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MODERN WIRELESS

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The Leading Radio Magazine.

Vol. XI. No. 28. APRIL, 1929.

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SPECIAL SUPPLEMENT, "RADIO AND THE GRAMOPHONE," PAGES 449-460

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MODERN WIRELESS

Vol. XI. No. 28. April, 1929.

This Month's Sets—Portable Set Problems—Television Tests—Too Optimistic.

This Month's Sets

THE "M.W." "Easy-Change" Crystal Set, which is described in this number, is a product of the "M.W." Research and Construction Department. Our constructional readers will find this a remarkably efficient little receiver, not only as regards sensitivity, but as regards selectivity as well. It will be found that alternative programmes can be brought in by the operation of a single panel switch with ease and reliability.

The "Long-Distance" Two, also designed and built by the MODERN WIRELESS Research and Construction Department, may be described as a stable and highly sensitive set for long-distance reception with telephone receivers. As one of the members of our Constructional Department said: "You can scour the ether of the whole hemisphere with this fine receiver." Allowing, of course, for enthusiasm it may be said that this receiver gives about the best anybody could expect of any two-valver for telephone reception.

The "M.W." "Portable" Three is a completely self-contained set of light weight and simple construction. It is easy to build and easier still to operate. This is just the set you want for the summer and open-air use. This again has been designed and built by the MODERN WIRELESS Research Department.

Portable Set Problems

THE "Simple-Screen" Four is a perfectly straightforward circuit, but embodied in it is a design of such an efficient character that it gives out-of-the-ordinary results. This is really a long-range loud-speaker set, but great attention has been given to the question of quality of reproduction. It is easy and inexpensive to build, and is another product of the MODERN WIRELESS Research and Construction Department.

Another feature to which we should like to draw special attention in this number is that entitled: "Portable Set Problems." The author is Mr. Percy W. Harris, the Editor of our contemporary, the "Wireless Constructor." Mr. Harris has carried out innumerable experiments with portable sets, and in this article gives readers of MODERN WIRELESS the benefit of the valuable and practical tests he has lately undertaken, and the results and data he has collected.

Television Tests

As we go to press, secret tests of television have been carried out. A transmitting apparatus for television has been installed in connection with the old Marconi House stand-by broadcasting gear, and on March 5th the Postmaster-General, with Lord Clarendon, Commander Kenworthy, Professor Fleming and many other well-known M.P.'s, were gathered together in the General Post Office to witness a private demonstration. Both the Baird Company and the guests who witnessed the demonstration agreed not to divulge or give any opinion concerning the test to the Press, but it is understood from well-informed circles that the guests were asked to write a non-technical report of what they thought of the demonstration.

It is also understood that further technical tests will be carried out by the B.B.C. with a view to determining whether the Baird system has undergone any improvement which would make it more acceptable from a technical point of view for broadcasting purposes.

A report has been current that this demonstration was forced because certain M.P.'s in the House were under the impression that television progress was being obstructed. This is the view held by Mr. Cecil Malone, M.P. He has been reported as stating in the "Daily Herald" that he thinks television has been obstructed unnecessarily, and, further, that he cannot help thinking the Cable interests fear television very much.

Too Optimistic

THIS view, of course, is perfectly unjustified by the facts. Every possible help has been given to television, but certain enthusiasts who have let their discretion run away with their common sense have rather overdone the sponsoring of television, to the extent of ignoring candid and technical criticism by those competent to understand the enormous difficulties which stand in the way of providing a public utility television service.

It may be judged how laymen can be carried away by their enthusiasm for a new invention when it is stated that one M.P. gave his opinion that "television, in fact, will soon knock even the Beam Wireless into a cocked hat."

Well, such enthusiasm is no doubt admirable, but considered in the cold light of technical impartiality, one must admit it is a little amusing. We sincerely hope that as a result of these new technical tests something transpires which will prove that television is now improved to such an extent that it is a practical proposition.

It would be of enormous benefit to trade in this country—to mention only one aspect of the value of television—if such a service could be definitely proved to be practical.

We will refrain from further comment, however, and wait for the report which will inevitably be made public when the results of the tests have been carefully examined, and judgment given.

IDEAL SHORT-WAVERS

An article of eminently practical interest.

By L. H. THOMAS.

I KNOW that "The Ideal Short-Waver" would have made a rather more attractive title for this article, but I have decided after careful thought that such a thing does not exist. Everyone has his own private idea of the short-wave enthusiast's dream of bliss, and there is no particular receiver or circuit that would please everyone sufficiently well to convince him that he had found the ideal short-waver.

For Rapid Searching

I may as well confess at once that, just at the moment, my ideal short-waver consists of a detector followed by two resistance-coupled note-mags. I like a set with a screened-grid stage very much indeed, but I am far more keen on rapidly searching round the whole short-wave spectrum to see what I can find than on merely tuning-in a distant broadcast at incredible strength and then going to sleep over it, so that my own ideal set must be one with which very quick searching is possible, and, naturally, one with the minimum number of controls to operate.

Resistance-coupled note-mags. attract me because of the silent background obtainable with two *good* resistances in use. Everyone is familiar with the perpetual undercurrent of "mush" which comes in on the short waves when the set is being operated just on the oscillation point. This mush is not to be confused with noises arising from a defective H.T. battery or a loose connection; it is inevitable to a certain extent.

Eliminating Mush

Quite recently I found that it was possible to arrange a resistance-coupled short-waver so that the mush was almost entirely absent, and I have decided that a much greater portion of it than I previously suspected is caused by long-wave stations and harmonics that are picked up directly on the primary winding of the L.F. transformer. This was confirmed by comparing the amounts of mush received when a cheap and an expensive transformer were in use. This particular portion of the mush is only heard when the set is oscillating, while another portion, which is never lost on some sets, is apparently due to a noisy grid leak. Trying some fifteen grid leaks produced *one* which did not make the noise!

A little reflection will show that a resistance-coupled set with an anode-bend rectifier has eliminated the two causes of this annoying "mush." Here, therefore, is another good reason for my own choice of the ideal short-waver. In passing let it be mentioned that unless really good and reliable anode resistances are used the mush is liable to be doubled or trebled in strength.

I inquired of a friend, whose only interest in short-waves lies in the logging of distant broadcasting stations, what he would consider to be the ideal short-waver, and his answer, though somewhat elusive, is rather interesting. He said: "Any set that will bring in stations that the ordinary 'detector and note-mag.' fan can't get!"

RADIO IN PERSIA

New officials connected with the National radio organisation receiving instruction in wireless transmission and reception.

As a matter of fact, such a set as this is a tough proposition at the best of times, since the average detector and note-mag. on short waves *will* get such an amazing number of stations.

On the broadcast waves the user of a set with one good stage of H.F. justly feels quite superior to his next-door neighbour with a mere two-valver, and can back up his superiority by the stations he receives and the manner in which he receives them. On short waves, however, it is by no means so easy. A set with two screened-grid stages needs to be very well designed and operated if it is even to bring in stations that the "H.F.-less" receiver does not get. True, a screened-grid set will get *the same* stations with much greater certainty and consistency, but it is a decidedly moot point whether it will get any others. I think, speaking from my own experience, that this friend, although he does not know it himself, would think the super-het. his ideal.

Super-Het's Drawback

I used one on a special series of tests lasting some six months, and, although Morse work was in question at that time, I used to amaze my friends by including in my lists of stations calls that they had never even heard of! So many of these appeared that a deputation solemnly called late one night to make sure that I was capable of reading Morse without garbling the call-signs! As a matter of fact, I was able to demonstrate the set working at its very best.

The super-het. has, of course, one huge drawback in the "second-channel interference" from which it is inseparable. There are quite enough stations on short waves occupying narrow bands of wavelengths now without our using sets that will bring each one of them in at two places on the dial. For broadcast this does not matter very much, since most of the short-wave broadcasters are fairly widely situated in frequency. For amateur Morse work, however, the extra interference introduced in this way is prohibitive.

Best for Home-Constructor

The absolute tyro, as far as short waves are concerned, would undoubtedly find his ideal set the much-derided detector and note-mag. Such a set, carefully designed, is capable of extreme sensitivity and ease of operation, provided that capacity-controlled reaction is used, and that the circuit is so arranged that both the variable condensers have their moving plates earthed. Good slow-motion dials, preferably with a metal screen of some kind, are also desirable. With these precautions it will usually be unnecessary to use a metal panel, or to set the condensers back behind the panel.

TALKING OF ANNOUNCERS ....

The author considers that radio announcing to-day is an odd way of earning a living, and recalls some of the fascination that attended the early days of broadcasting when he himself was a Director-Announcer.

By A. CORBETT-SMITH.

TALKING about our radio announcers, I often wonder what is the special attraction about the work in these days. What it is, I mean, which brings men back to the game after years ?

For Manchester listeners have lately welcomed the return of their old friend, Mr. T. C. L. Farrar (" Uncle Ajax," if I mistake not) ; the London and Daventry audiences are reviving old memories through the well-remembered voices of Mr. Eric Dunstan (after his India adventure), of Mr. Rex Palmer and Mr. Derek McCulloch. All returned to microphone duty after a long silence.

Mr. Rex Palmer, who undoubtedly is one of the most popular of all announcers. His voice has been heard from Savoy Hill since the earliest days of broadcasting.

To-day it seems rather an odd way of earning a living, when you come to think of it. It is so—what shall I say ?—negative ; as the B.B.C. now orders conditions of working. So very different from the early days of radio when the announcers were hard-working sharers in the strenuous activities of a station's 98-hour week, and *did* things—mighty well, too !

What the Judge Said, and . . .

Very nervous work, too, I should imagine, to-day. Mispronounce " Kirkcudbright " or " Alnwick " in the News Bulletin and it seems that you have half the population of the British Isles down upon you the next morning.

And why is it that (excepting for impressionable women who seem to treat them as film stars) the announcers are so often the subject of derision amongst folk who certainly should know better ?

For instance, I was in a Law Court the other day when the defendant in an action was described as an employee of the B.B.C. Like a flash the judge turned to the defendant.

" Oh," remarked his lordship, in a tone of scathing irony, " I suppose you are one of those ' golden-voiced ' announcers who call us——"

" No, my lord," broke in the defendant hurriedly, " I plug pipes." (*Laughter.*)

But I shall hazard an explanation of that. Curious as it may seem, our so-called " intellectuals " still regard broadcasting with a certain contempt. Just as they lately regarded the cinema. The announcer is the liaison officer between the B.B.C. and the public. The overt representative of the B.B.C. Thus, whenever chance occurs, he it is who gets trounced.

A suave and polished gentleman, your announcer of to-day, with an odd stamp of bureaucratic officialdom about him. Just like his employers. Yet gracious and courteous withal. For the B.B.C. ever was a most courteous body. But I often wish that he would occasionally break loose and be himself—a human being, instead of a vulcanite mouthpiece.

. . . What the Bandsmen Said

No, most certainly the game is not so cheery and exciting as it used to be in the old prehistoric days. Days when a studio carried three or four telephone

Mr. Cecil Lewis, a previous radio " Uncle," who a few years ago retired from active broadcasting in order to write and arrange dramatic productions – many for the microphone.

receiver microphones strung from the ceiling, and you always forgot to switch on the particular " mike " into which you were speaking. When, instead of the throbbing tones of King Richard II in his dying speech, the audience, by accident of " mike," would be treated to a lively private discussion between a couple of bandsmen in the corner upon the probable winner of the 3.30 race.

Guide, Philosopher, and Friend

I shall always remember the very first bit of radio announcing which I ever did. Cardiff, February, 1923. I took on the News Bulletin by way of a try-out, and recited each item in a different voice, with appropriate dramatic emphasis.

There was a lovely murder item, for one. I put that over like Henry Irving declaiming " The Dream of Eugene Aram." Very blood-curdling and shuddery! The next item was a trifling London coster comedy. That went over in the style of Albert Chevalier in " Knocked 'em in the Old Kent Road." A choice fragment from Moose River Gulch, Pa., was given in the guise of a " hobo " from Coney Island. The Stock Exchange prices, with interpolated comments, were, for once, as joyous as a Jack Hulbert *revue*.

Imagine that from 2 L O to-morrow night! And picture the Corporation's post-bag the next morning!

" Ah! " say you. " Thank heaven we have progressed since those days! We couldn't stand for that sort of foolery now! "

Quite! But that, of course, was an extreme case. Just a puppy worrying a slipper, as you might say. But as for the " progression "—well, I am not so sure. We may have gained on the swings, but we have certainly lost on the roundabouts.

Between London and the provincial stations a great gulf lay fixed. London announcers always had to mind their P's and Q's. Away in the country the station director himself was invariably the principal announcer, and he

A photograph which recalls the early days when, as the author says, " a studio carried three or four telephone receiver microphones strung from the ceiling."

played a vastly different part from his brother in London.

And the part which instinctively he assumed was that of " guide, philosopher, and friend " to his unseen audience. He vaguely knew himself to be assisting at the birth of a new and mighty force. He was opening, to scores of thousands of folk, the gateway into a new and very wonderful world.

And yet, by an odd and fortunate paradox, he had no time to stop and think of it like that. His daily work was far too strenuous. Had he stopped to think he would have been too over-awed by his dread responsibility to continue.

And so it was that, in the joy of this new and exhilarating game, we director-announcers sat aloft in our tiny watch-towers like so many portly Falstaffs, " uttering most

The Hon. David Tennant, who until recently was an announcer at Savoy Hill. Not long ago he was bequeathed a fortune by Viscountess Grey, but he generally arrived at the studio in a small and quite inexpensive car.

contagious breath." We laughed and the world laughed with us. And we all, audience and announcers, were the better and happier for it.

Crude and amateurish much of it may have been by present-day standards. But, at least, it was big and human. And, above all, it glowed and rollicked with the golden spirit of Youth. We made our appeal to the heart rather than to the brain. We treated the grown-ups like children, jolly school-boys and girls, and the young folk we treated like grown-ups. We were all just one happy family together.

The Laughter of Creation

Things are generally like that at the beginning of a venture. It is the laughter of creation, as when " the morning stars sang together." But the hour quickly passes. Radio entertainment has swung into an ordered stride. Programme items are timed to the fraction of the Greenwich second-hand. Announcers, and their victims, are neatly dressed, tabbed and docketed behind plate-glass windows: " This style, £3 17s. 6d." But I am glad if Manchester is glad to have " Uncle Ajax " home again.

America, as usual, has gone very thoroughly into the matter of the " ideal announcer." But the decisions of the authoritative committee formed to consider it do not really carry us very far. They have concerned themselves, for the most part, with abstruse details like rate of speech, with pitch variations and suchlike fearful wildfowl.

But one factor they did emphasise strongly. The need for " personality " on the part of the announcer. And, as an old stager, I cannot but agree.

Personality, in any walk of life, is a gift from the gods. Whether pleasing or displeasing it does lift a man out from the rank and file of a crowded world. But in a man who has the daily task of presenting to millions of mixed folk a programme of artistic and educative merit, a gracious, sincere and sympathetic personality is, surely, of the first importance.

And if, combined inseparably with this entertainment, we add what I have always conceived to be the ultimate function of radio—the welfare, health and happiness of the community and so the formation of character—we come to see yet more clearly how paramount is the need for that

(*Continued on page* 475.)

The "M.W." PORTABLE THREE

This interesting set has been specially designed by the "M.W." Research Dept. to combine many of the best features of the "transportable" and true portable types. Its unusually powerful L.F. side enables it to put up a remarkable performance, even on an enclosed frame aerial.

THE increasing popularity of the "transportable" type of set is rather apt to make us forget our old friend the true portable, with its very real attractions.

By "portable," of course, I mean the kind of set which is not too large or too heavy to be carried about with reasonable ease, and so can be taken on motoring expeditions, away on holidays, and so on.

The "Transportable" Type

The "transportable," on the other hand, is a bigger and more powerful type of receiver which is really intended for convenient use in any room in the house, its main advantages being the absence of external batteries and wires, pleasing appearance, and its power of providing a programme just where you want it. Such sets will undoubtedly form a larger and larger proportion of those in use in the future, and although their range is necessarily limited by the fact that they work on an enclosed and not too efficient frame aerial, modern examples can put up quite a useful performance.

A good example of a home-construction design for a set of this type is the "M.W." "Transportable" Four, described in the last two issues. This set was actually capable of bringing in foreign stations on the speaker after dark, not, of course, at very great volume, yet at quite pleasant strength.

That such results can be obtained with only four valves indicates that the modern set of this type is reaching a pretty high level of efficiency.

True, it cannot be recommended as an ideal outfit for the man whose main interest is long-distance reception, but the fact that it is capable of bringing in foreigners is a good indication of the reliability with which it will perform its main function of receiving the local and 5 G B, and doing it, moreover, with a good reserve of power.

Limitations of Portability

The real portable can only be defined as a receiver of comparatively small size and really moderate weight, and that cuts out the possibility of using many valves right away. To get the fullest measure of

COMPONENTS REQUIRED

1 Panel, 16 in. × 7 in. × $\frac{3}{16}$ in. or $\frac{1}{4}$ in. (Radion, Trolite, Ripault, "Kay-Ray," Becol, etc.).

1 Special cabinet, with baseboard 4½ in. deep (Ready Radio).

1 ·0005-mfd. variable condenser (Burton, Lissen, Igranic, Lotus, J.B., Dubilier, Utility, Ormond, Formo, Gecophone, etc.).
NOTE: One of the smaller and lighter types is obviously to be preferred.

1 ·00005-mfd. miniature type condenser (J.B., Burton, Cyldon, Igranic, etc.).
NOTE: The capacity need be approximate only, since this is the reaction condenser. A panel-mounting neutrodyne type will serve at a pinch.

1 On-off switch (Bulgin, Lotus, Lissen, Igranic, Benjamin, Burne-Jones, etc.).

3 Sprung valve holders (Formo, Lotus, Lissen, W.B., Igranic, Benjamin, Pye, Marconiphone, Bowyer-Lowe, B.T.H., Burne-Jones, etc.).

2 H.F. chokes (Lissen, Igranic, Cosmos, R.I.-Varley, Bowyer-Lowe, Dubilier, Burne-Jones, etc.).

2 L.F. transformers of low ratio and fairly small dimensions (Philips and R.I.-Varley "G.P." type in original. A few other suitable types are the Igranic "J," Mullard, Cossor, Marconiphone "Universal," etc.).

2 2-mfd. condensers (Lissen, T.C.C., Mullard, Dubilier, Hydra, Ferranti, etc.).

1 Wire-wound anode resistance, about 50,000 ohms (Lissen). If one of the other good makes is chosen, e.g. R.I.-Varley, Igranic, Dubilier, Mullard, Ferranti power type, etc., a holder will also be required.

1 ·0003-mfd. fixed condenser (Igranic, Mullard, T.C.C., Dubilier, Clarke, Goltone, Lissen, Magnum, etc.).

1 ·001-mfd. fixed condenser (Goltone, etc.).

1 ·0003-mfd. ditto (Dubilier, etc.).

1 2-meg. grid leak and holder (Lissen, Dubilier, Mullard, Igranic, Pye, Ediswan, etc.).

