easily introduced and one requires greater precautions in order to avoid untoward happenings. For example, there is a tendency to self-oscillation in these high output valves, due to feed-back either through the valve or through the common impedance of the battery or mains unit, or by direct coupling. This oscillation, of course, may not occur at the audible frequency with which we are dealing, but at some parasitic frequency very often inaudible.

(*Continued on next page*)

RADIOGRAMS

FOR the relay of the bells of St. Paul's Cathedral on July 27 the usual practice of placing the microphone near the bell tower will not be used. Instead, the pick-up units will be placed close to the River Thames and the sound of the bells will mingle with a multitude of river noises.

A true Bank Holiday spirit will prevail over the programme to be broadcast on August 4, when we are promised a pot-pourri of suitable songs arranged by Gordon McConnell. The entertainment will be sponsored by Edgar Lane, a friend of the late Albert Chevalier, whose songs will again be heard by National listeners.

The evening of July 26 will also be devoted to a variety entertainment, in which will be found Gillie Potter, Mabel Marks, Ann Penn, Maurice Toubas, Ernest Shannon, and the comedy artistes, Arthur Klein and Mona Magnet. *Dressing for Dinner*, by H. N. Edge, is the title of the sketch which rounds off the programme.

Dulcima Glasby, who has prepared many plays for the microphone, has now written one of her own; it is called *Obsession* and will be broadcast through the Regional transmitters on July 31 and through National on the following evening.

For the Children's Hour, L. Du Garde Peach, of *Punch*, has prepared a series of up-to-date Aesop Fables; for a grown-up entertainment, entitled *Fireside*, he has written a special sketch to be included in the National programme on August 13.

Chekov's farce, *The Wedding*, arranged for the microphone, will be broadcast on August 7 for the first time through the National stations; it will be followed by a new play by Richard Hughes, entitled *A Comedy of Danger*.

South Carolina, one of the few States in the U.S.A. to collect a tax on receivers, has up to the present netted £4,000. The whole of the proceeds are awarded to the maintenance of a tuberculosis sanatorium.

Station WGST, of Atlanta, Georgia, has been granted a licence for a short-wave television transmitter and will instal the apparatus at once. The station plans a series of television experiments.

The Jenkins Television Company, of Brooklyn, has started a daily broadcast featuring television coupled with the regular evening programme.

As a step toward extension of its trans-oceanic service into the Pacific, the Atlantic Telegraph and Telephone Company of New York has applied for a permit to erect a short-wave radio telephone station in California. The first regular service will be to the island of Oahu, in the Hawaiian group.

In August many of the concerts given by the Vienna Philharmonic Orchestra at Salzburg (Austria) during the annual Musical Festival in that city will be relayed to the Rosenhuegel high-power transmitter, as well as to Budapest and to some of the German and Swiss stations.

"WILL THE HIGH-MU VALVE STAY?"

(*Continued from preceding page*)

The presence of such an oscillation is highly destructive to the valve. The anode current rises to values in excess of the normal limits, and before very long the valve loses its emission and has to be replaced. Quality, of course, suffers if such an oscillation is present, but in some cases the loss of quality is not very marked, and the cause of the trouble is not detected straight away. One may simply notice that the quality is not quite up to what one would expect, but may search in all sorts of other directions in order to locate the trouble, all of which time the valve is slowly being ruined by the parasitic oscillation.

The remedy, of course, is to apply the usual oscillation stoppers and to use milliammeters in the anode leads when first constructing the circuit, since the presence of an oscillation is immediately detected by an abnormal reading on the milliammeter.

Then, again, the difficulties due to common impedance feed-back, and such like, are accentuated with the higher gain stages; and, finally, one must be well aware of what one is doing in order to obtain really good response when using a high-stage gain. Factors which are of relatively small moment where one is going to limit the amplification of a stage become troublesome and the design, generally speaking, becomes more difficult.

These factors are gradually leading to a swing of the pendulum in the opposite direction. High-stage gains have been employed for some time, and the valves introduced have been of a type suitable for the purpose, but it is quite possible that there will be a return to less ambitious output valves in the future.

YOUR VALVES — How to Choose and Use Them

A continuation of the review of prominent types of valves

IN continuing our reviews of the leading valve ranges, some reference to the significance of the two characteristics constantly referred to may be useful.

From the amplification factor *and* the impedance of a valve, its efficiency can be readily gauged. For a given impedance, the amplification gives the clue to the efficiency of the valve.

Suppose we have a valve of 20,000-ohms impedance; with an amplification factor of 20, this valve would be more efficient than a valve with the same impedance but a lower amplification factor. Some confusion is caused by the fact that there is no standard impedance for any valve type, so this characteristic cannot be taken as a true index.

But the mutual conductance is a very useful index, depending on both the amplification factor and the impedance. Thus for a given amplification factor the lower the impedance the greater is the mutual conductance. This factor is given by most valve makers, and is a definite indication of the goodness of the valve.

MARCONI AND OSRAM

MADE by the Marconi Osram Valve Co., Ltd., is a very extensive range of valves, marketed by the General Electric Co., Ltd., as Osram valves, and by the Marconiphone Co., Ltd., as Marconi valves.

So complete is this range that practically every type is available with a two-, four-, or six-volt filament. We must acknowledge how excellent are the general characteristics of all Marconi and Osram valves.

The type number of these valves gives a useful clue to their functions and filament consumptions. Thus H210 implies a high impedance valve with a two-volt .1 ampere filament; while a P625 is a power valve with a six-volt .25 ampere filament.

Two-, four- and six-volt Marconi and Osram general-purpose valves are available as H, HI., and L types.

The H210, with an impedance of 50,000 ohms, has an amplification factor of 35 and a mutual conductance (the factor of "goodness") of .7. The H410 has an impedance of 60,000 ohms, an amplification factor of 50 and a mutual conductance of .66. In these high-impedance valves the two-volt filament is just as good and often better than a four- or six-volt filament.

Four screen-grid valves for battery operation are included in the Marconi and Osram range. The S215, S410, and S610 provide alternative filaments for two, four, or six volts respectively. How similar are the characteristics is shown by the fact that the mutual conductance of the S215 is .85, of the S410, .9 and of the S610, 1.05.

Power valves are notable in the Marconi and Osram range. The P215 is deservedly popular. With an impedance of 5,000 ohms and an amplification factor of 7, this valve achieves the high mutual conductance of 1.4 with a very economical filament.

Larger power valves are included, notably the P240, with a mutual conductance of 1.6 and an impedance of 2,500 ohms; the P425, with a mutual conductance of 2 and impedance of 2,300 ohms; the P625 with a mutual conductance of 2.5 and an impedance of 2,400 ohms. It will be seen that in these power types the larger filament is worth while.

The .8 series of mains-operated valves include S.G., Det., H.F., L.F., and P. types.

More generally useful are the indirectly-heated valves. These have four-volt one-ampere filaments indirectly-heated by A.C. mains. There is a complete range of screen-grid, general-purpose, and low-frequency types. Recently, this range was usefully augmented by the PX4, which, with its four-volt .6 ampere filament is equally useful for battery and mains operation.

MULLARD

AS over thirty Mullard receiving valves are made by the Mullard Wireless Service Co., Ltd., it is difficult to do justice to the range in such a short note. Briefly, Mullard valves can be divided into two-, four- and six-volt types, for battery operation; and four-volt types for mains operation. In addition, there are no less than ten high-tension rectifying valves to augment the mains valves.

In the two-volt range are all the recognised types for screen-grid and other high-frequency amplification, detection, and power amplification. The alternative valves available for any given position are notable. For example, the PM2DX is specially designed for detection, but under some conditions the PM1HF or PM1LF could also be used. In two-volt power valves, Mullards provide three alternatives. There is the PM2 small power valve, with an impedance of 4,400 ohms and an amplification factor of 7.5; the PM252, a larger power valve with an impedance of 2,600 ohms and an amplification factor of 5.4; or there is the Mullard PM22 pentode valve which has the considerable amplification of 82.

In four- and six-volt ranges, similar types are made, the six-volt power valves having very useful characteristics. The PM256A, for example, has a maximum anode voltage of 200, an impedance of 1,400 and an amplification factor of 3.6. This is a useful valve for moving-coil loud-speaker work.

For all-electric sets, Mullard four-volt indirectly-heated mains valves are available in all the required types. The S4V is the screen-grid valve in this class, with good characteristics, namely an amplification factor of 1,000 for an impedance of just over 900,000. A new addition to the Mullard A.C. valves is the A.C./Pen., a four-volt one-ampere pentode valve, with a maximum anode voltage of 250.

PHILIPS

OF particular interest to constructors of mains units are the rectifying valves of Philips Lamps, Ltd. They can be divided into four groups: (*a*) Philips gas-filled thermionic rectifying valves; (*b*) Philips regulator lamps; (*c*) Philips luminescent rectifying valves; (*d*) Philips high-vacuum rectifying valves.

The Philips gas-filled valves are specially suitable for accumulator charging, although some of them have still more specialised uses, as in the rectification of multi-phase A.C.

The Philips regulator lamps are very useful in conjunction with the above rectifying valves, enabling the charging current to be kept constant within specified limits.

Philips luminescent rectifying valves are recommended only for exceptional circumstances; they have one great advantage, in that they can be connected direct to the mains supply without the need for an intermediate mains-transformer.

Philips high-vacuum valves are most useful as rectifiers in H.T. units for A.C. mains. A wide range is available, including valves with anode voltages up to 2,000 volts.