1 Filter output L.F. choke (Burne-Jones centre-tapped type in set, with centre terminal not used. Another type of moderate size and weight is the Pye 20-henry).

Material for frame winding, flex, battery plugs and spades, etc.

Loud speaker (see text), batteries and valves.

portability, it is probably wisest to give up the idea of using a loud speaker, and come down to a very sensitive little two-valver for headphone reception, but that is probably going too far to please many people.

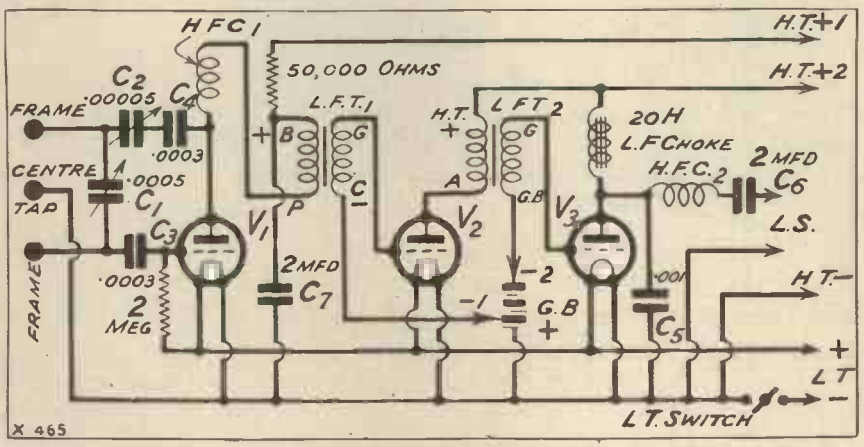
There is just one class of all-enclosed set which is something of compromise between the two types, and that is the three-valver. Using a really good frame-aerial circuit of the Hartley type, and two powerful L.F. stages, such a set will give quite good loud-speaker reception up to perhaps 30 or 40 miles from a main station, and will do the same for 5 G B almost anywhere in the South and Midlands.

Conservative Claims

Reception of foreign stations is possible, but it requires skilful handling, careful setting of the frame aerial, and so on, and we do not feel it is fair to claim it for such a receiver. The performance which can be expected, however, is good enough to justify the building of the set as a general receiving outfit for use at home as well as for portable purposes. By choosing a suitable cabinet or case of pleasing appearance, the set can be made very presentable, and so qualified for inclusion in the "anywhere in the house" class.

By working things out to fairly fine limits in the design such a receiver can just be got down to limits of size and weight which justify one in calling it a portable, careful choice of a case being one of the most important points. Really, a set like this can be regarded either as a large portable or a small transportable and forms a compromise which has a great deal in its favour.

You will find that the set illustrated on these pages forms a rather good example of this type. It is decidedly moderate in size, for its height, width and depth are only 18½, 16½, and 6¾ in. respectively, and its performance is definitely exceptional.

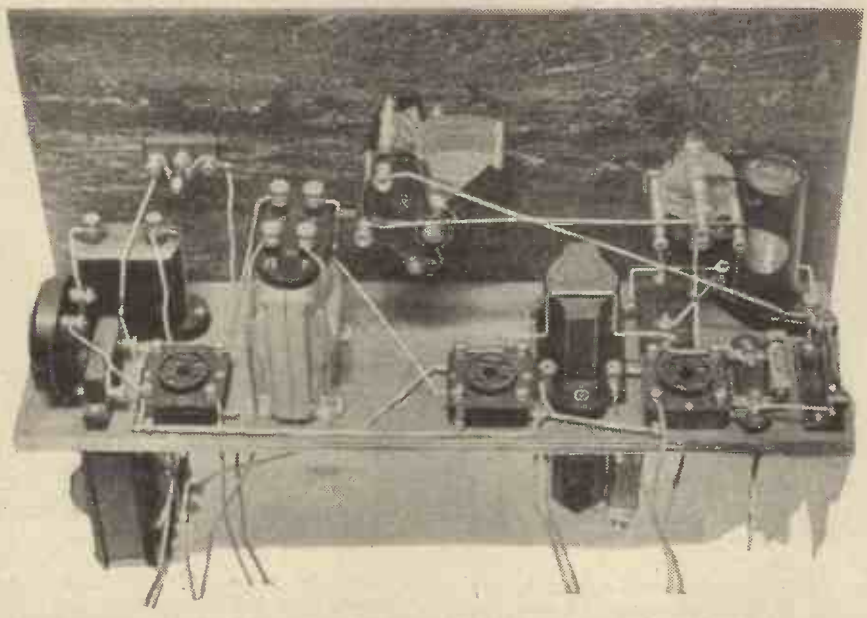


This last is due to a rather interesting feature, namely, the use of an unusually powerful L.F. side. As a rule, designers of portable and transportable sets hesitate to seek very high magnification in the L.F. circuits, because they fear instability as a result of the absence of an earth connection.

That fear is generally quite justified, but we have found that with the aid of modern devices for preventing battery coupling it becomes quite feasible to use two transformer-coupled stages, and, of course, the "mag." thereby obtained is tremendous. The risk of L.F. instability which remains is slight, and if it does occur it is generally quite simple to deal with. (We will give some hints on this point a little later on in this article.)

A glance at the circuit diagram at this point will show you how the set is arranged. There is first of all a Hartley type of detector circuit, with a centre-tapped frame aerial and a very small-sized reaction condenser, then two transformer-coupled L.F. stages with the usual modern provisions to prevent instability due to battery coupling and feed-back at H.F. from the set to the frame aerial.

These safety devices comprise the standard type of anti-motor-boating filter at the detector stage, an output filter for the loud speaker, and an arrangement of H.F. choke and by-pass condenser in the anode circuit of the last valve. This last is intended to prevent any H.F. component which has made its way as far as the last valve from going through the loud speaker and setting up feed-back effects via the frame-aerial winding. It can on occasion prove a very essential device to break a possible reaction chain, and although it is not necessary in every case it is not advised that it should be omitted.



Although the set proper (here seen removed from the case) is very compact, it is by no means cramped. The placing of one or two bulky components under the baseboard helps to avoid crowding.

Results on Test

This combination as a whole we found extremely stable and well behaved, and the results it gave on test were considerably better than we had hoped for. In the "M.W." laboratory, for example, it gave really full and adequate loud-speaking on both 2 L O and 5 G B, the latter with perceptibly less than the maximum permissible amount of reaction, so that quality was still good.

As a matter of fact, these two stations were very nearly as loud as

on the "M.W." "Transportable" Four. The reason, obviously, is that the receiver has a more powerful L.F. side than it was found safe to use in the "Four," where there was already a sensitive H.F. stage. The difference between these two designs, so far as performance goes, is naturally found on weaker signals, such as those of foreign stations, where the "Four" begins to show the advantage to be derived from its H.F. stage.

The "Three," then, is a very suitable set for use on 5 G B and a not-too-distant local. It would obviously be unfair to lead the reader to expect to pull in a string of foreigners as well just because on a very good night a skilful operator could squeeze them out of the speaker by mis-using reaction. We do not propose, therefore, to make any such claims, despite the fact that we rather surprised ourselves with this set one particularly good night.

General Assembly

So much for preliminaries. Now let us get down to business and see how the set is put together. The general system of assembly is a fairly simple one. The case we have used is an existing pattern, of quite normal type. Above, it has a compartment in which the set proper is housed, this latter being built in just the usual way with a panel and a rather narrow baseboard. Below is a grille, upon the back of which the speaker unit is to be mounted, and behind which is a space for batteries.

Winding the Frame

The whole back of the cabinet is detachable, and carries four ebonite corner strips with saw-cuts to hold the frame-aerial winding. This winding consists of 14 turns of No. 26 D.S.C. wire, with a 7-turn tap At one side of this winding a little block of ebonite is fitted, and on this there are to be fitted three small terminals or brass screws with soldering tags. To the outer two the ends of the windings are finished off, and the centre-tap goes to the middle one.

Flex leads are then provided from these three terminal points to the approximate points in the set, and these should be of sufficient length to permit the back to be opened a little to give access to the batteries.

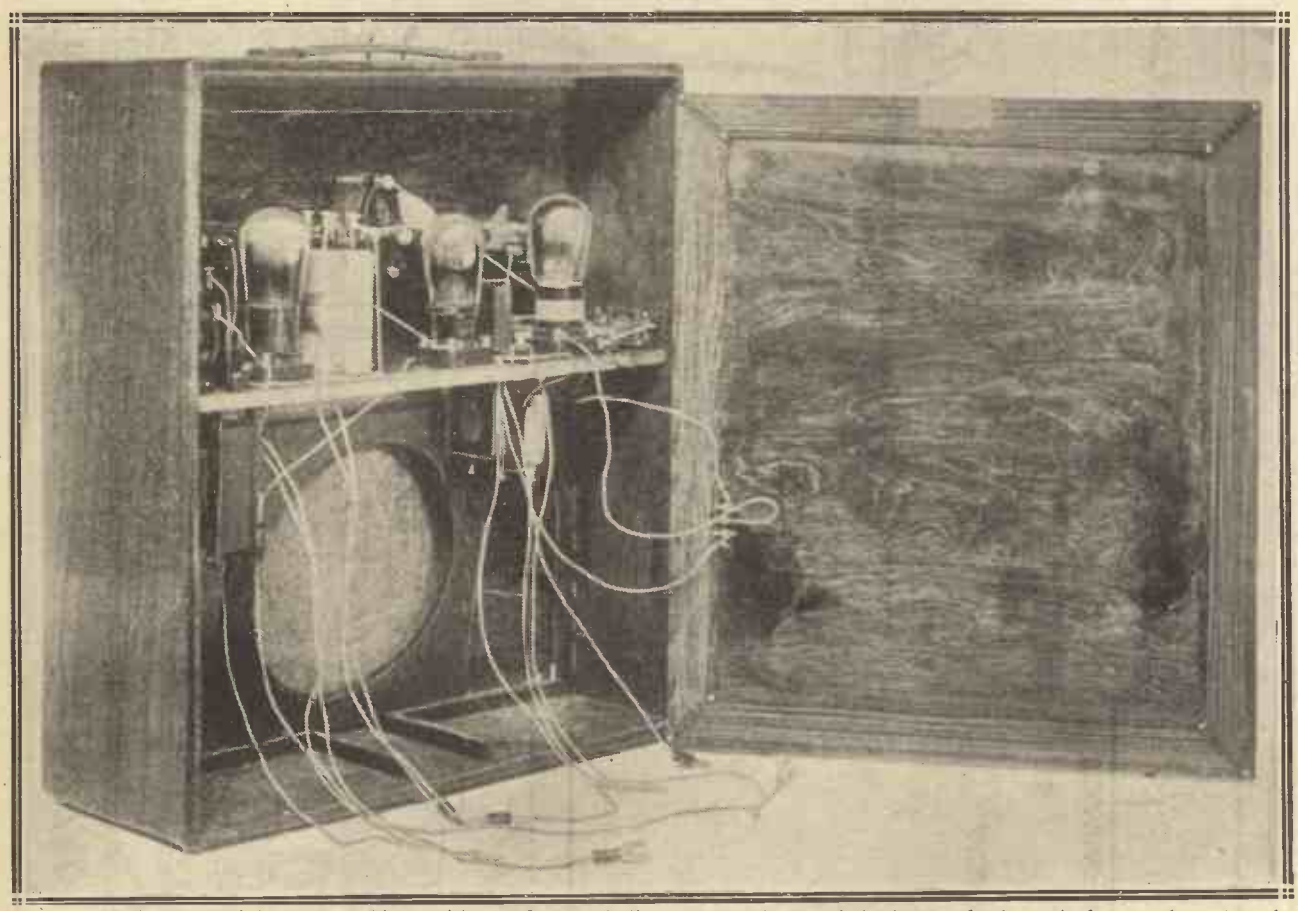
The photographs and diagrams will make these details quite clear, and, of course, the actual method of construction is a matter which can be varied to suit your own ideas. By the way, you will find this particular cabinet is supplied with the ebonite corner supports for the frame fitted and all ready for winding.

Choosing Light Components

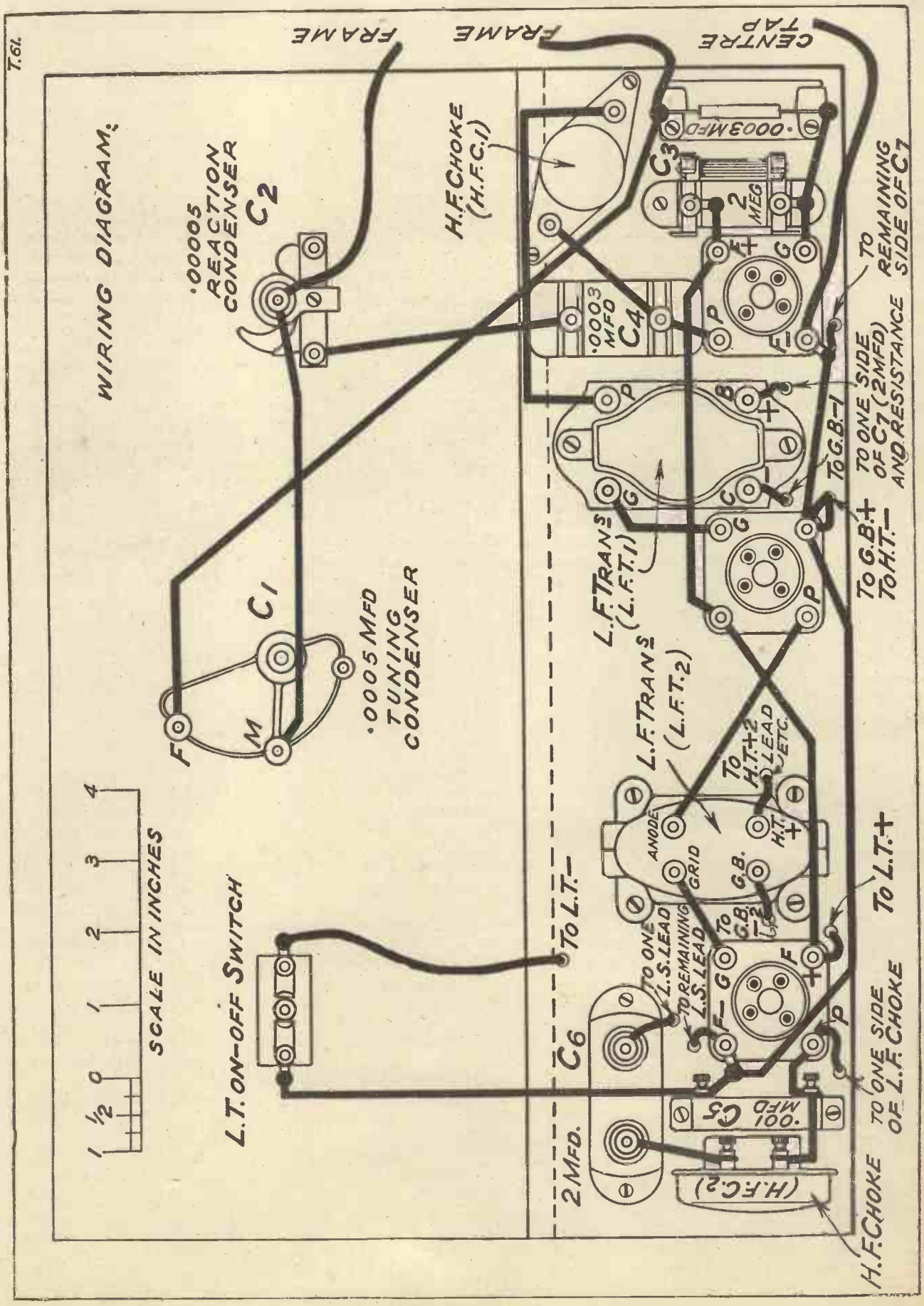
The construction of the set proper is very simple, and calls for no particular explanation. The choice of components is of some importance in any receiver designed for portability, however, and a few notes here may be helpful. First of all, it is quite obvious that an effort should be made to select components of moderate size and weight, and the list of parts elsewhere will give you some help in this direction.

The variable condenser should obviously be chosen with some care, since some of the best makes which are noted for their mechanical excellence are far too heavy for use in a portable.

The two L.F. transformers, again, call for discretion, since a pair of the largest types would be exceedingly weighty. It is necessary, therefore, to obtain two of the smaller types introduced recently, in which the use of special materials and methods has enabled the manufacturers to keep



The completed set fitted into the cabinet with the frame winding connected up and the battery leads ready for attachment to the batteries. Note the space for the loud-speaker unit.


T.61.
WIRING DIAGRAM.
.00005 REACTION CONDENSER C2
H.F. CHOKE (H.F.C.1)
FRAME
FRAME
CENTRE TAP
.0003 MFD
C3
2 MEG
.0003 MFD C4
TO REMAINING SIDE OF C7
TO ONE SIDE OF C7 (2 MFD) AND RESISTANCE
TO G.B.-1
TO G.B.+
TO H.T.-
C1
.0005 MFD TUNING CONDENSER
F
M
L.F. TRANS (L.F.T.1)
L.F. TRANS (L.F.T.2)
TO H.T.+2 (LEAD ETC.)
ANODE
GRID
G.B.
H.T.+
TO G.B.-2
TO ONE L.S. LEAD
TO REMAINING L.S. LEAD
TO L.T.-
TO L.T.+
C6
2 MFD.
C5
.001 MFD
(H.F.C.2)
H.F. CHOKE
TO ONE SIDE OF L.F. CHOKE
L.T. ON-OFF SWITCH
SCALE IN INCHES
1 ½ 0 1 2 3 4

down the size and weight and yet get a satisfactory performance. It is wisest, by the way, to use transformers of two different makes, types, or ratios. This is in the interests of stability, since if two exactly similar transformers are used a little difficulty sometimes results.

You will note in the photos that the first H.F. choke and the reaction condenser fit pretty close together, and if different makes are used it is possible that they will clash.

The remedy in this event is to move the reaction condenser one inch nearer to the tuning condenser, and shift the L.T. switch inwards by a similar amount to keep the layout balanced. You should evidently look into this point before drilling the panel.