P.R.

TWO ranges of valves are made by P.R. Radio Products, both unusually low in price. The 1929 P.R. valves are made in the usual R.C., H.F., L.F. and P. types for two-, four-, and six-volt accumulators. The construction of these valves is claimed to result in great economy of H.T. consumption. A few examples will illustrate the P.R. characteristics. The P.R. 2HF is a two-volt .1 ampere valve, with an impedance of 28,000 ohms and an amplification factor of 13. The low-frequency valve has an impedance of 15,000 ohms for an amplification factor of 8. The two-volt super-power valve PR120, has the useful figures of 3,800 ohms impedance and amplification factor of 4.

For very little more money, the P.R. golden series are available, including a screen-grid H.F. amplifier for two-volt accumulator. This SG25 has an impedance of 220,000 ohms for an amplification factor of 150.

The golden range includes two-, four-, and six-volters for high-frequency, detector, low-frequency and power stages.

SIX-SIXTY

FOR a long time now the Six-Sixty Radio Co., Ltd., has been noted for its range of Six-Sixty valves. These are available in a useful range for two-, four- and six-volt accumulators.

The SS210HF is a good general-purpose valve with an impedance of 25,000 ohms. The SS210LF, with an impedance of 12,500 ohms, is more suitable for low-frequency amplification. If the valve precedes a resistance-capacity coupling, there is the SS210RC, with an impedance of 55,000 ohms.

A steep-slope valve, specially designed for the detector stage, is the SS225D. This has the low impedance of 11,000 ohms, but, as the slope is 1.2, the valve gives the useful amplification factor of 13.5. As an output valve for use with the types already mentioned, SS220P is specially suitable. It has an impedance of 4,800 ohms and an amplification factor of 7. The filament current is .2 ampere.

The SS215SG is a typical modern screen-grid valve, with an impedance of just over 200,000 ohms and an amplification factor of 190. The SS230SP is a super-power two-volt valve giving good quality with considerable volume. There is also the SS230PP, a two-volt pentode for use where extra

(*Continued on next page*)

"YOUR VALVES: HOW TO CHOOSE AND USE THEM"

(Continued from page 92)

amplification is required, such as when only one stage of low-frequency amplification is employed.

Corresponding types are available for a four-volt or six-volt accumulator. In addition to these battery-operated valves, Six-Sixty have produced a range of valves for A.C.-mains operation. There is the SS4GPAC, suitable for use as a detector or first low-frequency amplifying valve. The heater voltage is 4 volts at 1 ampere. The SS4DETAC has a very low impedance, namely 7,000 ohms, but as it has an amplification factor of 15, it is specially suitable as a detector. The increased efficiency of valves heated from A.C. mains is evident from the SS4PAC, which, with an impedance of 3,000 ohms, is a fine power valve having an amplification factor of 10. This mains series is completed by a screen-grid valve and a pentode valve.

TRIOTRON

IN the Triotron range are two- and four-volters for battery operation, as well as one or two special-purpose types, and a selection of A.C. mains valves.

Taking them in turn, we note a useful set of two-volters; TD2 is a medium-impedance detector, with an amplification factor of 11. Like others in this range the filament current is very low, being .07 ampere at two volts.

HD2 is mainly for high-frequency amplification; its impedance is 24,000 ohms and the amplification factor 17. Another valve, SD2, can also be used for this stage, but its characteristics make it specially suitable for detection. It has a steep slope, the amplification factor being 21 for an impedance of 12,400. The filament current has been justifiably increased to .14 ampere for this special detector.

For resistance-capacity coupling, there is WD2, with an amplification factor of 44 for an impedance of 62,000 ohms. ZD2 is a small power valve with quite good characteristics; amplification factor 6.2 and impedance 6,200 ohms. The UD2 is for big volume, with an impedance of 3,350 ohms and amplification factor of 5. The filament current is quite moderate at .22 ampere.

A good selection of four-volters is included in the Triotron range; XD4 is a good power valve, with the modest filament consumption of .15 ampere at 4 volts. The impedance is low, being 2,400 ohms, but the amplification factor at 6 is high, indicating a good slope.

A.C. mains valves and an H.T. rectifying valve complete the Triotron range. Four-volt filaments at .9 ampere are standard; the SN4 is for detection, an efficient valve with good characteristics. Although the impedance is only 8,000 ohms the amplification factor is 22. AN4 is for general purposes; impedance, 14,000 ohms, amplification factor 28. WN4 is for resistance-capacity coupling and YN4 for general low-frequency amplification. Full-wave rectifiers GN24 and half-wave rectifiers GN14 complete a varied range.

VATEA

MARKETED by Abbey Radio is the Vatea range of valves, which consist of two- and four-volters for the usual H.F., detector, L.F., and power stages; then there are some special multiple-grid Vatea valves, directly-heated and indirectly-heated mains valves, and, finally, a four-volt rectifying valve with a D.C. output of 60 milliamperes.

In the two-volt range the HX210 is the general-purpose valve, with an impedance of 13,500 ohms and an amplification factor of 14. The SX210 is the screen-grid valve, with quite a high efficiency. The impedance is only 130,000 ohms, for an amplification factor of 143.

The two-volt super-power valve, LX230, with a filament-current consumption of .3 ampere, has a high efficiency; its impedance is 2,850 ohms, and the amplification factor 6.3.

Three one-volt A.C. mains valves are included; the filaments are directly heated from A.C., and pass .5 ampere. The rated efficiency of these valves is high. The detector, for example, has an amplification factor of 14 for an impedance of 6,500 ohms.

A range of four-volt indirectly-heated mains valves includes types for H.F., Det., and P. stages. A screen-grid Vatea, SV4100, is a feature of the mains series.

FOTOS

MARKETED by the Concerton Radio and Electrical Co., Ltd., is a range of Fotos valves. Type BA9 is for general purposes, having an impedance of 20,000 ohms and an amplification factor of 9. The filament is economical, taking .05 ampere at 2 volts.

Type BC9 is more useful for low-frequency amplification; its impedance is 9,000 ohms for an amplification factor of 9. Here the filament is rated at 2 volts .12 ampere.

Type BD9, with an impedance of 4,500 ohms, is suitable as a power output valve. The amplification factor is 9. The filament passes .2 ampere at 2 volts.

In the four-volt Fotos range, there is type C9 for detection or low-frequency amplification, with an impedance of 7,500 ohms and an amplification factor of 9. The filament current is only .06 ampere.

Type D9 is a four-volt power valve, with an impedance of 4,500 ohms and amplification factor of 9. The filament current is .2 ampere.

D100 is the Fotos pentode and C150 is the Fotos screen-grid valve.

CRYSTAL CONTROL

ALTHOUGH a piezo-electric crystal is one of the most stable high-frequency oscillators known to radio science, it still falls short of perfection. For instance its fundamental frequency varies slightly with temperature. So far as external temperature conditions are concerned, these can be avoided by mounting the crystal in a separate casing fitted with a thermostat control. Unfortunately the internal temperature of the crystal also varies with the applied H.F. load, and this in certain cases, gives rise to an unavoidable frequency drift.

M. A. L.

When Asking Technical Queries

PLEASE write briefly

A Fee of One Shilling (postal order or postage stamps) must accompany each question and also a stamped addressed envelope and the coupon which will be found on the last page. Rough sketches and circuit diagrams can be provided for the usual query fee. Any drawings submitted should be sent on a separate sheet of paper. Wiring plans and layouts cannot be supplied.

Queries cannot be answered personally or by telephone.

"SOME PHOTO-CELL CIRCUITS AND THEIR USES"

(*Continued from page* 82)

In telegraphing a picture by the Karolus-Telefunken or Belin systems, light is reflected from successive points of the moving image on to the cell, and the light is interrupted several hundred times a second in order to make it intermittent. The effect is to produce a series of unidirectional impulses, and by means of grid bias these form an alternating current which can be sent on a carrier wave of suitable frequency over the telephone lines.

The first two stages of amplification suitable for a television circuit are shown

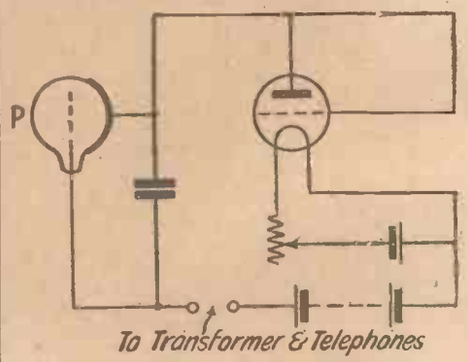


Fig. 6. A smoke detector circuit

in Fig. 5, as given by Campbell & Ritchie, in their book, "Photoelectric Cells." Either anode or cathode of the cell can be connected to the valve. One of the difficulties in any elaboration of this circuit is the distortion at high frequencies, for example, above eight or ten thousand, caused by capacity effects, and there is a fruitful field here for experiment.

Other types of circuit are those in which the current from the cell is allowed to charge up a condenser, as shown in Fig. 6. A voltage much higher than the glow potential is applied to the photo cell P, with a condenser shunted across it. When no light falls on the cell, the condenser will charge up until when the glow potential is reached, current passes through the cell If the filament emission of the valve is adjusted so that it is just below that of the glow discharge current, the discharge of the condenser will not persist, but the latter will repeatedly charge and discharge, so that a series of clicks will be heard in the telephone. When light falls on the cell, the glow potential is either not reached, or the condenser discharges are less frequent, and the frequency of the note heard in the telephone either diminishes or the noise stops altogether.