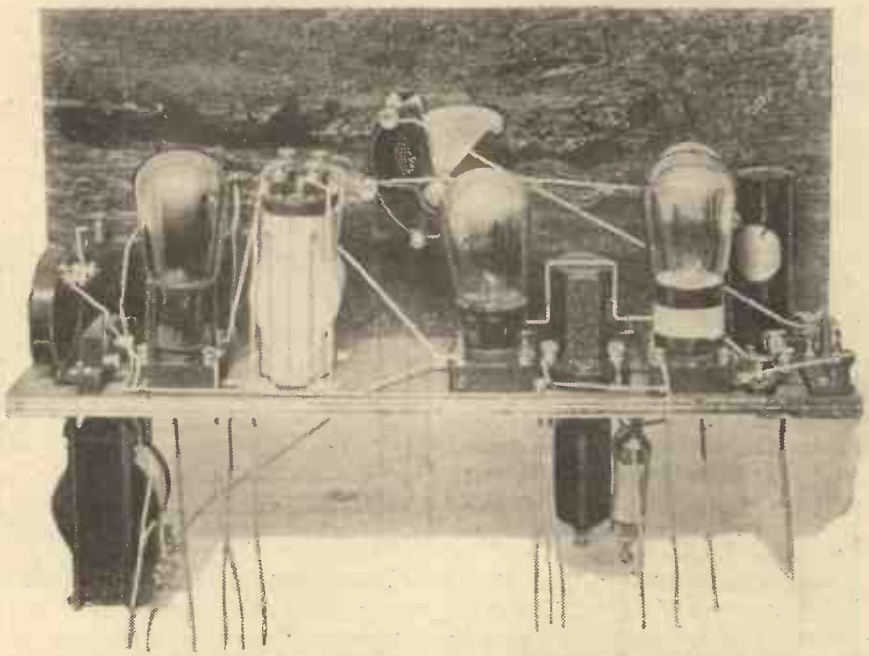
To be on the safe side it is best to use H.F. chokes of different makes in the two positions in this set, and it is necessary to choose a very compact one for the second (i.e. the one in the output circuit). The original chokes were a Lissen (detector position) and an Igranic (output valve).

Saving Space

The rest of the assembly is a quite straightforward business, and calls for little further consideration. You will see, by the way, that we have adopted the usual scheme of a set of flex leads and plugs or spades for all the battery leads instead of terminals, since a considerable amount of space is saved thereby.

On the underside of the baseboard you will find one or two parts are mounted to save space, and the connections thereto call for a little care, but they are quite clear on the wiring diagram. One of these parts is the resistance used in the detector H.T. feed lead for the prevention of battery coupling, and this in the original was a Lissen wire-wound anode resistance which, being fitted with terminals at the ends, was "hung" directly in the wiring without a holder.

Other types could, of course, be used, but the necessary holder should then be remembered. (Any resistance of the anti-motor-boating type will suit.) The value for this should be round about 50,000 ohms, but it is not critical; 60,000 or 70,000 will do.



Another view of the set itself, showing the open nature of the layout. Note:—With some of the larger reaction condensers it may be necessary to move this component nearer to the tuning condenser to clear the H.F. choke or the detector valve. (See text.)

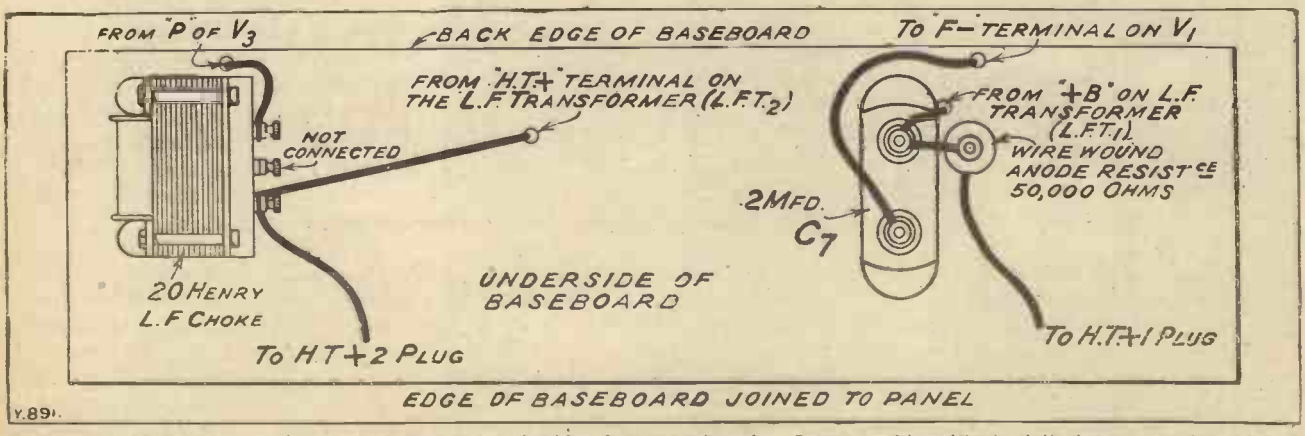
Now about the loud speaker. There is room in the cabinet for several different types, and we do not wish to prejudice your choice here, for it is obviously very much a matter of personal taste. For example, you could use one of the special portable set types produced by Messrs. Cromwell Engineering Co., and by Messrs. F. Squire.

These are supplied in the form of a kit of parts, but they are very quickly and easily put together. (One was used in the "M.W." "Transportable" Four.) Again, there are several commercial speakers specially intended for fitting into portables which are sold ready assembled.

Packing the Batteries

The battery compartment is of fair size, and you will find no difficulty in packing in 100 or 120 volts of H.T., a 9-volt G.B. battery, and a small unspillable 2-volt accumulator. This last should preferably be of rather a squat shape, to facilitate packing securely.

In arranging the batteries it is best to try to distribute the weight evenly between right and left, so that the set shall be easy to carry,



A separate wiring diagram for the parts on the underside of the baseboard. Compare this with the full diagram on the previous page and note the wires passing through holes in the baseboard.

and two separate 60-volt H.T. units are a help here. Having found a good distribution of weight it is advisable to wedge all the batteries in place firmly, and some wooden wedge pieces are useful for this purpose. (At a pinch some paper wedges can be folded up, and will serve quite well.)

Valves should, of course, be 2-volters, and for the detector you want one of the H.F. type (20,000 to 30,000 ohms) or a medium impedance R.C. type (40,000 to 60,000 ohms), the latter being slightly better. For the second socket use a "general purpose" or "L.F." type (10,000 to 18,000 ohms or thereabouts), and in the last socket a small power valve.

H.T. Adjustments

As regards H.T. voltage adjustment, you will find that there is a separate lead for the detector valve, and this requires adjustment to find the voltage which gives you the smoothest reaction control. This voltage will probably be higher than you would expect, as a result of the voltage drop across the anti-coupling resistance, so try voltages from, say, 60 volts upwards for a start. The other H.T. positive lead, of course, requires all the volts you can give it.

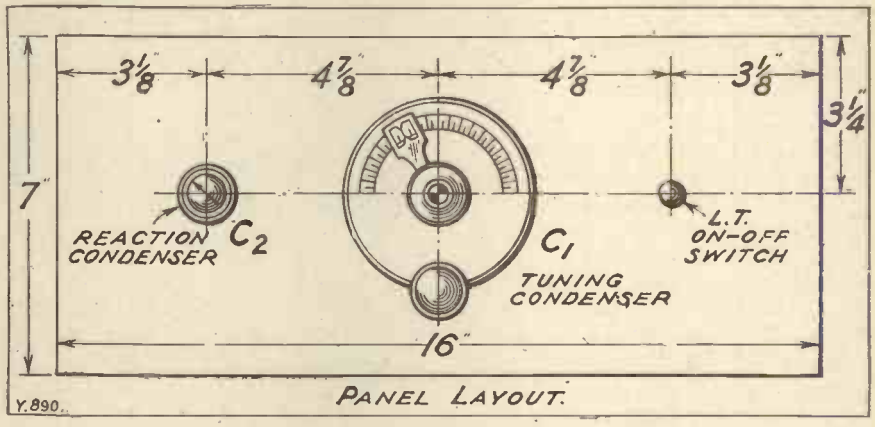
Finally, as to the remedies for L.F. instability in this receiver. Don't be alarmed that we should mention this point, because it is really a very remote risk, and we only bring it up because it is a new type of set to many people and we want to cover all the possibilities. Actually, if you make a good copy and take no liberties it should be a perfectly stable set, and the chances of trouble are very slight indeed.

Extra Stabilising

The main safety precautions are already included in the set, and should be ample in all normal cases. Where some slight irregularity occurs, however, the following hints should enable you to achieve stability. Try, first, reversing the loud-speaker leads, then a ¼-meg. grid leak in parallel across the second L.F. transformer secondary terminals. Next, if by some ill-chance there are still signs of instability on the L.F. side (very unlikely), reverse the connections to the secondary of one of the L.F. transformers. This is not a very desirable procedure, and so should not be resorted to if it can be avoided.

Now, perhaps, some hints on the use of the set as a permanent installation during the winter months may be desirable. In the ordinary way, of course, it can be taken from room to room, and will pick up the programme on the enclosed frame aerial. To do this properly the set must be placed correctly so that the frame is edgewise to the oncoming waves, and so it is necessary to revolve it until you find the position which gives the loudest signals.

By the way, this setting is not necessarily that of the true direction of the transmitting station, because the waves may be deflected considerably by metal and other conducting objects in the building. The experiment of revolving the set should, therefore, always be tried, and some rather surprising effects will sometimes be obtained.



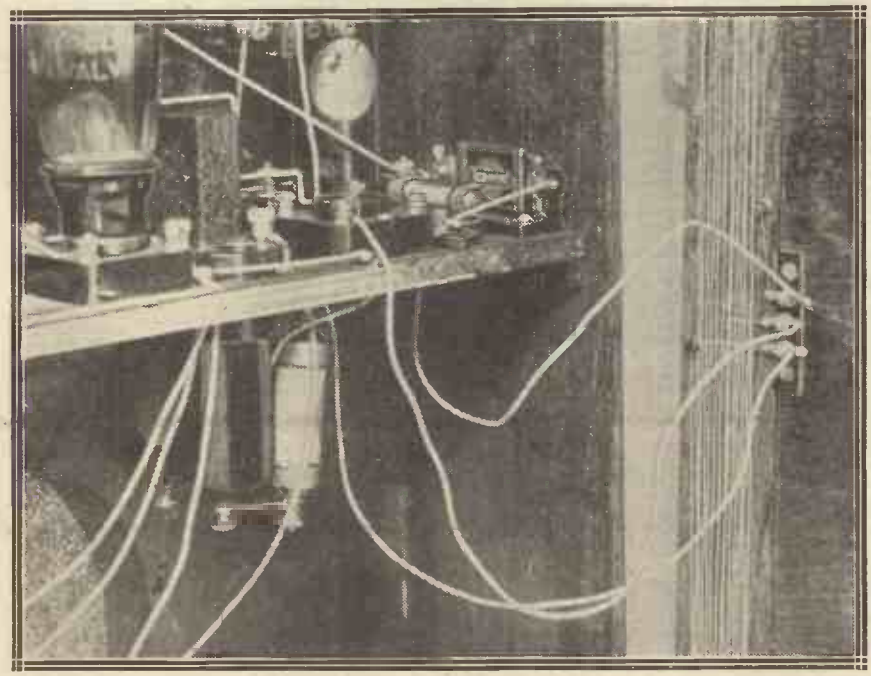
PANEL LAYOUT.

During the winter, when the set may become a more or less permanent installation in a particular room, it may be desired to attach the existing aerial and earth to increase the range of the set. It is quite easy to do and, of course, gives you a chance of picking up distant stations properly, and also permits the set to be placed in any position, since the directional properties of the frame will now largely disappear.

How to Do It

This is what is needed. Connect the earth to L.T. negative, or indeed to any convenient point on the L.T. circuit. For example, you could fit a terminal or socket in the detachable back of the case, and wire this to the centre-tap on the frame. This makes quite a neat job.

The aerial is to be connected to a tapping point on the frame winding, suitable points being at 2, 3 and 4 turns from the centre (it doesn't matter which side), some sockets in the back of the case again being suggested. The tuning range then remains the same, i.e. that of the normal broadcast band.



A helpful view showing the connections of the frame aerial and the arrangement of the anti-coupling filter for the detector valve.

PORTABLE SET PROBLEMS

By

PERCY W. HARRIS, M.I.R.E.

An article dealing with the design and operation of outdoor receivers for summer use.

THE design of a portable receiver is fraught with many problems—interesting problems, it is true, but none the less difficult. Having spent a good deal of time in endeavouring to solve such problems, it occurred to me that an article dealing with the outstanding points in portable set design might be of interest and possibly of some value to MODERN WIRELESS readers.

Before dealing with the actual circuits, let us analyse the position carefully to see exactly what we want, and how the design of a "portable" differs from that of the ordinary kind of receiver.

First of all the set must be completely self-contained. This means it must have its own aerial (or collecting system), its own power supply, with high-tension, low-tension, and grid bias, and a built-in loud speaker. Secondly, it must be reasonably compact and truly portable. Some alleged portables can only be lifted by a healthy, grown man, and few people would care to carry them even half a mile. Fortunately the word "transportable" has recently been introduced, to indicate the self-contained set which is not necessarily of the type one can carry about easily. Compactness is related to portability, and even the lightest set is awkward if unduly large.

Upkeep and Quality

Thirdly, the cost of upkeep must be kept within reasonable limits. It is on this point that many of the commercial portable sets (and particularly those sold at low prices) fall down so miserably. Cost of upkeep includes high-tension replacements, low-tension charging (with replacement of low-tension accumulator when worn out), and valve replacements.

Fourthly, the quality of reproduction must be good. Nothing is so irritating as poor quality reproduction, and, as many listeners are still unaware of what can be obtained in good quality loud-speaker reproduction, and poor quality is not always immediately apparent, many poor sets "get by."

Simplicity and Certainty

Fifthly, the set should be easy to operate. The average set-user is unskilled and probably will remain so. The expert can get marvellous results out of a portable set if it is provided with a number of variable controls, but the only portable set which appeals to the average purchaser is one on which he himself can get as good results as the expert.

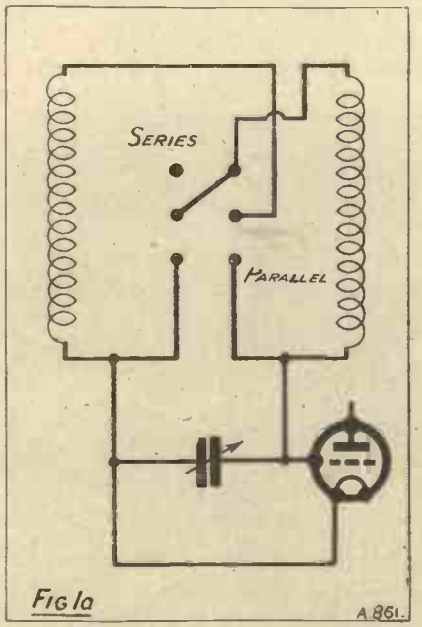


FIG 1a A.861.

Sixthly, the set must be "safe." Safety in portable sets is not often considered, but when one remembers that the mere portability of such a receiver tempts one to shut it up and place it anywhere, see how easily a leaky accumulator can do pounds worth of damage by burning holes in carpets, ruining floors and furniture, and goodness knows what else besides! Portable sets are often stood on easy chairs, and think what would happen if even a teaspoonful of accumulator acid leaked through the case to the chair. A badly designed set, too, may develop internal "shorts," and it must not be forgotten that a new high-tension battery short-circuited is quite capable of causing a nasty fire. Further, we have not yet reached perfection in valve manufacture, and an internal short-circuit in a valve may cause all kinds of trouble. Safety in a set can come only from using good components, and good material, and a good design properly carried out.

Loud Speaker Problems

I have listed our main requirements under separate headings, but it is remarkable how interlinked are these various requirements. For example, consider a receiver operating with its batteries two or three feet off, and with a loud speaker the same distance away. The set may be giving excellent quality and general satisfaction. Stand the speaker on top of the set, however, and bring the batteries within an inch or two of the receiver, and we may get either a terrific howl or audio-frequency reaction, which completely spoils the quality.

Thus one, two, and four of our

requirements are closely interlinked. Compactness itself is easily achieveable, but quality with compactness is by no means so easy. One of the biggest problems is getting proper results in a self-contained set which has the loud speaker extremely close to all other parts.

There are several points of contact between quality and compactness. If we are to achieve good quality it is no good trying to build a set with too small a cone. Too many manufacturers gain compactness by using high-tension batteries of far too small size. Efficiency will be considerably reduced, too, if we wind our frame in such a way that a large number of metal parts come close to it, for the ideal frame aerial should be wound as far as possible " on air." It is very easy to experiment on this line by taking a set working with an open frame and placing various objects, such as low-frequency transformers, loud speaker, etc., immediately within the frame. You will find that both tuning and strength are very considerably altered by such inclusions.

The Question of Weight

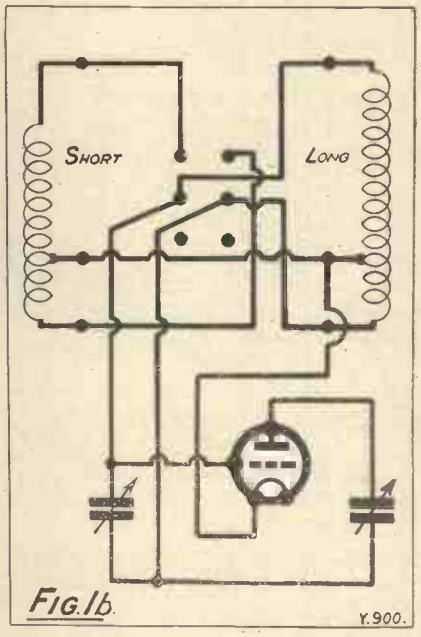
Weight can be cut down in many ways, but in most of them efficiency is sacrificed. It is sheer folly to obtain the smallest high-tension battery of the voltage you require, the smallest and lightest 2-volt accumulator, and the lightest transformers regardless of quality. It is equally absurd to cut down the high-tension voltage in the same way.

On the other hand, the case or cabinet is often needlessly heavy, and so long as the case is strong it can be made as light as possible. Avoid, however, using metal work to obtain this lightness. It might occur to you that a light metal frame would give all the rigidity and strength you require. True, it will, but as your frame aerial has to be included in this receiver, the metal framework will probably prevent you receiving any signals at all!

Getting the Right L.T.B.

We thus see that weight and efficiency must be carefully balanced against one another. High-tension should be adequate for the current consumption of the set, and the wireless designer in working out his receiver will see that high-tension demands are brought down to a reasonable figure so that a comparatively small high-tension battery may be used at an efficient rate of discharge.

The cost of upkeep, our third point, requires a good deal more consideration than it generally gets. The main cost is for the replacement of high-tension batteries, and the batteries of many portables now sold " give up the ghost " in about three weeks if the sets are regularly used each day. If the low-tension accumulator is too small it will need very frequent recharging. A 20-ampere hour (actual) accumulator is a satisfactory size. A 20-ampere hour unspillable accumulator of the type used in portable receivers should give ten days' to a fortnight's service on the average portable set, assuming the receiver to be used about three hours every day. It is a wise plan to get two accumulators so that when one is away at the charging station the other will enable you to " carry on."