An apparatus based on these lines is in use for the detection of light scattered by smoke.

AT THE MAZDA VALVE WORKS

WHEN the B.T.H., Ediswan, and Cosmos organisations pooled their resources last year we looked forward to big developments from this immense radio merger. Some idea of the size of the combine can be gathered from the fact that the total invested capital is in the region of nine million pounds. And behind this capital is considerable experience and research in valve manufacture, dating back to the early days of the war, when valves were first produced.

That we were justified in our interest in the merger is quite evident from the extraordinary efficiency of the present Mazda valves. The manufacturers recently invited us to visit the Cosmos Works at Brimsdown, where Mazda valves are now being turned out in a big way.

We have been asked to stress the fact that Mazda valves, which are distributed by the sales organisation of the Ediswan Electric Co., Ltd., of 12 Newman Street, London, are being mass-produced to cope with the great demand that is considered inevitable during the next season.

In preparation for this demand we see huge stacks of all types of Mazda valves are piling up at the works. Walking through these works, we were impressed with the new automatic plant designed to speed up production. To give an example, one new machine can turn out ten thousand valve "pinches" per day, compared with the six hundred odd that were the maximum possible with the former machinery. In the various processes inspected there was ample evidence of a general change-over to plant capable of turning out valves at a very much greater rate than previously.

Two of the stages that particularly interested the writer were the final evacuation of residual gases by means of a high-frequency coil held for a few seconds over the glass bulb of the valve, and the test for microphonics, done by tapping the valve under operating conditions and observing whether any microphonic noises are set up in a near-by loud-speaker. This test is very ruthless and certainly accounts for the good performance of Mazda valves in portable sets.

Two interesting "side-shows" ought to be reported. One was a loud-speaker set employing only one valve. Good quality signals were being picked up by this new Mazda A.C. pentode. The other hook-up showed batches of Mazda super-power valves to good advantage. Driving a moving-coil loud-speaker, they were responsible for reproduction of exceptionally fine quality.

BROADCAST TELEPHONY

Broadcasting stations classified by country and in order of wavelengths. For the purpose of better comparison, the power indicated is *aerial energy*.