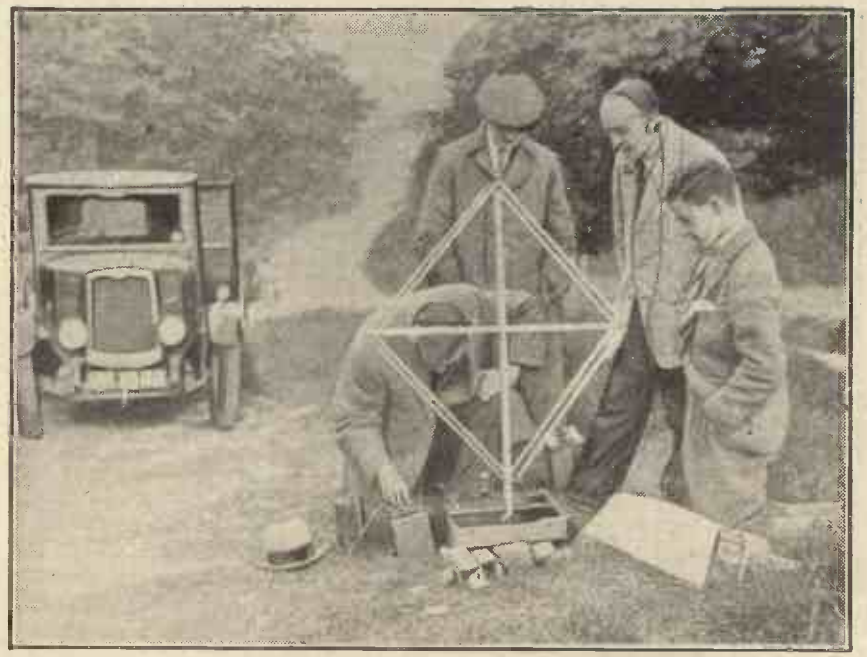


At the same time, it should not be imagined that the cost of charging is the only cost in connection with accumulators. None of them are everlasting, and cheap and inferior accumulators may only stand up to work for about six or nine months, after which they may have to be replaced. We thus see that the cost of upkeep of a cheap set with a shoddy accumulator and too small a high-tension battery may be so excessive as to make your total wireless costs greater than if you have bought a set costing two or three guineas more, but with better batteries.

Single-Dial Tuning

Good quality should be demanded by every portable set purchaser. It can be obtained and many sets have it. The purchaser should not be put off with the excuse that one must tolerate poor quality because the set is self-contained and portable. The average reader would be surprised if he knew how many factors had a bearing on quality and how difficult it is to make a set which is both portable and really good in its reproduction.

The question of the set being easy to tune is of the utmost importance to the average user. After all, the real enthusiast builds his own set and, except for those cases where the



A field day arranged by the members of Sheffield and District Wireless Society, who tried to track a secret transmitter by means of frame aerial bearings. This photograph shows one party at work.

erection of an outside aerial is difficult, he generally prefers the many advantages of a set with a separate aerial and earth. A single tuning dial and reaction control is all the ordinary listener cares to handle, and although a set can be made much more efficient with two or three tuned circuits, I think the difficulties in manipulation of such a set more than outweigh the additional sensitivity and selectivity. After all, the selectivity problem is easy in portable sets, for the frame aerial itself is an enormous help.

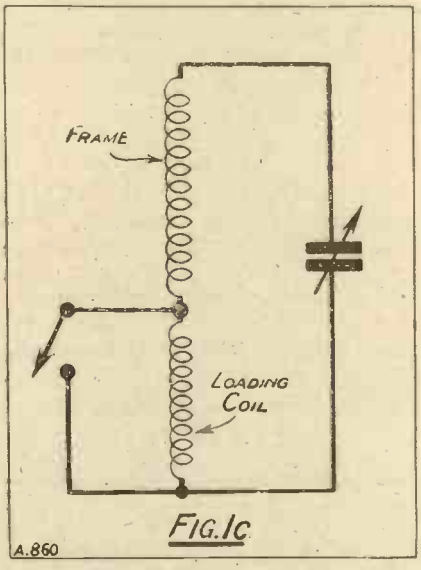


FIG. 1C.

A single tuning dial and a reaction control do not necessarily make the set easy to handle. Many portable sets have very crude reaction of the floppy kind, making it almost impossible to reach that highly efficient state just below oscillation. Other portable sets suffer badly from hand-capacity effects which can easily render useless the finest reaction control.

Difficulties of Designers

On the point of safety, there is little to be said other than that all the components should be of first-class quality, and the set really well-made as well as well-designed.

Coming now to the general design of a self-contained set, we will take some of the difficulties against which the designer will come, some expected and others perhaps unexpected. The chief difficulties can be set out as:

1. Instability.
2. Howling and microphonic trouble to some extent related to (1)).
3. Hand- and body-capacity effects.

Instability in relation to the high-frequency portion of the set may easily cause a tremendous lot of trouble. It must be remembered that the whole set is "up in the air," there being no earth connection giving a point of common potential to many parts of the circuit and largely counteracting hand and body effects. The second cause of instability is the frame aerial, which is also one of the tuning coils (frequently the *only* tuning coil).

It will be realised what difficulties we are up against in this regard when it is considered that a small astatic coil, such as one of those used in the "Certainty" Four, and a frame aerial are at the opposite extremes, the first being designed to have a tuning effect with a minimum of external pick-up, and the second with a maximum. Whereas in the ordinary type of receiver we aim at having our pick-up exterior to the coil, in a portable our main tuning coil is the only source of pick-up.

Simplified Sets

The third cause of instability is due to the extremely confined space in which we must build our set, this calling for very careful layout of parts when we have more than one tuned circuit. The growing use of aperiodic or untuned couplings has very considerably simplified the problem of portable set design, and is, in fact, the main reason why portables complete with valves, batteries, etc., have been able to sell at such low prices. Most portables have four or five valves, and in the case of a five-valve receiver two of these valves are always high-frequency magnifiers.

When these stages are untuned we can pack them quite tightly, but when one or more of them is tuned the design of the set involves really intricate radio engineering if we are to obtain, in actual practice, efficiency of each of the high-frequency stages.

Neatness and Efficiency

All leads should be as short as possible, and one should carefully avoid running grid and plate leads parallel with one another. Filament wiring, however, can be bunched as much as you please, and in fact is better so treated. Many constructors, desiring to obtain as good appearance as possible in their sets, carefully arrange the wires to have right-angle bends. This makes the set look neat but very often brings wires parallel with one another. It is much better to take a lead by the shortest path between the two points joined if this can be done, and if the lead does not come parallel with another lead.


An army "portable" set in use. It may take a vehicle to accommodate it, but you must not forget that a complete transmitter is included in the apparatus.

It is also very wise to place a ¼-megohm grid leak in the grid of each of the low-frequency valves, and when a combination of a resistance and transformer coupling is used I have found it advantageous to put the transformer first and the resistance next. If the transformer is put first a condenser of ·0003 or ·0005 mfd. can be joined between the plate of the detector valve and filament without spoiling the performance of the transformer. Some transformers, such as those of Ferranti and the Lissen Super, have built-in condensers of correct value. Others require an external condenser.

Some H.F. Tips

A condenser of this value placed across an R.C.C. unit would spoil its performance by considerably lowering the plate impedance, but in the case of transformer coupling the transformer is generally designed to have a condenser in this place, and thus we get not only the quality desired, but a very helpful high-frequency bypass. R.C. units should be shunted by a ·0001 mfd. condenser to filament.

A very important point is to join a fixed condenser of, say, ·001 mfd. between the plate of the last valve and the nearest filament point. This will get rid of a great deal of trouble which is often caused by high-frequency currents getting into the loud-speaker leads, and as the loud speaker is almost invariably placed inside the frame-aerial leads, the presence of high-frequency currents here may lead to all kinds of feed-back troubles.

The second difficulty of howling and microphone noises is more complex than at first appears.

Mounting the Valves

Mounting the valves on so-called anti-microphonic bases, and even packing them in cotton wool, often has not the slightest effect in reducing the trouble. In many valves, vibration of the electrodes is set up by the sound waves from the immediately adjoining loud speaker, and as these vibrations bring about variations of current of corresponding frequencies, these being magnified again, we can easily get a "chain effect" producing a strong howl. Obviously it is the beating of the sound waves upon the glass which is the cause of the trouble and not vibrations set up through the baseboard.

A good deal can be done by choosing the right valves, by which I mean individual specimens which are less microphonic than others of the same make, and, of course, the makes themselves vary. All kinds of claims are made for the microphonic properties of various valves, but I have at times found microphonic valves—and bad ones at that—in every one of the leading makes.

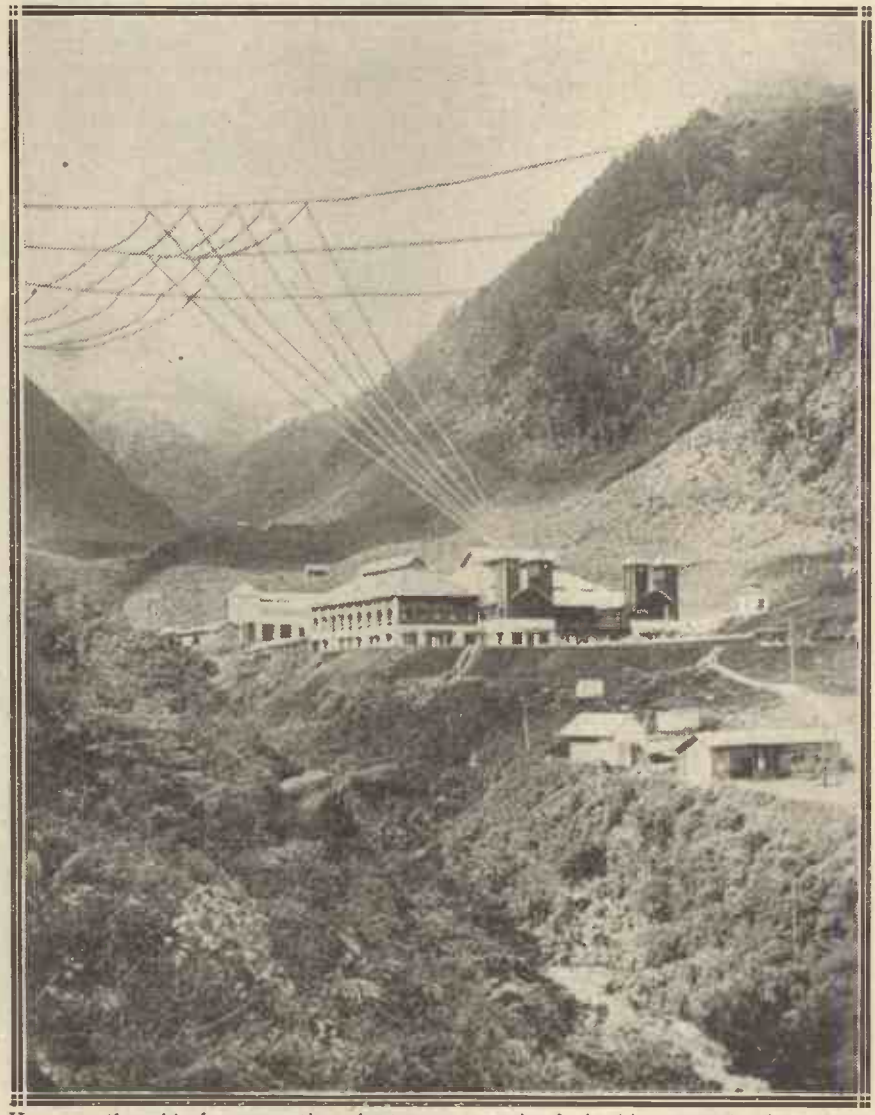
If you are troubled in this way and cannot overcome the difficulties otherwise, try covering the bulb itself with a thin layer of plasticine, which can be obtained from any toyshop. The detector bulb is the one which usually gives most trouble, although occasionally the first low-frequency valve may be noisy. In the case of a portable set where the valves are arranged in a narrow slot, filling the intervening spaces with cotton wool is often a help, and is indeed adopted by some manufacturers of portable sets.

The howling caused by microphonic reaction and the howling which is due to other causes must be carefully differentiated. If, for example, we have two transformer-coupled low-frequency stages and the transformers are similar in every way electrically, the primaries may form "tuned anode" circuits tuned to exactly the same frequency in which there is always enough feedback to cause oscillation even when reversed connections and other customary palliatives are adopted.

L.F. Reaction Effects

Frequently, too, in a portable, H.F. currents get through into the low-frequency side, and are returned to complete a vicious circle through the loud-speaker leads to the frame aerial; while low-frequency reaction effects due to badly placed components and wiring may be so intense as to cause motor-boating

(*Continued on page* 470.)



Have you thought of summer-time short-wave reception? At this season the short waves come over very well, one of the best being Radio Malabar (Dutch East Indies), whose aerial, seen above, is suspended between two mountains.

HINTS ON USING FULTOGRAPHS

By PERCY W. HARRIS, M.I.R.E.

THE Fultograph "still-picture" receiver is one of the most fascinating devices yet made available, not only to the wireless experimenter—who is expected to know a good deal about handling a set—but also to the ordinary listener whose sole interest is in reception without knowing how it is done. Many people have the impression that, while the Fultograph receiver gives good results, it can only be operated by a skilled person. Actually, the knack of handling it can be acquired in an evening.

Be Methodical

Having received more Fultograph pictures than most people, I can claim to know the little ways of this ingenious instrument. Once the apparatus is obtained I should put down as the leading requisites for success a clear table, a suitable dish, a little method, and a plentiful supply of good, clean blotting paper.

When you first begin Fultograph reception you will find that the interval between pictures seems rather short, and if you do not proceed methodically you will find that a new picture starts before you are quite ready. Actually, the time interval is long enough if you know how to proceed, so I will describe my own method.

How to Prepare

I use an ordinary half-plate porcelain developing dish obtained from Boots', the chemists. Do not be tempted to use those irritating little celluloid dishes which, in order to obtain some rigidity, are ribbed at the bottom. In spite of this ribbing they tend to twist and turn and the paper has an irritating habit of settling into the grooves and sticking when you want to get it out in a hurry. Use the porcelain dish. The half-plate size is just right and it does not take too much solution.

Do not stint the blotting paper. Go to the stationer's and get two or three large sheets, folding each double sheet into four. Then take a sharp knife and cut through the folds so that you have a pile of blotting paper sheets which are about twice the size of the Fultograph paper. Now lay one small cut piece of blotting paper near the machine and keep the remaining pile of pieces at your right hand with the dish on the left. Pour enough solution from the Fultograph bottle into the dish so that the paper can be just covered, insert a sheet of paper (after marking the smooth side with a pencil tick), rock the dish and then turn the paper upside down and rock again. This will remove any air bubbles. Now blot the sheet quickly between any of the sheets on the pile and lay it carefully on the piece of blotting paper near the machine. Repeat the process with a second piece of paper. When it is blotted off take the first piece and wrap it round the Fultograph cylinder.

This last process is not half so easy as it sounds, and there is quite a knack in doing it properly. It is not a bad plan before you put any paper on the cylinder to take a sharp point and scratch a line the length of the cylinder, using the spring clip as your ruler. When you lift up the clip you will see this line and it will form a guiding edge for your paper and will make the folds come underneath the clip in the right position. Avoid creases or looseness. The time of soaking and the time of drying is not at all critical. I start about ten minutes before a transmission and as soon as one picture is under way I start damping a second sheet.

DAILY TIME-TABLE

MONDAY.			
Daventry 5 X X & London 2 L O	12 midnight	to	12.15 a.m.
Berlin, 1,649 m. ..	12.45 p.m.	to	1.15 p.m.
Vienna, 518 m. ..	2.15 p.m.	to	2.45 p.m.
& 2 pictures after evening programme			
TUESDAY.			
Daventry 5 X X	2.0 p.m.	to	2.25 p.m.
Berlin	9.45 p.m.	to	10.15 p.m.
Vienna	2.15 p.m.	to	2.45 p.m.
& 2 pictures after evening programme			
WEDNESDAY.			
Daventry 5 G B	11.15 p.m.	to	11.45 p.m.
Berlin	12.45 p.m.	to	1.15 p.m.
Vienna	2.15 p.m.	to	2.45 p.m.
& 2 pictures after evening programme			
THURSDAY.			
Daventry 5 X X	2.0 p.m.	to	2.25 p.m.
Berlin	12.45 p.m.	to	1.15 p.m.
Vienna	2.15 p.m.	to	2.45 p.m.
& 2 pictures after evening programme			
FRIDAY.			
Daventry 5 X X London 2 L O	12 midnight	to	12.15 a.m.
Berlin	9.45 p.m.	to	10.15 p.m.
Vienna	2.15 p.m.	to	2.45 p.m.
& 2 pictures after evening programme			
SATURDAY.			
Daventry 5 G B	11.15 p.m.	to	11.45 p.m.
Berlin	12.45 p.m.	to	1.15 p.m.
Vienna	2.15 p.m.	to	2.45 p.m.
& 2 pictures after evening programme			
SUNDAY.			
Berlin	12.45 p.m.	to	1.30 p.m.
Vienna	2.15 p.m.	to	2.45 p.m.
& 2 pictures after evening programme			

Transmissions from Radio-Paris will commence shortly, but times are not yet available. Other Continental stations will be starting in the near future.

Don't Waste Time

Directly the transmission of a particular picture ceases (you will know by the cessation of the piping synchronising signal), switch off the relay panel *first* and then stop the machine by applying the brake. Quickly pull up the spring bar, peel off the picture and lay it aside. *Do not attempt to dry it at the moment.* Now slip on the second piece of paper and wind up the machine, replacing the stylus at the beginning. You will then be ready in good time for the next picture, but avoid stopping to examine or dry the first picture (no matter how interesting it may be!), or you will be sure to miss the next one!

I find it a good plan after each transmission to see that there is no fluff adhering to the Fultograph stylus and that the cylinder itself is quite clean. Wiping it with a damp cloth is the best method, for sometimes small pieces of paper will stick and form a lump under the next piece of paper, and you may miss this when clipping it on, particularly if the lump comes on the underside of the stationary cylinder. Any such irregularities will spoil the picture.

Adjusting Strength

Immediately the second picture starts and you have damped the third piece of paper, dry off the first picture as quickly as possible. Speed in drying makes for permanence.

It is important when receiving a Fultograph picture to adjust the strength of the signal so that the picture is neither too weak or too strong. If the signal is too strong you will get dirty whites and clogged up shadows, while if it is too weak the picture will be thin and washy. When you first buy or build a Fultograph it is a good plan to "waste" the first day's pictures by trying various experiments so as to get the best colour and strength.

Quite an efficient speech microphone can be made up quickly by mounting an ex-Government D.III "watch type" microphone in cotton wool in a short length of cardboard tube, so arranging it that the diaphragm is at an angle of, roughly, 45° to the vertical (see Fig. 2). If it is desired to introduce a certain amount of damping so that a degree of quality in musical reproduction is obtained, one or two discs of thin felt or similar material may be mounted over the diaphragm under the screw-on cap.

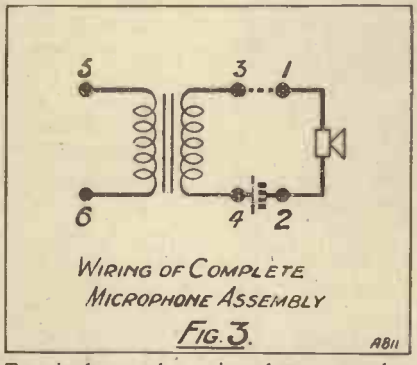
Microphone Connections

A suitable transformer for this instrument can be obtained for a few shillings at any Government surplus stores, and where one microphone only is to be used the transformer may be mounted inside the cardboard tube also.

In this case, six terminals should be mounted outside, so that either microphone or transformer may be used independently, or both of them wired up with a battery to form a complete microphone input circuit. Fig. 3 shows these connections, and Fig. 4 a photograph of a completed assembly.

In this form the microphone may be connected to a pick-up adaptor, and used in precisely the same way if the fade unit is undesired, and two stages of amplification will give quite useful results up to a distance of two feet for speech.

It should be remembered that a cheap carbon microphone is always likely to "pack," and for that reason an occasional shake will do it good. Having allocated our microphone to the first pair of terminals on the fade unit, the pick-up will, of course, go direct to the second pair, leaving the third pair to receive the output from the actual wireless receiver. Most experimenters have their receiver and amplifier as separate units, but some who hitherto have used a pick-up adaptor in a complete set will find it necessary to bring the leads outside if the fade unit is to be employed



WIRING OF COMPLETE MICROPHONE ASSEMBLY

FIG. 3.

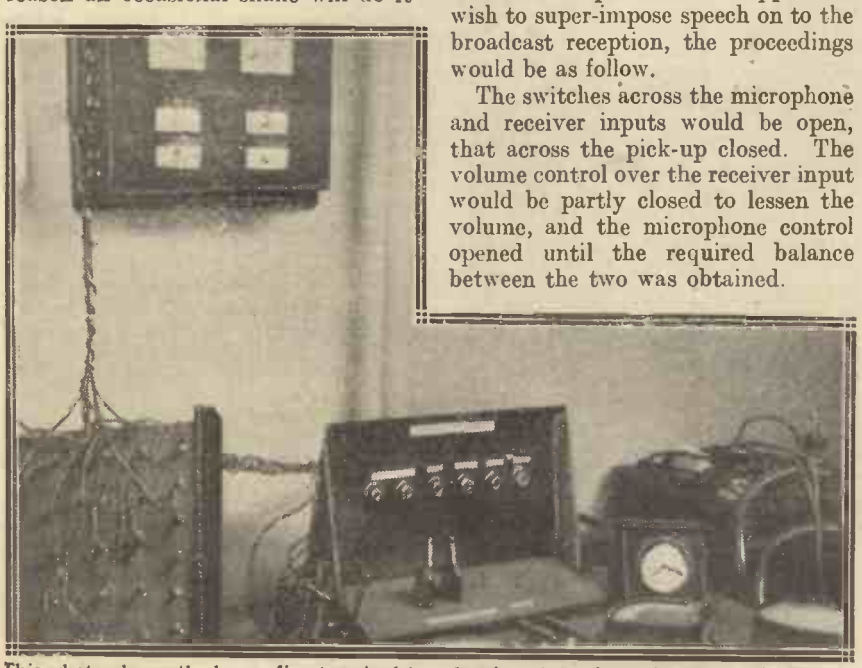
Terminals 1 and 2, microphone; 3 and 4, transformer primary; 5 and 6, transformer secondary; 1 and 3, shorting strip, or cut-out switch; 2 and 4, two-volt battery.

Others, again, may use a crystal set followed by an amplifier, and in this case it is only necessary to connect the 'phone terminals of the receiving set to the fade unit.

How It Is Done

These arrangements complete, the fade unit is ready for use. The operation will be easily followed after one or two experiments. Suppose we wish to super-impose speech on to the broadcast reception, the proceedings would be as follow.

The switches across the microphone and receiver inputs would be open, that across the pick-up closed. The volume control over the receiver input would be partly closed to lessen the volume, and the microphone control opened until the required balance between the two was obtained.



This photo shows the house-line terminal board, microphone input board, cue indicators and meters.

Should the set be receiving a talk which would be improved with a musical accompaniment, then a record could be played and the pick-up and receiver inputs balanced. If the operator wishes to dispute the talk, then he can still add the microphone and say what he thinks about it!

Fig. 4. The six-terminal microphone.

The next thing that will be found of use and interest is a jack board, or preferably two of them. Many experimenters have two or even more receiving circuits, some complete sets, and others just temporary hook-ups.

There is probably one main amplifier and several lines to different rooms in the house. Connecting-up different arrangements of all this apparatus takes a considerable amount of time and this will be saved by installing a panel of ordinary double-contact jacks.

General Arrangement

The general arrangement is to take the outputs of all receivers, inputs and outputs of amplifiers, fade unit inputs and house lines to jacks, and then to make the desired connections by means of couplers consisting of short lengths of flex with a plug at each end.

Now, if we wish to connect a particular receiver to the amplifier and then to a house line, we take two couplers, plug one into the jacks representing the "receiver output" and "amplifier input" and the other into the "amplifier output" and "check loud speaker" or "'phones."

In an Emergency

Having confirmed all is O.K. the latter plug is then transferred to the house-line concerned. If anything goes wrong a quick test can be made by taking the plug from "amplifier input" and transferring to "check 'phones."

The 'phones are then connected to the receiver direct, and if this is at fault, a stand-by crystal set or experimental receiver can be brought

(Continued on next page.)

AMATEUR BROADCASTING

—continued from previous page

into use by transferring the " receiver output " plug to the jack representing the other set. It will readily be realised that all this is both fascinating and extremely useful.

A second and smaller jack board may be employed if the microphone

Fig. 5. Here is the microphone input board again, the dual turntable for the pick-ups, and a portion of the terminal board. Installed above them is the cue indicator board.

system is extended to other parts of the house. The writer has used such a system for various purposes, including relaying music from one room to another, listening to carol singers on the doorstep (and, incidentally, their spoken estimates of what they might get !), eavesdropping on a family of starlings in the roof during feeding time, the production of a wireless play in the home, and the production of effects for a home cinema. Very few experimenters get to work on these lines, but those who do find it full of possibilities and most interesting.

A Further Suggestion

One further suggestion in connection with the jack boards. There are occasions when the leads to the various jacks are altered to some other instrument or house line, or when for some particular arrangements the jack connections are undesired.

For such emergency it is a good plan to install in the " control room " a large terminal board consisting of pairs of terminals representing all the jacks and house lines in the system.

If the permanent connections (i.e. leads from jacks and house lines) are taken to the back of the board, the front is left to receive the connections from the various units and these may be changed about as often as desired. Of course, the identification labels to the jacks must be altered accordingly.

Layout of Units

The extent to which these suggested arrangements are carried out, and the general layout of units, is left to individual requirements, but a general idea may be obtained from the photographs of the writer's arrangements.

Fig. 5 shows the terminal board on the extreme left and the microphone-input board on the right. The meters show the total H.T. and L.T. currents taken by everything in the room.

A panel on the wall above is an indicator of what microphone and pick-ups are in action in connection with a studio and miniature cinema theatre included in the system; it also acts as a cue indicator.

Inputs and Outputs

Fig. 6 shows the layout of the sets, amplifiers and jack boards. The small switch panel supplies correct H.T. and L.T. to all units from the accumulators mounted on the bottom shelf; the left-hand jack board is an " exchange " dealing with the inputs and outputs, while the right-hand panel deals with the house lines and check receivers.

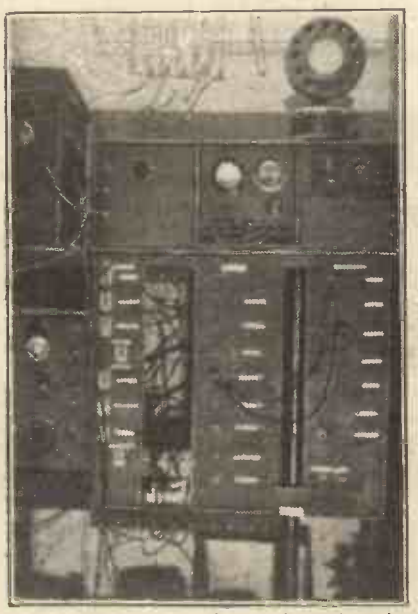


Fig. 6. Part of the fade unit and main amplifier (top) and broadcast receiver. Left, the H.T. and L.T. switch-board and the " exchange " and " output " jackboards. All the batteries are housed below and the leads brought to the terminal strip at the bottom of the boards.

HELPFUL HINTS AND TIPS

One disadvantage of a low-resistance voltmeter is that it takes an unnecessarily high current from the battery, or whatever source is being measured.

* * *

Another serious disadvantage of a low-resistance voltmeter is that when connected across the source of potential it is measuring it passes such a heavy current that the conditions obtaining are radically altered, and therefore a misleading reading is given.

* * *

The use of the correct type of valve is one of the secrets of successful distortionless reception.

* * *

Detector's H.T.

When the detector valve is coupled to the L.F. stage by means of a resistance in its plate circuit, it is necessary to apply a much higher voltage than would be the case if a transformer were used here.

* * *

When weak signals are being received it is very often an advantage to increase the value of the grid leak, and 4, 5 or 6 megohms is not an uncommon value to use in such circumstances.

* * *

For short-wave work it often pays to experiment with the value of the grid condenser, as generally a very much smaller condenser can be used than when an ordinary set is employed.

* * *

Generally speaking, where H.F. screening is attempted, it is better to screen the complete stage rather than the coil alone.

* * *

Saving Screening

Where binocular coils, astatic coils, or the so-called fieldless coils are used, the amount of screening required for H.F. stages is correspondingly reduced.

* * *

It is impossible to exercise too much care in the wiring, etc., when high-tension is being taken from the mains.

* * *

Careless or faulty handling of wires connected to the electric light mains may result not only in dangerous shocks but in a risk of fire due to electrically-heated wiring.

* * *

Arc lamps as used for " sunlight " ray treatment are capable of causing tremendous interference with nearby receiving sets.

* * *

Generally speaking, a wave-trap is not much good for cutting out local interference of the type caused by trams, flashing signs, power lines, etc.

* * *

Advertising signs of the flashing electric type are capable of causing almost unbearable interference in neighbouring wireless sets if carelessly wired or maintained.

* * *

More Battery Brevities

Great progress has been made in late years in the design of " mass " accumulator plates for use when the rate of discharge is very low relative to the capacity of the cell.

* * *

Special plates of the above type—generally known as " mass " type plates—can be left for very long periods in a semi- or nearly fully-discharged condition without any fear of sulphation.

IS 5GB A FAILURE?

From a Special Correspondent

A good many of our readers in the north, especially in the Manchester district, have probably agreed with "An Experimenter," whose criticisms of 5 G B have been appearing in the "Manchester Guardian," to the effect that 5 G B has not in past months in many cases satisfied northern listeners.

All-Round Radiation

This criticism has been supplemented and confirmed by a good many other correspondents in the north, and we ourselves have had many letters of complaint from readers on the apparent failure of 5 G B to do its correct duties. One of the engineers of the B.B.C. recently stated that the reception of Daventry Experimental station was stronger in the north than in other parts of the country about a year ago, for the reason that the mast system used in those days was such that there was a strong directional effect which was advantageous to northern listeners.

But it was found that this particular arrangement, although advantageous to northern listeners, was disadvantageous to listeners in other districts, particularly in the Birmingham district, and consequently new 300-ft. masts were erected, to make radiation more even, giving the north its fair share of strong reception, rather than the larger and unfair share it previously had.

The Question of Quality

In its own area, that is within a radius of 100 miles, 5 G B is now stated to give better quality than any other station in the world; and its reliability factor can be seen from its record to be an excellent one, despite the fact that it has not the right amount of spare plant that should be normally at the disposal of a service station.

The B.B.C. engineers report that they have not noticed that since the wave-length change 5 G B's reception has in any way fallen from its usual high level. It may be that some of our readers will be surprised at the statement that 5 G B is intended only to give a service area over a radius of 100 miles; that, in fact, it is little more or less than a medium high-powered local station

This is certainly a new aspect of the credentials of 5 G B, for Captain Eckersley stated in 1927, when the station was opened, that 5 G B should be heard at the same strength as 5 X X all over the British Isles. If 5 G B is not officially regarded as an alternative station to the programmes sent out by 2 L O and 5 X X, not only the northern listeners but listeners generally must only conclude that the alternative programme policy of the B.B.C. no longer exists, except in the sense that 5 G B does give an alternative programme over a limited service area.

If this new statement regarding 5 G B is the accepted explanation of the B.B.C. Executive, then certainly listeners are entitled to know why it is that the promise was made in 1927 that 5 G B should be an alternative station to the programmes sent out by 2 L O and 5 X X, and why that obligation has not been fulfilled.

MIHALY'S NEW "TELEKINO"

There have been so many false alarms concerning the development of television that it is no doubt with some misgiving that our readers have read in the newspapers about another "perfected" television invention. But the inventor is the well-known Hungarian expert, Denes von Mihaly, who has long been known as a serious research worker in connection with television.

Mr. Mihaly now claims that a moving film can be sent out from broadcasting stations and picked up by anyone possessing a simple receiving apparatus which he estimates will only cost a few pounds. This apparatus is known as the "Telekino."

A Berlin correspondent states that at a demonstration he saw two receivers of different sizes. One receiver gave a picture 3½ in. by 4¾ in., and would cost, to the public, about £5. The other receiver gave a picture 8 in. by 9 in., and a complete outfit of this type would cost about £20.

According to this newspaper man, to operate the receiver is the simplest thing in the world. A knob is turned until the picture focusses itself out from the reddish glow caused by the neon lamp on a ground-glass screen. It is said that this new "Telekino" apparatus of Mr. Mihaly's is a great improvement on that of the Karolus apparatus, which has already been described in MODERN WIRELESS in some detail.

A Tall Order

Herr Kucko, the President of the Wireless Department of the German Post Office, who supervises for the German Government the technical side of German broadcasting, has stated, according to the "Daily Express," the following opinion:

"I am prepared to forecast that before the end of the year the Berlin broadcasting station will be transmitting cinematograph films by wireless into homes all over Germany."

That sounds rather a tall order, but, on the other hand, Herr Kucko is a responsible Government official and it is a little difficult to imagine him making such a statement unless it was founded on something very substantial.

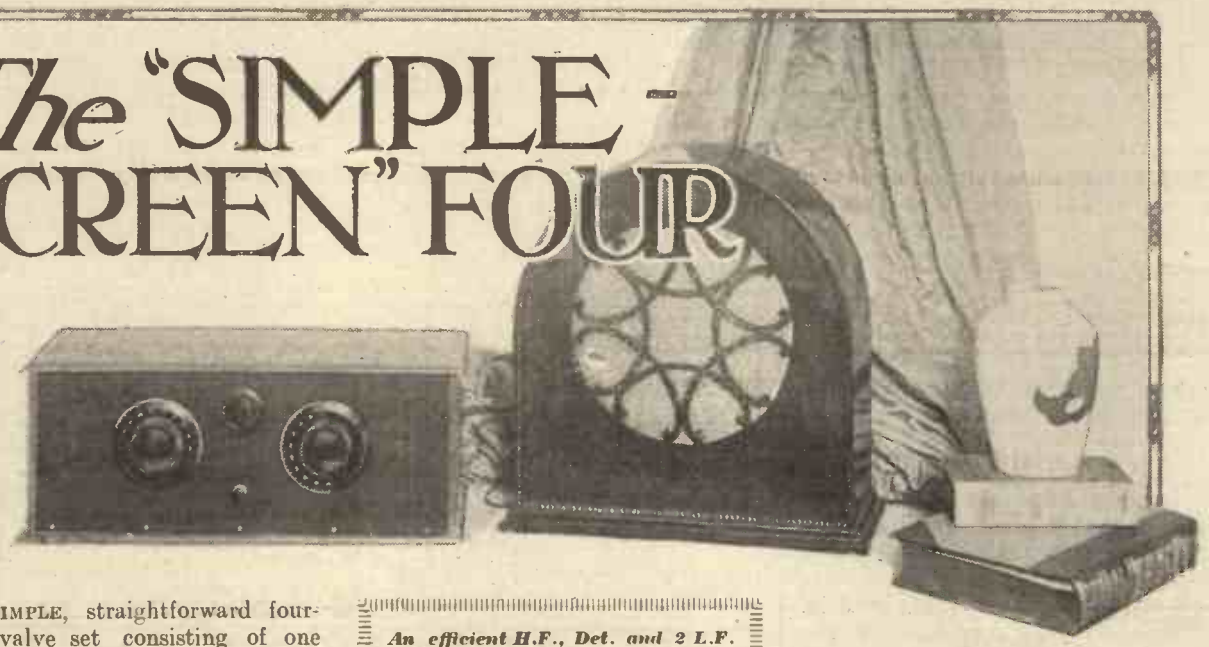
Mr. Mihaly's success with his "Telekino" is said to have been due to his discovery by experiment that it is not necessary for the telegraphic transmission of pictures, as was hitherto believed, to send 10,000 elements per second. Between 900 and 1,400 are enough and, according to the inventor, "suggestion" supplies the deficiencies. He admits, however, that when it is necessary to show more than one person in a televised picture, the number of 1,400 elements must be considerably exceeded.

"Early Days"

It is too early to say yet whether Mihaly has really evolved a television system which will be of interest outside the laboratory or to students of television, but our Berlin correspondent is now busy acquiring the latest facts, and we hope to be able to place before our readers very shortly a detailed explanation of Mihaly's new system.

F. E.

The "SIMPLE-SCREEN" FOUR



An efficient H.F., Det. and 2 L.F. receiver, employing extremely simple screening and split-primary neutralisation.
Designed by the "M.W." Research and Construction Department.
Described by A. Johnson-Randall.

A SIMPLE, straightforward four-valve set consisting of one H.F. valve, a detector, and a couple of L.F. stages is perhaps the best type of receiver it is possible to obtain for economical all-round work.

The three-valver is probably more popular, but the four has just that bit of extra punch that makes all the difference on a distant station. Most owners of three-valve sets sooner or later wish that they had a little more power when they find that it is not possible to bring some attractive item from a Continental station up to full loud-speaker strength.

A "Straight" Circuit

Of the various possible circuit arrangements, the straight, neutralised, split-primary H.F. valve, together with a resistance-transformer combination on the L.F. side, takes a lot of beating.

In the opinion of some enthusiasts, the screened-grid valve is infinitely superior to our old and trusted friend the three-electrode H.F. valve. It is quite true that a screened-grid stage will give exceedingly high amplification, and it is probable that the magnification obtained is one and a half times that of a neutralised valve. There is another question to be considered, however, and it is that of selectivity.

The A.C. resistance of an S.G. valve is high, and demands a suitable tuned arrangement in the anode circuit if the full benefit of its high magnification characteristic is to be obtained.

Split-Primary Coupling

A tuned-anode is the obvious scheme to use, but it lacks the selectivity of the split-primary H.F. transformer, which has a "loosely" coupled primary winding of few turns. The latter is quite suitable when a three-electrode valve of medium A.C. resistance is employed. Hence on the score of selectivity the triode (three-electrode valve) used in conjunction with a split-primary transformer is to be preferred. For this reason the screened-grid valve has not yet ousted the popular neutralised circuit.