Metres	Kilocycles	Station and Call Sign	Power (Kw.)
		GREAT BRITAIN	
25.53	11,751	Chelmsford (5SW)	15.0
*200	1,500	Leeds	0.13
*242	1,238	Belfast	1.0
*261	1,148	London Nat.	45.0
*288.5	1,040	Newcastle	1.0
288.5	1,040	Swansea	0.13
288.5	1,040	Stoke-on-Trent	0.13
288.5	1,040	Sheffield	0.13
288.5	1,040	Plymouth	0.13
288.5	1,040	Liverpool	0.13
288.5	1,040	Hull	0.13
288.5	1,040	Edinburgh	0.35
288.5	1,040	Dundee	0.13
288.5	1,040	Bournemouth	1.0
288.5	1,040	Bradford	0.13
*301	995	Aberdeen	1.0
*310	968	Cardiff	1.0
*356	842	London Reg.	30.0
*377	797	Manchester	1.0
*399	753	Glasgow	1.0
*479	626	Midland Reg.	25.0
1,554	193	Daventry (Nat.)	25.0
		AUSTRIA	
*246	1,220	Linz	0.5
*283	1,058	Innsbruck	0.5
*352	851	Graz	9.0
*453	666	Klagenfurt	0.5
*517	581	Vienna	20.0
		BELGIUM	
206	1,460	Antwerp	0.4
216	1,391	Chatelineau	0.25
216	1,391	Brussels (Conference)	0.25
339	1,256	Binche	0.3
244.7	1,226	Glient	0.25
246	1,218	Schaerbeek	0.5
338	887	Forest	3.0
*509	590	Brussels	1.0
		CZECHO-SLOVAKIA	
*263	1,139	Moravska-Ostrava	10.0
*279	1,076	Bratislava	12.5
294.6	1,018	Kosice	2.0
*342	878	Brunn (Brno)	12.0
*487	617	Prague (Praha)	5.0
		DENMARK	
*281	1,067	Copenhagen	0.75
1,153	260	Kalundborg	7.5
		ESTONIA	
401	748	Reval (Tallinn)	1.5
		FINLAND	
*221	1,355	Helsinki	10.0
*1,796	167	Lahti	40.0
		FRANCE	
29.7	10,180	Radio Experimental (Paris)	1.4
175	1,714	St. Quentin	0.1
210	1,430	Radio Touraine	0.5
219.9	1,364	Beziers	0.3
219.9	1,364	Fécamp	0.7
237	1,265	Bordeaux (Radio Sud-Ouest)	1.0
289	1,255	Nimes	0.25
250	1,200	Juan-les-Pins	0.5
256	1,171	Toulouse (PTT)	1.5
265	1,130	Lille (PTT)	0.7
*272	1,102	Rennes (PTT)	0.5
286	1,046	Montpellier	0.3
*287	1,044	Radio Lyons	0.5
294.8	1,017	Limoges (PTT)	0.5
306	980	Bordeaux (PTT)	1.0
309	970	Radi Vitus	1.0
316	950	Marsilles (PTT)	0.5
326	914	Grenble (PTT)	0.5
329	914	Post Parisien	0.5
345.2	869	Strasbourg. (testing shortly)	12.0
369	812	Radi LL (Paris)	0.5
385	779	Radi Toulouse	8.0
447	671	Paris (Etat)	0.8
466	644	Lyon (PTT)	5.0
1,446	207	Eiffel Tower	12.0
*1,725	174	Radi Paris	16.0
		GERMANY	
*218	1,373	Flensburg	0.5
*227	1,319	Cologne	4.0
*227	1,319	Münster	3.0
*227	1,319	Aachen	0.35
232.2	1,290	Kiel	0.35
*239	1,256	Nürnberg	2.0
244	1,227	Cassel	0.25
*253	1,184	Gleiwitz	2.0
*259	1,157	Leipzig	2.5
*270	1,112	Kaiserslautern	0.25
*275.8	1,087	Königsberg	2.5
*283	1,058	Magdeburg	0.5
*283	1,058	Berlin (E)	0.5
*283	1,058	Stettin	0.5
*316.8	947	Bremen	0.35
*320	937.6	Dresden	0.25
*325	923	Breslau	1.5
*360	833	Stuttgart	1.5
*372	806	Hamburg	1.5
*390	770	Frankfurt	1.5
*418	716	Berlin	1.5
*453	662	Danzig	0.25
*473	635	Langenberg	15.0
*533	563	Munich	1.5
*560	536	Hanover	0.35
565	530	Augsburg	0.25
570	527	Freiburg	0.35
*1,635	183.5	Zeesen	20.0
1,635	183.5	Norddeich	10.0
		HOLLAND	
31.28	9,599	Eindhoven (PCJ)	30.0
*299	1,004	Huizen (between 11.40 a.m. and 5.40 p.m. B.S.T.)	6.5
*1,071	280	Huizeu	6.5
*1,071	280	Scheveningen-Haven	5.0
*1,875	160	Hilversum	6.5
		HUNGARY	
210	1,430	Budapest (Csepel)	1.0
550	545	Budapest	20.0
		ICELAND	
*1,200	250	Reykjavik (shortly testing)	16.0
		IRISH FREE STATE	
*225	1,337	Cork (1FS)	1.0
*413	725	Dublin (2RN)	1.0
		ITALY	
25.4 and 80		Rome (3RO)	9.0
291	1,030	Turin (Torino)	7.0
332	905	Naples (Napoli)	1.5
381	788	Genoa (Genova)	1.0
*441	680	Rome (Roma)	50.0
453	662	Bolzano (IBZ)	0.3
*501	599	Milan (Milano)	7.0
		LATVIA	
*525	572	Riga	7.0
		LITHUANIA	
*1,935	155	Kaunas	7.0
		NORTH AFRICA	
365	821	Algiers (PTT)	16.0
416	720	Radio Maroc (Rabat)	10.0
1,250	240	Tunis Kasbah	0.6
		NORWAY	
364	824	Bergen	1.0
368	815	Frederiksstad	0.7
445	674	Rjukan	0.18
453	662	Nidaros	1.2
453	662	Tromsö	0.1
455	659.3	Porsgrund	0.7
*493	608	Oslo	60.0
		POLAND	
214	1,400	Warsaw (2)	2.0
234	1,283	Lodz	1.5
*313	959	Cracow	0.5
*335	896	Poznan	1.2
381	788	Lvov	2.0
384	780	Wilno	0.5
*408	734	Katowice	10.0
1,411	212.5	Warsaw	8.0
		PORTUGAL	
320	937.6	Lisbon (CTIAA)	0.25
		ROUMANIA	
*394	761	Bucharest	12.0
		RUSSIA	
720	416.6	Moscow (PTT)	20.0
800	375	Kiev	20.0
824	364	Sverdlovsk	25.0
1,000	300	Leningrad	20.0
1,060	283	Tiflis	10.0
1,073	279	Rostov (Don)	10.0
1,103	272	Moscow Popoff	40.0
*1,304	230	Moscow-Stchelkovo (C.C.S.P.)	100.0
1,380	217.5	Bakou	10.0
		SPAIN	
251	1,193	Barcelona (EAJ15)	0.5
266.7	1,125	Barcelona (EAJ13)	5.0
*349	860	Barcelona (EAJ1)	8.0
368	815	Seville (EAJ5)	1.5
424	707	Madrid (EAJ7)	2.0
462	649	San Sebastian (EAJ8)	0.5
		SWEDEN	
135	2,222	Motala	60.0
231	1,301	Malmo	0.6
*257	1,160	Hörby	10.0
272.1	1,102	Falun	0.5
*322	932	Göteborg	10.5
*436	689	Stockholm (tests)	60.0
*542	554	Sundsvall	1.0
*770	389	Ostersund	0.6
1,251	239.8	Boden	0.6
*1,348	222.5	Motala	30.0
		SWITZERLAND	
*403	743	Berne	1.0
*459	653	Zurich	0.63
678.7	442	Lausanne	0.6
760	395	Geneva	0.25
1,010	297	Basle	0.25
		TURKEY	
*1,220	245.9	Istanbul	5.0
1,961	153	Ankara	7.0
		YUGOSLAVIA	
307	976	Zagreb (Agram)	0.7
432	694	Belgrade	2.5
574.7	522	Ljubljana	2.5