Readers who live within 10 miles or so from a B.B.C. station will find the increased selectivity of the split-primary scheme very valuable when

COMPONENTS AND MATERIALS REQUIRED

1 Insulating panel, 18 in. × 7 in. × $\frac{3}{16}$ in. or $\frac{1}{4}$ in. (Resiston, Becol, Trolite, "Kay Ray," etc.).
1 Cabinet to fit, with baseboard 10 in. deep (Camco, Arteraft, Raymond, Pickett, Lock, Gilbert, Bond, etc.).
1 ·0001 fixed condenser (Lissen, T.C.C., Mullard, Dubilier, Clarke, Igranic, Goltone, etc.).
2 Baseboard-mounting coil sockets (Lotus).
4 Valve holders (sprung type). (Lotus, Benjamin, W.B., Igranic, Burton, Pye, B.T.H., Marconiphone, Wearite, Burne-Jones, Formo, Bowyer-Lowe, etc.)
2 ·0005 mfd. variable condensers, slow-motion type (J.B., Lotus, Igranic, Cyldon, Dubilier, Lissen, Burton, G.E.C., Pye, Formo, Ormond, Utility, Colvern, Raymond, etc.).
1 ·0001 or ·00015 reaction condenser (Cyldon, Dubilier, Bowyer-Lowe, Burton, Igranic, J.B., Lissen, etc.).
1 Neutralising condenser (Gambrell, Burne-Jones, Igranic, Bowyer-Lowe, Peto-Scott, J.B., etc.).
1 Standard aluminium screen, 7 in. × 6 in. (Ready Radio, Paroussi, Burne-Jones, etc.).
1 Six-pin coil base (Burne-Jones, Lewcos, Bowyer-Lowe, Colvern, etc.).
1 H.F. choke (Wearite, R.I.-Varley, Igranic, Lewcos, Lissen, Dubilier, Bowyer-Lowe, Cosmos, Burne-Jones, Climax, Colvern, etc.).
1 ·0003 fixed condenser and one ·001 ditto (Dubilier, Burne-Jones, Mullard, Lissen, T.C.C., Igranic, Clarke, Goltone, etc.).
1 2-meg. grid leak and holder (Dubilier, Ediswan, Igranic, Mullard, Lissen, Pye, etc.).
1 Filament "on-off" switch (Lotus, Benjamin, Lissen, Burton, Igranic, Burne-Jones, Wearite, Pioneer, Bulgin, etc.).
1 R.C. coupling unit (Mullard, R.I.-Varley, Lissen, Dubilier, Marconiphone, etc.).
1 L.F. transformer (see text). (Lissen, R.I.-Varley, Ferranti, Brown, Philips, Igranic, Cossor, Mullard, etc.)
2 Grid-bias battery clips.
1 Terminal strip, 16 in. × 2 in., and 11 terminals (Belling & Lee, Eelex, Igranic, Burton, etc.).
Quantity of flex, Systoflex, 16-gauge wire or Glazite, screws, etc.

they wish to listen to stations operating on wave-lengths close to that of the local.

In addition, since the secondary circuit of a split-primary arrangement is lightly damped the "build up" effect of reaction is very beneficial and is helpful in increasing still further the selectivity.

Moreover, a neutralised circuit is easy to stabilise provided the design is sound and the layout can be made simple from the constructional standpoint. This is a point in its favour where the "not too expert" constructor is concerned.

Aerial Tuning

Consider for a moment the H.F. side of the set being described. The screening is of the simplest possible nature; in fact, it is a small piece of aluminium about 7 in. by 6 in. The aerial circuit consists of two plug-in coils, the correct sizes of which the constructor quite possibly has in stock. By using a small coil in the aerial socket the selectivity of the set may be enhanced, and by employing a larger one the signal strength improved.

Thus one is able to vary signal strength or selectivity to suit one's particular needs. Also there is a series aerial condenser, a useful refinement because it overcomes the defects of high-capacity aerials which may otherwise flatten tuning.

The detector needs no comment. The well-tried leaky-grid condenser method is used, and is the best for all-round work.

components could be 250,000 ohms (not greater) for the anode resistance, ·006 or ·01 mfd. for the coupling condenser, and 2 megohms for the grid resistance.

The last stage is transformer-coupled, and the ratio suggested is between 2·5 and 3·5–1. A good quality modern instrument should be used, otherwise the reproduction will not be up to the standard required by loud speakers of up-to-date type.

Another point to bear in mind is that the H.F. choke must be one with a very large number of turns. This is essential if reaction is to be obtained on the 5XX band of wave-lengths. Many of the troubles in which the main symptoms are poor and uneven reaction control are due to the use of an unsuitable H.F. choke. Do not buy an unnamed choke of few turns and expect first-class results.

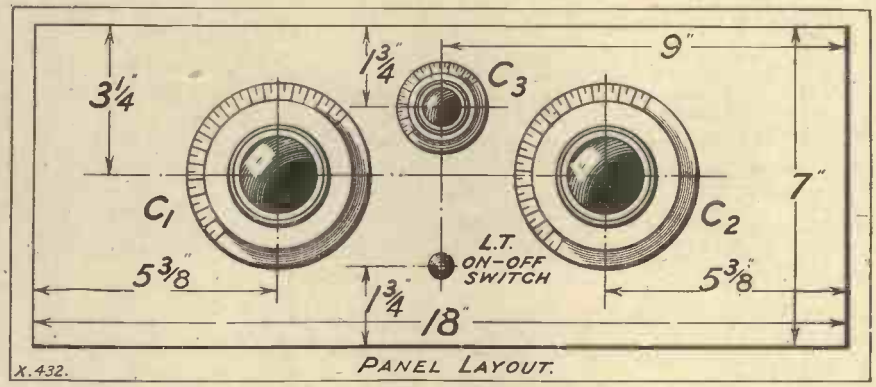
While on the subject of reaction it may be as well to point out that there are on the market R.C. units which have anode resistances of extremely high value.

Now these high value resistances are quite O.K. from the point of view of amplification if they are used with a suitable valve. In a reaction circuit they have certain disadvantages.

In this particular circuit, for instance, it would not be possible to get reaction at all with such units. Therefore, choose a unit having an anode resistance value in the neighbourhood of 250,000 ohms.

You will now be ready to make a start with the construction of the set.

Commence by drilling the panel. You will see that there are four components. These are the two tuning condensers (the two large dials), the reaction condenser, and the filament "on-off" switch.

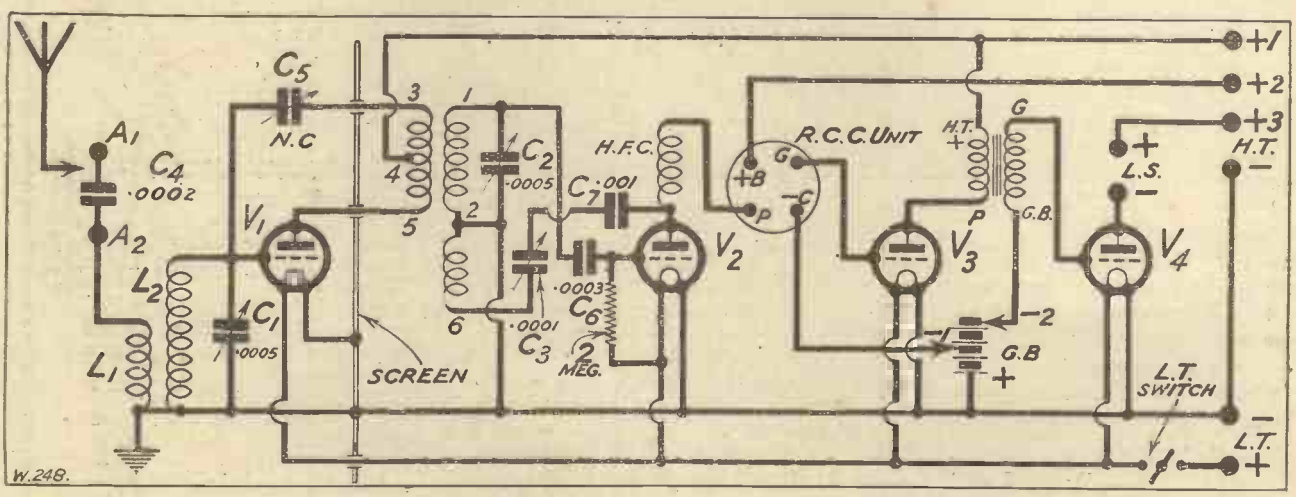


PANEL LAYOUT.

The necessary dimensions are given on the drilling diagram and it will be found that only four holes need be drilled if single-hole-fixing components are used. You will, of course, require five holes along the bottom edge of the panel to secure it to the baseboard.

If you employ substantial wood-screws you will not need special angle brackets. When you have secured the panel to the baseboard you will then be able to plan out the positions for the remaining components with the aid of the diagrams and photographs.

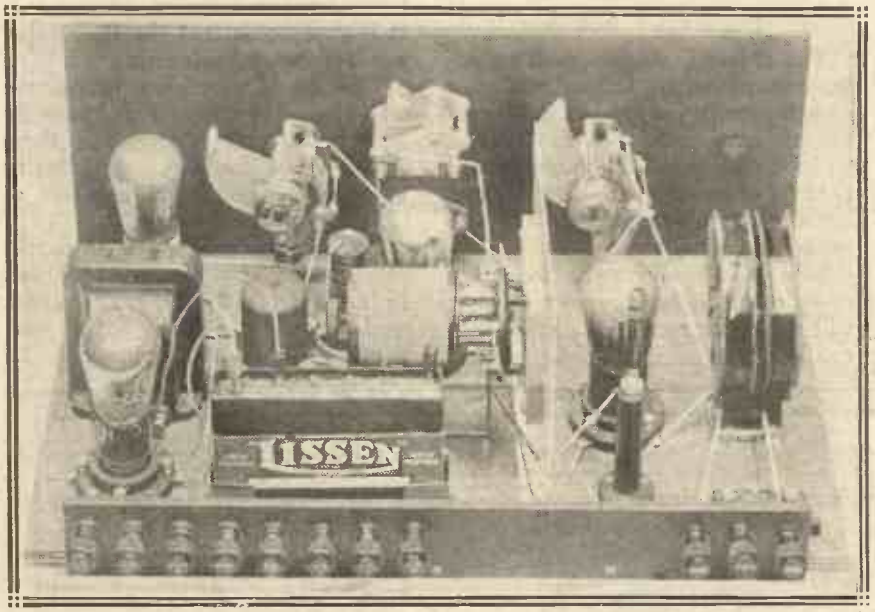
Note the location of the screen and place it in position, but before you do so mount on it the six-pin base.



The third valve is resistance-coupled, a compact unit being shown in the photographs and diagrams. Those who prefer to use separate components, however, may do so with the knowledge that equal results will be obtained. The values of these

Then arrange the H.F. choke, grid condenser and leak, and any other parts which are placed near the front of the baseboard. Do not forget to leave adequate clearance between the third valve holder and the H.F. tuning condenser vanes, otherwise you will find that the moving vanes tend to foul the valve.

Also the G.B battery clips should not be too close to the six-pin coil. Remember that the G.B. battery must be spaced away from the split-primary transformer, which has to be removed and changed for another of suitable type when you desire to receive 5 X X or any of the other long-wave stations.



A general view of the "Simple-Screen" Four, showing how the components are arranged.

Wiring Up

Next we come to the wiring. This is quite straightforward, but it is advisable to concentrate on those leads which are near the panel first of all, and gradually to work towards the back of the baseboard. It also pays to keep the wiring neat and orderly and near the baseboard, since, if this procedure is followed out, there is no danger of the leads fouling such parts as valves, etc.

When you have completed the wiring you will naturally be eager to try out the set.

If you wish to cover the medium and long wave-bands you will need four plug-in coils and two split-primary H.F. transformers. For the medium wave-band (250 to 550 metres) insert a No. 25 or 35 coil in the aerial socket and a No. 60 in the secondary socket. Place a "250 to 550 metres" split-primary H.F. transformer in the six-pin socket.

Then you will require four valves. You can use the 2-, 4-, or 6-volt types. Insert three H.F. type valves in the first three valve holders. Such valves are those having impedances of between 12 and 20,000 ohms. In the last valve holder you can use an ordinary small power valve, or one of the super-power type. If you are situated very near a powerful transmission a super-power valve will be best, but for ordinary work the power type is quite O.K.

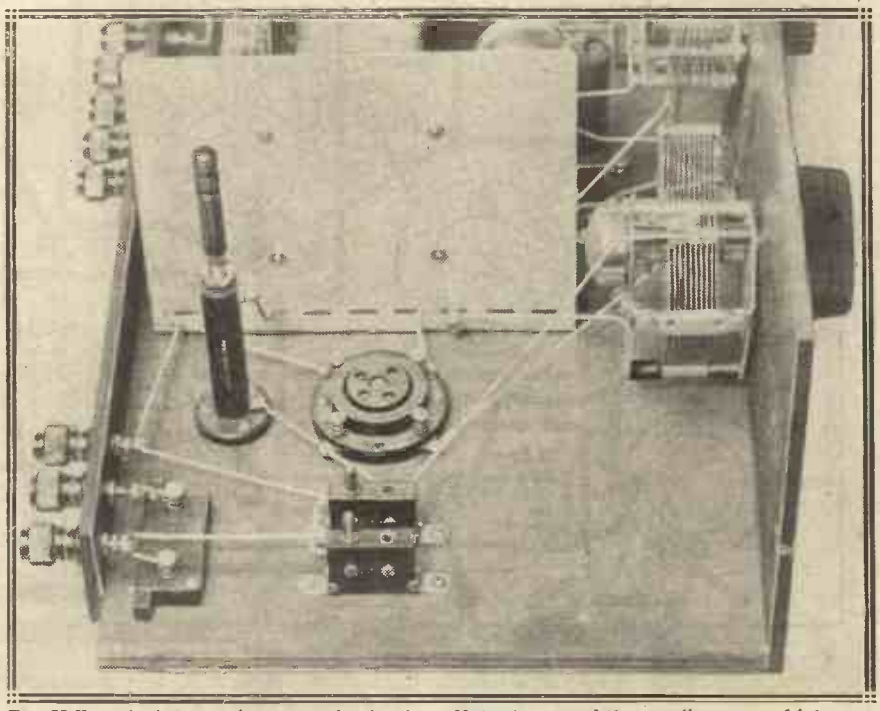
Then you will also need a 9-volt grid-bias battery, or two 9-volt batteries in series, according to the valve you are using in the last socket. If you decide to employ an 18-volt G.B. battery you may have to mount it on the inside of the cabinet owing to lack of space on the baseboard.

Connect up the H.T. and L.T. batteries. Also the aerial, earth and loud speaker. Apply 120 volts H.T. to H.T.+3, about 80 volts to H.T.+2, and 80 or 90 to H.T.+1. Switch on the valves, but before doing so see that you have applied the correct grid bias to the two L.F. valves. The first L.F. valve will require about 3 volts, and the second 7½ to 9, if of the small power type, or about 18 if a super-power.

Neutralising

Place the reaction control at its minimum and rotate the two tuning controls. The H.F. valve will probably oscillate, and you will hear squeals or a rushing sound. You should then commence to neutralise the set. The procedure is as follows:

Set the reaction control at minimum and likewise the neutralising condenser. Now, on setting the tuning condensers so that the two tuned circuits are in step with each other it will probably be found that the set is oscillating. To test for oscillation, touch one or other of the sets of plates of the tuning condensers. You will probably find that the set will only oscillate under the above conditions when the two circuits are in tune with each other, and this can be used as an



The H.F. end of the set is extremely simple. Note the use of the small screen which gave the title to the receiver.

indication. It is convenient to perform the operation at some point near the middle of the tuning range. Now, increase the capacity of the neutralising condenser.

Test at intervals for oscillation as this is done and you will presently find that the set has ceased to oscillate and will not recommence even when the tuning dials are slightly readjusted. Now increase the reaction a little, until the set once more oscillates, and again increase the neutralising condenser setting until oscillation ceases. Slightly readjust the tuning condensers again to make sure that the set is completely stable once more. Proceed in this way until it is found that the correct adjustment of the neutrodyne condenser has been over-shot. Once this point has been passed it will be observed that further increases of the neutrodyne condenser setting no longer stop oscillation, but cause it to become stronger.

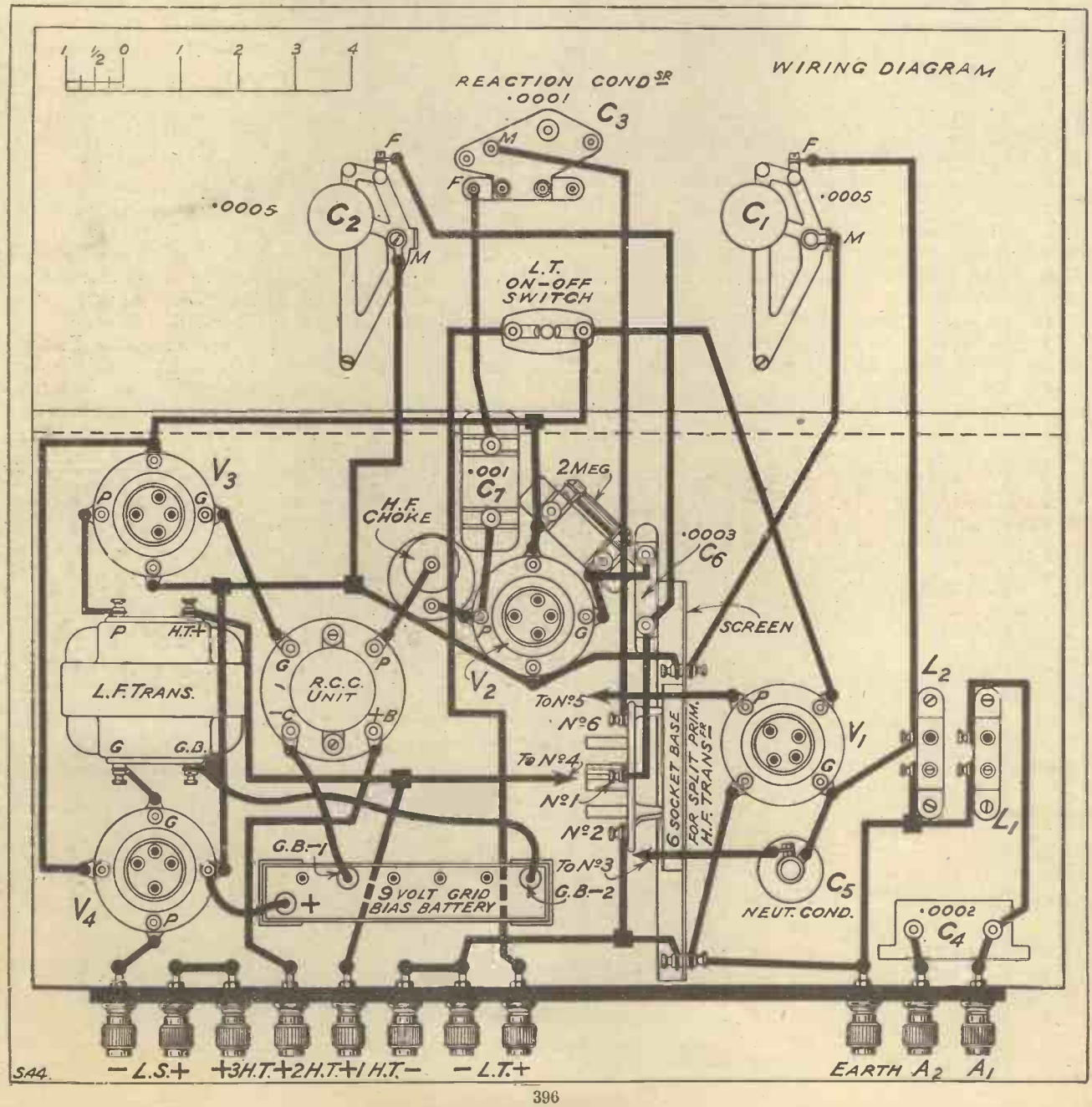
Receiving 5XX

The object is to find such an adjustment of the neutralising condenser as will permit the greatest setting of the reaction condenser to be used without producing oscillation. It will then be observed that when the two tuned circuits are in step and the set is brought to the verge of oscillation a slight movement in either direction of the neutrodyne condenser will cause the receiver to break into oscillation.

When you have neutralised the set properly you can then try for 5XX and other stations on the long waves. Insert a 75 or 100 coil in the aerial socket, a No. 200 in the secondary, and a 1,000- to 2,000- metre H.F. transformer in the six-pin socket It is improbable that the H.F. valve will require re-neutralising.

This set is very easy to operate and, provided that it is properly built with good components, there will not be the slightest difficulty in receiving a large number of broadcast programmes.

The receiver was tested in south-east London at a distance of about 15 miles from 2LO. The aerial used for the test was not a particularly good one, having only an



average height of 15 ft. and a length of 100 ft.

In spite of this, however, all the well-known Continental transmissions on both the long and medium wave-bands were tuned in at loud-speaker volume, and the degree of selectivity was found to be adequate for all normal purposes.

No readjustment of the neutralising condenser was necessary on the long waves. On the medium broadcast wave-band the loudest signals were received with a No. 35 coil in the aerial socket and the aerial lead joined to terminal A_1. This, of course, may vary with different aerials.

The best selectivity with the test aerial was with a No. 25 coil in the aerial socket and the aerial lead to A_2.

Resistance Coupling Values

On the long waves both No. 100 and 150 coils in the aerial socket gave good volume, but a No. 75 was desirable from the point of view of selectivity. A No. 75 is also useful for listening to Hilversum.

So far little has been said about the values of the resistances in the R.C.C. unit. In some cases, with certain makes, there will be no choice. In others the unit may consist of two clip-in resistances with a condenser in the base.

The value of the anode resistance should not be greater than ·25 megohm, otherwise it will probably be impossible to obtain reaction. This point is important. The grid resistance may have a value of 2 megohms, and if any choice is given the coupling condenser can be between ·005 and ·01 mfd.

Grid Bias

Then, again, the amount of grid bias used on the first L.F. valve depends upon the valve itself and the H.T. voltage used. If you find that 3 volts decreases volume, cut the grid bias (G.B. — 1) down to $1\frac{1}{2}$ volts. If you find, however, that the use of even so small a value as $1\frac{1}{2}$ volts is too much, then it is quite possible that you are not using enough H.T. on H.T. + 1. Alternatively, your first L.F. valve may not be of the correct type.

In extreme cases you may find that there is a slight tendency for the low-frequency valve to howl or distort. Such cases are very rare indeed in a set of this nature, and would only occur if the H.T. supply was producing a coupling effect. For instance, dry batteries in a partially run-down condition sometimes produce troubles of this nature. Mains units also introduce back coupling. If such a trouble does occur, try reversing the leads to the primary of the L.F. transformer, or the insertion of an "anti-mobo" device in series with the detector valve H.T. lead.

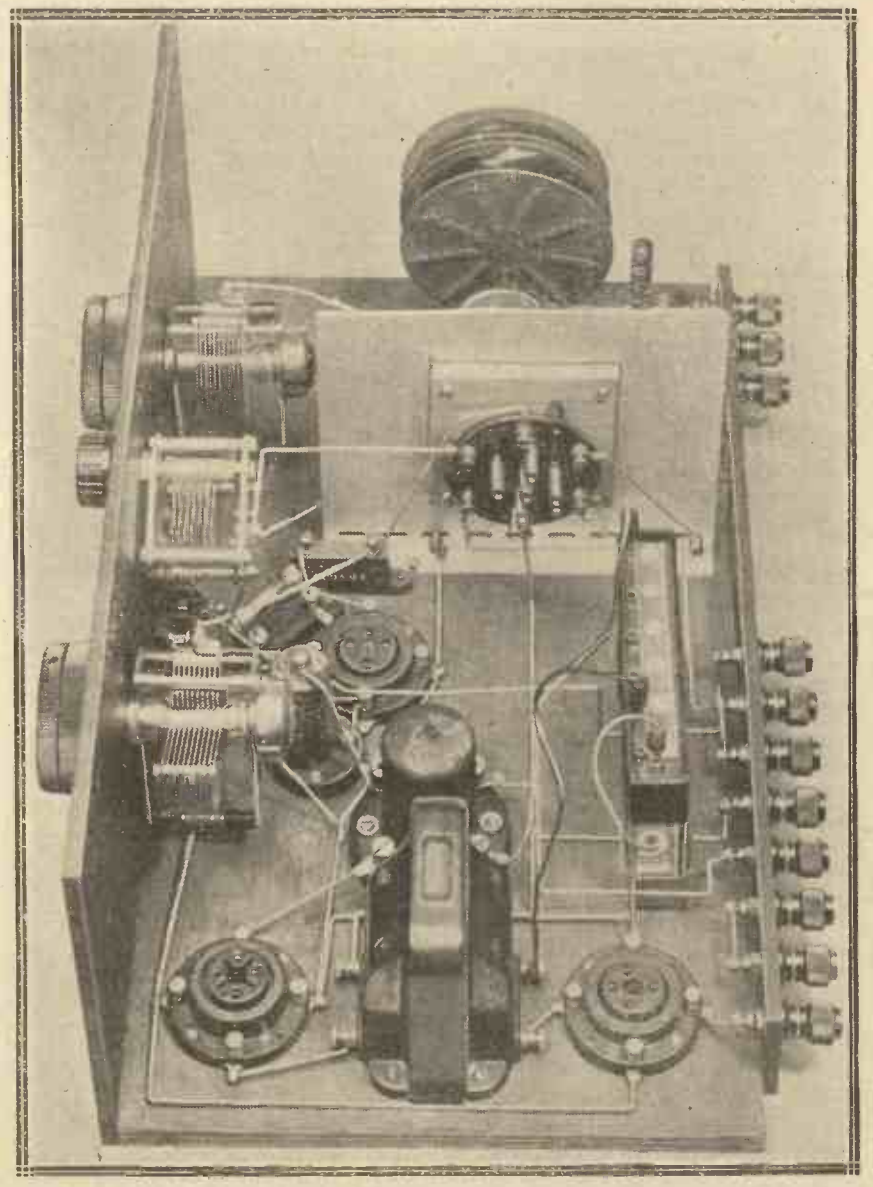
Incidentally, any good low-ratio L.F. transformer of modern design is suitable for this receiver. The ratio can be between 2·5 and 3·5–1, and you will have a number of makes to choose from having ratios between these limits.

You may also wonder whether you ought to purchase a super-power valve for the last stage. Well, it depends entirely upon the volume you are handling. If you are fairly close to a B.B.C. station, or within easy loud-speaking distance of 5 X X or 5 G B, it will probably pay you to use a super-power type of valve. If, on the other hand, you want maximum amplification from each stage, then a power valve will suit you because the magnification is greater.

You must bear in mind that while an ordinary power valve gives you louder signals it does not handle big volume.

Sometimes the fact that such a valve gives greater amplification makes up for its inability to deal with very strong signals. The first L.F. valve is not critical provided the valve you choose has not too high an impedance.

For good reproduction the impedance should not exceed 20,000 ohms, or so.



The main portion of the receiver. Here again simplicity is the keynote of the whole design, and the components are arranged so that the wiring is easy to carry out.

Quite an efficient speech microphone can be made up quickly by mounting an ex-Government D.III "watch type" microphone in cotton wool in a short length of cardboard tube, so arranging it that the diaphragm is at an angle of, roughly, 45° to the vertical (see Fig. 2). If it is desired to introduce a certain amount of damping so that a degree of quality in musical reproduction is obtained, one or two discs of thin felt or similar material may be mounted over the diaphragm under the screw-on cap.

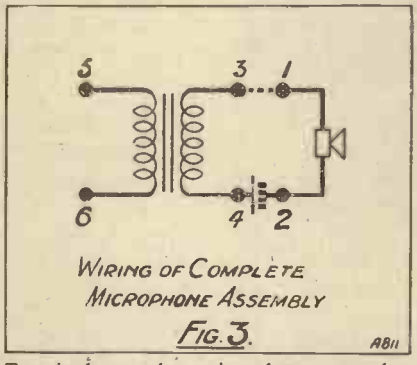
Microphone Connections

A suitable transformer for this instrument can be obtained for a few shillings at any Government surplus stores, and where one microphone only is to be used the transformer may be mounted inside the cardboard tube also.

In this case, six terminals should be mounted outside, so that either microphone or transformer may be used independently, or both of them wired up with a battery to form a complete microphone input circuit. Fig. 3 shows these connections, and Fig. 4 a photograph of a completed assembly.

In this form the microphone may be connected to a pick-up adaptor, and used in precisely the same way if the fade unit is undesired, and two stages of amplification will give quite useful results up to a distance of two feet for speech.

It should be remembered that a cheap carbon microphone is always likely to "pack," and for that reason an occasional shake will do it good. Having allocated our microphone to the first pair of terminals on the fade unit, the pick-up will, of course, go direct to the second pair, leaving the third pair to receive the output from the actual wireless receiver. Most experimenters have their receiver and amplifier as separate units, but some who hitherto have used a pick-up adaptor in a complete set will find it necessary to bring the leads outside if the fade unit is to be employed



WIRING OF COMPLETE MICROPHONE ASSEMBLY

FIG. 3.

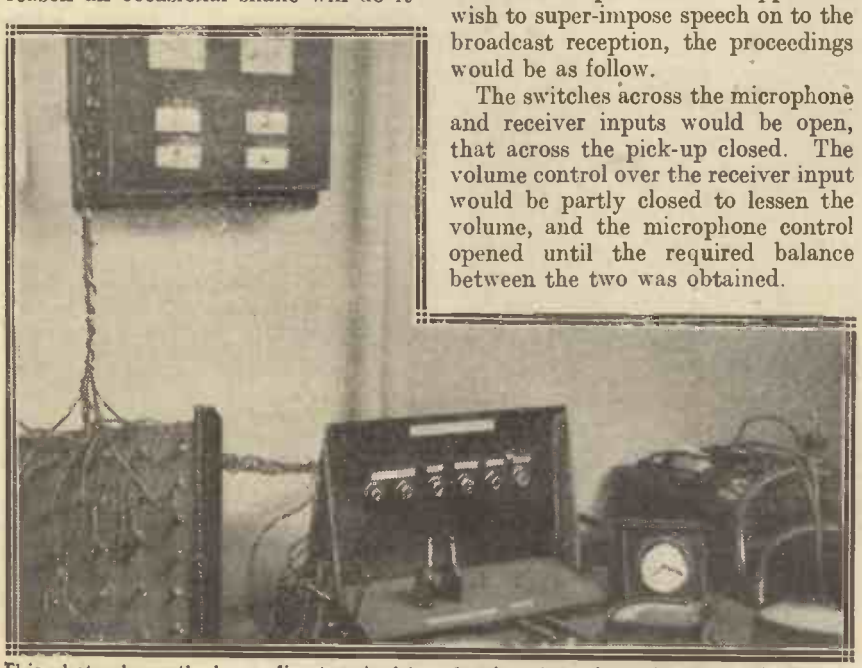
Terminals 1 and 2, microphone; 3 and 4, transformer primary; 5 and 6, transformer secondary; 1 and 3, shorting strip, or cut-out switch; 2 and 4, two-volt battery.

Others, again, may use a crystal set followed by an amplifier, and in this case it is only necessary to connect the 'phone terminals of the receiving set to the fade unit.

How It Is Done

These arrangements complete, the fade unit is ready for use. The operation will be easily followed after one or two experiments. Suppose we wish to super-impose speech on to the broadcast reception, the proceedings would be as follow.

The switches across the microphone and receiver inputs would be open, that across the pick-up closed. The volume control over the receiver input would be partly closed to lessen the volume, and the microphone control opened until the required balance between the two was obtained.



This photo shows the house-line terminal board, microphone input board, cue indicators and meters.

Should the set be receiving a talk which would be improved with a musical accompaniment, then a record could be played and the pick-up and receiver inputs balanced. If the operator wishes to dispute the talk, then he can still add the microphone and say what he thinks about it!

Fig. 4. The six-terminal microphone.

The next thing that will be found of use and interest is a jack board, or preferably two of them. Many experimenters have two or even more receiving circuits, some complete sets, and others just temporary hook-ups.

There is probably one main amplifier and several lines to different rooms in the house. Connecting-up different arrangements of all this apparatus takes a considerable amount of time and this will be saved by installing a panel of ordinary double-contact jacks.

General Arrangement

The general arrangement is to take the outputs of all receivers, inputs and outputs of amplifiers, fade unit inputs and house lines to jacks, and then to make the desired connections by means of couplers consisting of short lengths of flex with a plug at each end.

Now, if we wish to connect a particular receiver to the amplifier and then to a house line, we take two couplers, plug one into the jacks representing the "receiver output" and "amplifier input" and the other into the "amplifier output" and "check loud speaker" or "'phones."

In an Emergency

Having confirmed all is O.K. the latter plug is then transferred to the house-line concerned. If anything goes wrong a quick test can be made by taking the plug from "amplifier input" and transferring to "check 'phones."

The 'phones are then connected to the receiver direct, and if this is at fault, a stand-by crystal set or experimental receiver can be brought

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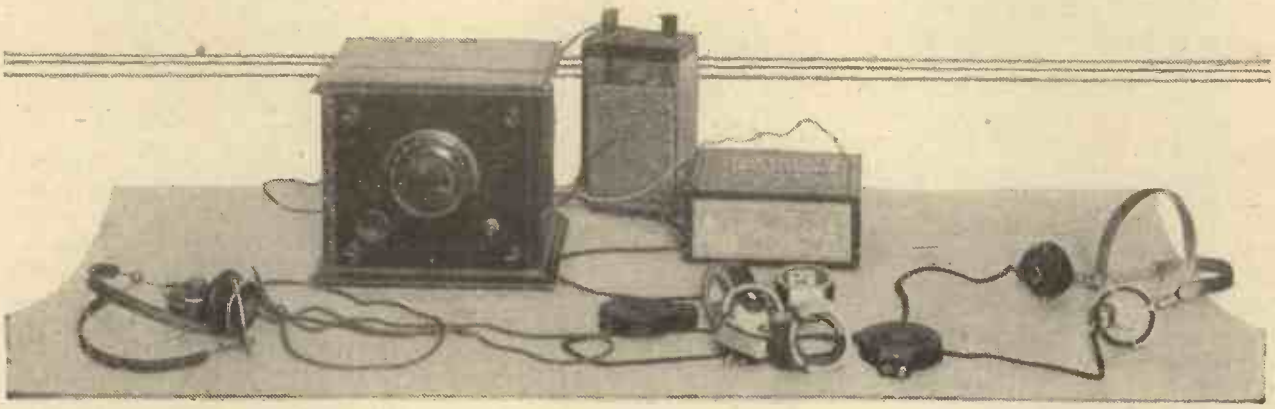
THE DETECTOR'S DUTIES



Has it ever occurred to you to wonder exactly what it is that your detector really does? Its duties are decidedly difficult ones—as this article shows.

By P. R. BIRD.

EVERY listener who is interested in his set knows that the detector is an essential part of it. Every listener knows, too, that there are two kinds of detector—the crystal and the valve. Totally different in appearance, what can these two appliances have in common with each other?

The crystal is one of Mother Nature's staggering surprises. Evolved by her centuries ago, it lay scattered prodigally, like most of her mineral gifts, with its peculiar properties unsuspected for centuries until the invention of wireless came along. This involved demands different from any that man had ever made, and the crystal detector was Dame Nature's answer; a magnificent card concealed for centuries up the sleeve of Mother Earth.

Distinctions and Differences

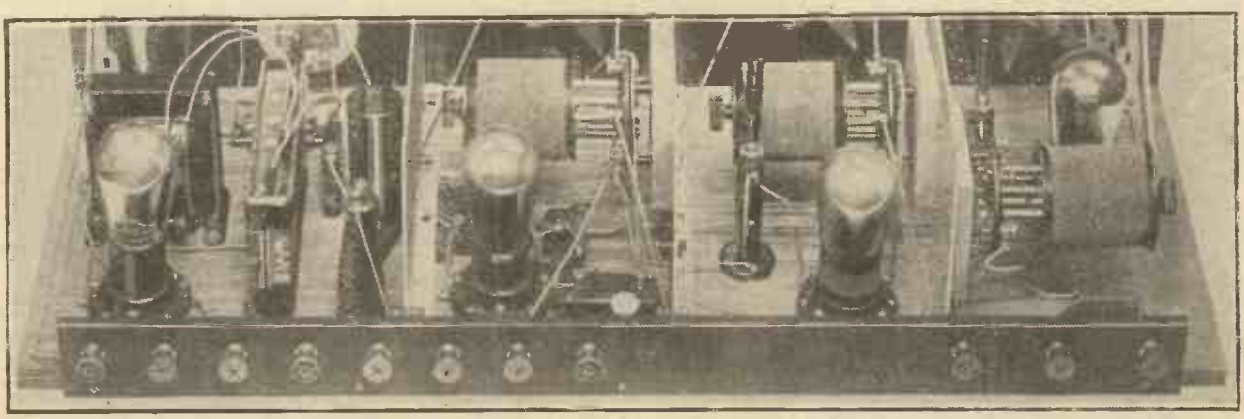
The valve detector is as different from a crystal as anything can be, apparently! The product of human ingenuity, it is an amalgamation of man's most recent discoveries and developments. Artfully contrived and artificially heated, it can only work in a man-made vacuum, stolen from space and protected from air pressure by a glass bulb. What can such an essentially artificial and modern contraption have in common with a natural crystal?

At first sight it would seem impossible that there could be any bond between two such dissimilar objects, especially when it is remembered that Nature's detector, the crystal, works naturally, by its own virtue, without any formality, and without artificial aid in the way of batteries. Whilst the man-made valve must be heated by an accumulator, continually fed, and vitalised by a high voltage, before it can do its duty as a detector.