All wavelengths marked with an asterisk have been allotted according to the *Plan de Prague*.

WIRELESS IN PARLIAMENT

From Our own Correspondent

MR. LEES SMITH informed Mr. Day that the number of prosecutions undertaken by the Post Office during the twelve months ended May 31, 1930, for the use of wireless receiving apparatus without a licence was 1,029. Convictions were obtained in 1,024 cases, the remaining five cases being dismissed for various reasons. The total amount of the fines and costs imposed by the courts was £1,193 19s. 7d. The Post Office expenses in connection with these prosecutions, less the sums awarded by the courts as costs, were borne out of the Post Office share of the revenue from wireless licences. The fines were not received by the Post Office, but were paid over to the Exchequer.

According to a report from the Assistant Trade Commissioner, the Government of India has taken over control of all radio broadcasting and it appears that all stations will be operated as a Government monopoly. The Indian Government has purchased all assets of the Indian Broadcasting Company amounting to approximately £21,600. The Government will assume full control.

It is interesting to note that in order to obviate any risk of the connection to the screen-grid valve of the receiver used on the Ringford-Smith transatlantic flight coming loose, a Belling-Lee anode connector was used.

Varley Pentode Output Transformer—It should be noted that the price of this transformer is £1 1s., and not £1, as stated in the advertisement on page 63 of our issue dated July 19.

"Amateur Wireless and Radiovision." Price Threepence. Published on Thursdays and bearing the date of Saturday immediately following. Post free to any part of the world: 3 months, 4s. 6d.; 6 months, 8s. 9d.; 12 months, 17s. 6d. Postal Orders, Post Office Orders, or Cheques should be made payable to "Bernard Jones Publications, Ltd."

General Correspondence is to be brief and written on one side of the paper only. All sketches and drawings to be on separate sheets. **Contributions** are always welcome, will be promptly considered, and if used will be paid for. Queries should be addressed to the Editor, and the conditions printed at the head of "Our Information Bureau" should be closely observed. **Communications** should be addressed, according to their nature, to The Editor, The Advertisement Manager, or The Publisher, "Amateur Wireless," 58-61 Fetter Lane, London, E.C.4.

FULL-SIZE BLUEPRINTS

When ordering, please send Postal Order, NOT STAMPS

CRYSTAL SETS (6d. each)

B.B.C. Brookman's Park Set AW265
Regional Crystal Set WM176

ONE-VALVE SETS (1s. each)

B.B.C. Official One AW208
Hartley Single-valver WM198

TWO-VALVE SETS (1s. each)

Loud-speaker America Two AW190
Talisman Two (D, Trans) AW194
British Broadcast Two (D, Trans) AW215
Easy-tune Two (D, Trans) AW226
Wavelets Two (D, Trans) AW229
No-battery A.C. Mains Two (D, Trans) .. AW230
No-battery Gramo-radio 2 (D, Trans) .. AW238
1930 Talisman 2 (D, Trans) AW239
Brookman's Two (D, Trans) WM168
Programme Two (D, Trans) WM177
New Crusader (D, Trans) WM182
Radio-Record Two (SG, D) WM187
Gleaner Two (D, Trans) WM200

THREE-VALVE SETS (1s. each)

All-wave High-mag. Three (D, 2 Trans) .. AW199
Knife-edge Three (D, RC, Trans) AW201
Talisman Two-three (D, RC, Trans) AW203A
Wide World short-wave Three (HF, D, Trans) AW207
Everybody's Three (SG, D, Trans) AW209
1930 Ether Searcher (SG, D, Trans) AW211
New All-Britain Three (HF, D, Trans) .. AW214
Best-by-Ballot Three (SG, D, Trans) Price 4d. free with copy of "AW" AW217
Brookman's By-pass Three (D, 2 Trans) .. AW220
Everybody's all-electric Three (SG, D, Trans) —A.C. AW221
1930 Clarion Three (SG, D, Trans) AW223
Beginner's Regional Three (D, 2LF) AW233
Standard Coil Three (HF, D, Trans) WM117
Fanfare (D, 2 Trans) WM157
Brookman's Three (SG, D, Trans) WM161
Community Three (D, RC, Trans) WM164
New Q3 (SG, D, Pentode) WM167
Brookman's Push-Pull Three (SG, D, Trans) 1/6 WM170
Celerity Three (SG, D, Trans) WM173
All-nations Three (D, 2 Trans) WM178
Inceptordyne (SG, D, Pentode) WM179
Brookman's A.C. Three (SG, D, Trans) 1/6 .. WM184
Music Marshal (D, 2 Trans) WM190
Gramo-Radio D.C. Three (SG, D, Trans) .. WM196
Concert Three (D, 2 Trans) WM199

FOUR-VALVE SETS (1s. 6d. each)

Clarion All-electric Three (SG, D, Trans—A.C. Rectifier) AW200
Music-Lover's Gramo-radio (SG, D, RC, Trans)—1s. 6d. AW202A
Music-Lover's Gramo-radio (Loud-speaker)—1s. AW202B
Horizon Four (SG, D, 2 Trans) AW237
Standard-coil Four (HF, D, 2 RC) WM122
Dominions Four (2SG, D, Trans) WM134
Arrow (SG, HF, D, Trans) WM154
1930 Monodial (2SG, D, Trans) WM158
Electric Four (All A.C.—SG, D, RC, Trans) .. WM162
Brookman's Four (2SG, D, Trans) WM174
Transportable Four (SG, D, 2 RC) WM180
Super Q (SG, D, 2 Trans) WM189
Lodestone Four (HF, D, RC, Trans) WM193
Searcher's Four (SG, D, RC, Trans) WM194
Invitation Four (SG, D, RC, Trans) WM201

FIVE-VALVE SETS (1s. 6d. each)

James Quality Five (2SG, D, RC, Trans) .. AW227
All-wave Lodestone Five (HF, D, RC, Push-pull) WM146
1930 Five (2HF, D, RC, Trans) WM171
Dual-screen Five (2SG, D, RC, Trans) WM185
Radio-Record Five (SG, D, Trans-parallel) .. WM188
Overseas Five (3SG, D, Trans) WM191

AMPLIFIERS (1s. each)

A.W. Gramophone Amplifier AW205
Brookman's Separator (HF Unit) AW212
Two-valve Amplifier AW216
"Mag" Gramo Unit AW224
Concentrator H.F. Unit WM169
Radio-Record Amplifier (DC Mains) WM183

MISCELLANEOUS (1s. each)

Short-wave Adaptor (1 v.) AW183
Simplest H.T. Unit AW197
By-pass Unit (Wavetrap) with copy "AW"—4d. AW218
"Twin" Brookman's By-pass (6d.) AW222
"A.W." Paper Loud-speaker AW231
James H.T and L.T. Charging Unit AW232
Simplest H.T. Eliminator for D.C Mains .. AW234
Simplest H.T. Eliminator for A.C. Mains .. AW236
Choke Output Unit AW240
A.C. Mains Amplifier WM149
H.T. Unit for A.C. Mains WM159
"W.M." Linen-diaphragm WM172
Brookman's "Wipe-outs" WM186
Short-wave adaptor for Overseas Five WM192
Staminator Unit for A.C. Mains WM202

PORTABLE SETS

Holiday Portable Three (D, RC, Trans) AW138 1/-
Music Leader (SG, D, RC, Trans) with copy "AW" .. .. AW203 -/4
Merry-maker Portable (D, 2 Trans) .. AW228 1/-
Sunshine Three (SG, HF, SG, D Trans) AW235 1/-
Continental Portable (SG, D, Trans) .. AW241 1/-
Wayfarer Portable (Super Het) WM139 1/6
Pedlar Portable Two (D, Trans) WM195 1/-
Pedlar Portable Three (D, 2 Trans) WM197 1/-
James Portable SG3 (SG, D, Trans) .. WM203 1/-

Copies of the "Wireless Magazine" and of "Amateur Wireless" containing descriptions of any of these sets can be obtained at 1s. 3d. and 4d. respectively, post free. Index letters "A.W." refer to "Amateur Wireless" sets and "W.M." to "Wireless Magazine" sets.

AMATEUR WIRELESS 58-61 FETTER LANE LONDON, E.C.4

PREPAID ADVERTISEMENTS

Advertisements under this head are charged THREEPENCE PER WORD, minimum charge THREE SHILLINGS.

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