The Basis of Broadcasting

That duty is, I think, one of the most interesting tasks ever expected of anything inanimate. To understand the difficulty of it we shall have to consider the conditions under which a detector does its detecting. In a few words, this is really a matter of electric currents, and of our old friend magnetism which invariably accompanies them.

Stated in general terms, the broad basis upon which broadcasting is built is of those two kinds of electric currents, named for want of better terms, "high-frequency" and "low-frequency" currents. The fundamental difference between these two classes of current is merely a difference in frequency, but by virtue of their different frequencies they do absolutely different things. Low-frequency currents, for instance, can be associated with *sound*.



Nowadays the first tuned and high-frequency amplifying stages are often screened off from each other by metal sheets, as shown, to ensure a stable input to the detector.

Under the correct conditions sound can be made to give rise to low-frequency currents, and thus "electrical sound" can then be conveyed along wires over enormous distances in the form of L.F. currents, with the appropriate and inevitable magnetic effects around the wire. If a diaphragm harnessed to a suitable electro-magnetic device is placed anywhere in this circuit the low-frequency currents can reproduce the sounds which brought them into being.

Soundless and Boundless

High-frequency currents, on the other hand, have no affinity with sound. Moving at unimaginable speeds they do unimaginable things. In some swift and hardly-to-be-conceived way of their own they travel in space at the speed of light. Unlike low-frequency currents they are "soundless," but again unlike low-frequency currents they are boundless. Not bound to a wire, but flung free and apparently as far-reaching as space itself.

In the transmitting aerial the broadcast energy is in the form of high-frequency currents, modulated by the low-frequency impulses which correspond with sound.

Put into plain language, the art of wireless broadcasting is the art of combining or mixing low-frequency currents with high-frequency currents into the most amazing combination of ingenuity ever designed. For what a wireless engineer does is to make high-frequency currents, fling them to the far corners of the world, and whilst they are moving with the speed of light, impress and impose upon them the low-frequency currents which represent speech and music. The high-frequency currents, though themselves inaudible, can carry this impress with perfect fidelity, a kind of living likeness of words and music, entrusted to a flying and far-reaching messenger.

It is the duty of the detector to disentangle the words and music and to reproduce those sound currents (low-frequency) after they have been brought to their destination by the high-frequency waves.

It is thus high-frequency-carrying-low-frequency-current which the detector has to deal with. Associated with the detector is a sound-reproducing device which is capable of converting suitable low-frequency impulses into sound. High-frequency current it cannot deal with, so it is the duty of the detector to pass on the low-frequency currents only. How this is actually done depends upon whether the valve or crystal is used as the detector.

Both are very interesting, and the crystal being the simpler of the two we will take this as an illustration. For some reason known only to Mother Nature, certain crystals of the type used as wireless detector (for instance, galena, carborundum, iron pyrites, etc.) will, when placed in an electrical circuit in conjunction with a suitable contact, differentiate very strongly between a current which is flowing in one direction and a current flowing in the opposite direction.

One-Way Traffic Only

If, for instance, we took a very sensitive measuring instrument, a tiny battery, and a crystal and cat's-whisker, and joined them all up, we would find that the measuring instrument would show either no current at all or else an appreciable current, according to whether the battery is connected up with its negative towards the crystal, or its positive. Suitable crystals, in fact, do not mind current flowing in one direction, but strongly object to a current flowing in the other direction!

Such a crystal (it may be either natural or synthetic) will therefore act as a kind of "valve." When connected in series with a pair of telephones, for instance, it will permit current to flow one way—say, from the 'phones to the crystal—but not currents to flow in the other way, i.e. from the crystal to the 'phones. If now such an arrangement—i.e. the rectifying crystal in series with a pair of telephones—is connected across a tuned circuit in which broadcast impulses are being received, certain corresponding pressures will be developed across the 'phones and crystal.

The effect of the currents flowing in this tuning circuit will, in fact, be to develop voltages across the ends of this extra detector circuit which has been added, and consequently current will tend to flow in that detector circuit. But although a medley of pressures is present at the ends of the circuit, the one-way peculiarity of the crystal detector, and its preference for current in one direction, and against currents in the opposite direction, will result in the choking back of certain currents, and in the ready acceptance of certain other suitable currents.

In a short article of this type it is impossible to follow out all the features of the whole affair, but the effect is very much as though the high-frequency current was suppressed altogether, and then half the low-frequency current was utilised, the other half being thrown overboard because it is unsuitable!

An Automatic Amplification

The valve, when used as a detector, behaves in very much the same way except that it has the great advantage that it automatically amplifies at the same time as it detects! (Considering the necessarily weak input from an aerial, this strengthening effect is of the greatest importance, and partly explains why valve sets are so much more in favour than crystal sets.) But so far as the actual work of detection is concerned they are equally entitled to honour, both performing that difficult task with almost uncanny delicacy and precision.

SIMPLIFIED S.G. CIRCUITS

Whether or not you have had experience in the construction of screened-grid-valve receivers you will find this article on S.G. circuits of absorbing interest.

By B. MEDLICOTT.

IN some of my early experiments with the screen-grid H.F. valve amplifier, I found that a very satisfactory degree of amplification could be obtained with an aperiodic

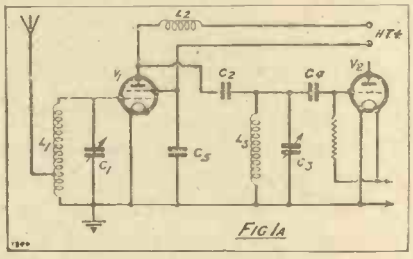


FIG.1A

circuit, when compared against a tuned circuit, as shown in Fig. 1 at B and A respectively, of which A shows a typical S.G. H.F. circuit.

It is interesting to see why this should be so, and a comparison of the two circuits should help to make this clear. Now, in Fig. 1A we are using shunt feed for the output circuit and a moment's thought will show you that the H.F. choke L_2 is, to all intents and purposes, shunted across the tuned circuit L_3 C_3, with the coupling condenser C_2 in series with it. (Note : To reduce the effect of the choke, should we not reduce the value of the coupling condenser ?) It would, therefore, appear that the total effective resistance of L_3 C_3 with L_2 in parallel must be less than the effective resistance of L_2 by itself.

An Important "But . . ."

It would seem logical, then, to remove the tuned circuit and get an increase in the effective shunt resistance of the output circuit, and so get greater amplification, by using the Fig. 1B circuit. But—and there is a but—there is one thing that I think has a very important bearing on the subject.

Redrawing Fig. 1B as at C, so as to show all the electrical quantities, we must insert the self-capacity of the choke L_2 and the plate-filament capacity of the H.F. valve, which is quite high with a S.G. valve. Since the H.T. positive end of L_2 is, to all intents and purposes, at earth potential as regards H.F. voltages, we can lump the self-capacity of the choke with the plate-filament capacity of the valve, and this is shown as two separate capacities in parallel at C_2 and C_3 in Fig. 1C.

The By-Pass Effect

Now, in the Fig. 1A circuit this capacity is in parallel with the tuning condenser C_3, and will, therefore, have no by-passing effect on the signal output from the H.F. valve. In Fig. 1B, however, this capacity acts

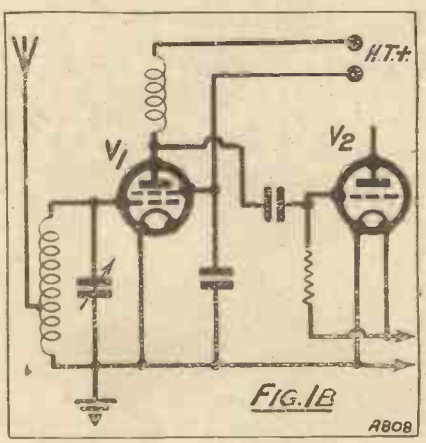


FIG.1B

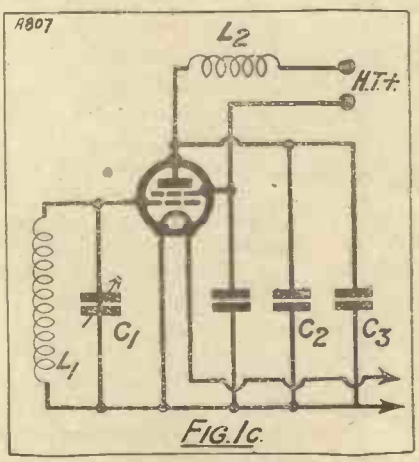


FIG.1C.

as a pure capacity which can be considered as connected between the plate of V_1 and L.T., so by-passing a considerable portion of the signal.

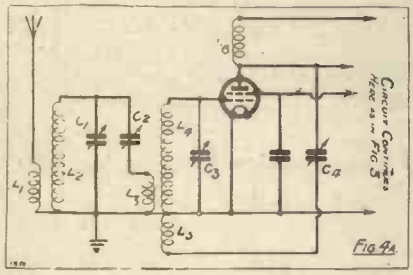
That this is what actually occurs is, I think, generally borne out by the practical results obtained, but there are cases I know where the removal of the tuned circuit has not brought about a loss in signal strength, as is usually the case, but does the opposite, produces an increase. I think myself, however, that this may be exceptional, and may be due to the characteristics of the particular H.F. choke employed, the layout of the set or other factors.

First in the Field

The interesting thing about this question, to which I have referred as a preliminary to another subject, is that it is likely to have a very marked modifying effect on present-day technique as regards H.F. amplification. The first published example

of a set on these lines was, I believe, the "New Business Man's Four," by Mr. Percy W. Harris.

Even if the loss in amplification which results from removing the tuned circuit is a fairly considerable percentage, this removal enables us to simplify the construction and handling of a receiver to an amazing extent, not only in the components that can be left out, but also in the actual layout and design, as well as enabling us to eliminate the greater part of the screening.



Take, for instance, a typical 2 H.F. S.G. set as shown in Fig. 2, in which shunt feed has been used to prevent battery coupling. Special astatic coils for L_1, L_3 and L_5 are employed to limit the fields of the coils, while complete screening has probably also been used, because necessary to separate adjacent input and output circuits, and this means three screening boxes, which makes the constructional work cramped and difficult to complete.

Long-Wave Pick-Up

Let us reconstruct it on the Fig. 1B lines, as outlined in Fig. 3, and see what a difference it makes. For one thing, the amplifying valves can be put close together, elaborate screening is no longer necessary, at least four components are cut out, and two tuning controls are done away with.

We have, in fact, an ideal single-control receiver which, further, owing to the elimination of sharply-tuned circuits which may be in a regenerative condition, will give wonderful quality on long-distance as well as local stations. Quality that should satisfy the most fastidious.

You will see that I have included reaction by means of a condenser C_4 and an extra winding L_4. C_4, of course, needs to be quite a small condenser, and this is desirable to get the fullest amplification for long-distance work on weak transmissions.

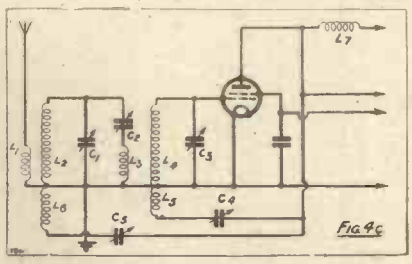
Now, what are the drawbacks of this circuit, I can hear someone say. And they are quite right; it has got one or two drawbacks. Firstly, one of the most important ones, a circuit of this description is prone to long-wave pick-up. This is apparently due to the high plate-filament capacity of the S.G. valve which serves to tune the H.F. choke; with two of them long-wave interference is often experienced, unless two totally different types and makes of choke are used.

An Important Point

This is an important point and must be carefully watched when making a set on these lines. Secondly, the tuning of the receiver will be very flat.

What, then, are we to do to rectify this. Well, we can do either of two things, both of which are fundamentally the same in that they involve the replacement of one of the tuned circuits: (a) We can put another tuned circuit in front of the set, as in Fig. 4A, or (b) we can put a tuned circuit in front of the detector, as at Fig. 4B. In the case of (a) a slight reduction in signal strength may be experienced, but not very much, because some of it is made up for by the removal of the aerial damping from the grid circuit proper of the 1st H.F. valve.

This gives an extremely logical arrangement. First, we start with the aerial and tuning circuits, as many stages (two, three or four) without difficulty either as regards layout and construction, or handling and stability. Next comes the rectifier and, lastly, the L.F. amplifier.

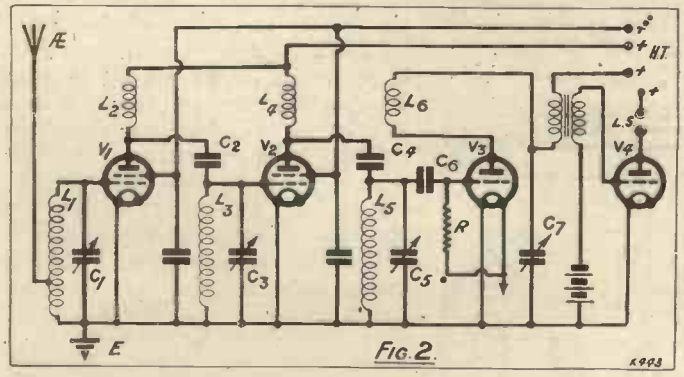


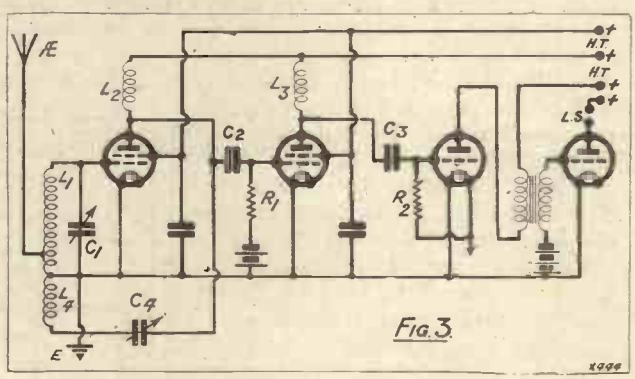
A suitable layout for a set built on the lines of Fig. 4A would be something like that shown in the sketch in Fig. 5. Very little screening would be necessary and the set could be made extremely compact for a receiver with two or more H.F. stages.

The Fig. 4B circuit has other advantages. For instance, the tuned circuit L_4 C_4, which would preferably be placed in the output of the last H.F. valve as shown, would enable reaction to be obtained from the detector. Also, it would be an effective short-circuit to any long-wave signal picked up in previous stages and would prevent interference from this source. On the other hand, it would make it necessary to employ considerable screening to prevent interaction between the two tuned circuits, which would otherwise introduce feedback and instability.

Some Practical Data

At the same time, this circuit would give rather greater H.F. amplification than that shown in Fig. 4A, owing to the greater efficiency given by V_3 with a tuned circuit in the input, especially if series instead of shunt feed were used.





as we want, to give the required degree of selectivity; we could use three tuned circuits if we wanted to, and gang them all together. Then we get the H.F. amplifier, and since this is aperiodic we can again use several

Some practical data as to the Fig. 4 circuits may be of interest and guidance. In Fig. 4A, for L_2 and L_4 I prefer to use a fairly large coil, say 65 to 70 turns on a 3-in. former, wound with 27/42 Litzendraht for

preference, so as to give the utmost efficiency and selectivity. L_1 and L_3 may be interchangeable with advantage, or a fixed winding of 10 to 12 turns will give quite good all-round results.

The above data will suit most of the equivalent circuit components in the other circuits shown.

An exceedingly interesting variation of the Fig. 4A circuit is shown in Fig. 4C, in which you will see I have

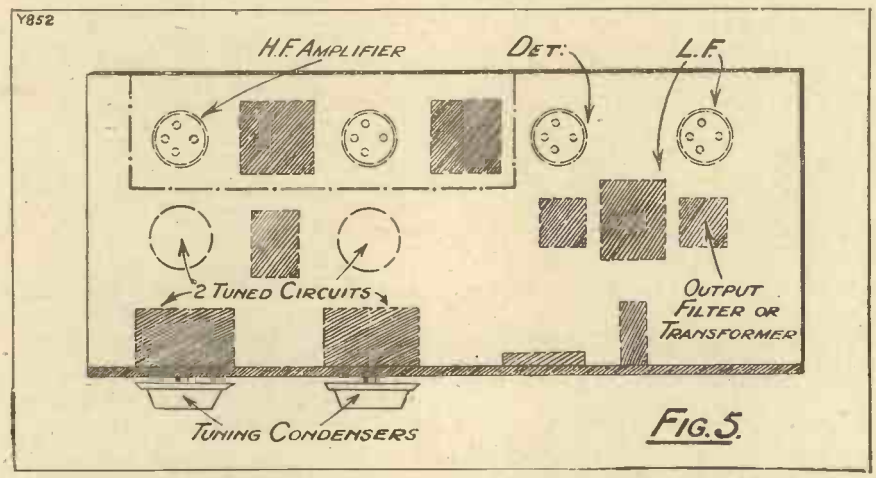


FIG. 5.

C_1 and C_3 with these coils should be ·0003 each, and condensers having a low minumum value should be chosen. C_2 may be an ordinary baseboard-mounting neutralising condenser, and once set may be left set. For the two H.F. chokes used for the aperiodic H.F. coupling you want high-inductance chokes, such as the Lewcos, Burne-Jones, R.I.-Varley, Cosmos, etc., and be sure to use two different makes. C_4, the reaction condenser, should be a neutralising condenser; the reaction winding L_5 being about 8 to 10 turns. The rest of this circuit will be identical with Fig. 3, and the following distinguishing letters refer to this circuit.

The coupling condensers C_2 and C_3 may be ·0001 to ·0003; the smaller value will help to prevent long-wave signals being transferred, while the

arranged for reaction to be applied to both tuned circuits. This, of course, not only still further improves the selectivity obtainable, but also increases the signal strength.

An Interesting Circuit

The values for the extra reaction winding and condenser are a matter for experiment, for the loose coupling of the first tuned circuit with the grid circuit of the H.F. valve will make it rather difficult to get reaction, unless a fairly large reaction condenser C_5 is used, or else a larger winding L_6 will be needed. This may not, of course, apply in all cases, and is merely a suggestion as to what you will need.

An interesting circuit on which I have done some preliminary work is shown in Fig. 6, and this has some points of special interest. I have

One of the effects of neutralising is that it enables us to introduce what is, in effect, a negative capacity in the output circuit, or anode circuit, of a valve. You probably know that an inductive load in the plate circuit of a valve which has an inductive input circuit will give rise to conditions that may produce oscillation. If, however, the load is capacitative, then the opposite is the case. The feed-back which results is due to the plate-grid capacity; when we neutralise the valve we neutralise this capacity, and if we over-neutralise slightly we have what is in effect a negative capacity.

Counteracting Capacity

If then we neutralise the S.G. valve as shown at V_1 in Fig. 6, then we can introduce what is in effect a negative capacity so as to counteract the shunting capacity due to the self-capacity of the H.F. choke and the plate-filament capacity of the valve, as described previously in Fig. 1C.

We can therefore expect to get a higher degree of H.F. amplification and less likelihood of long-wave pick-up interference. We must, however, be able to apply reaction, or else we shall be worse off, rather than better. But now we can do it from the detector valve. With the Fig. 1B circuit reaction from the detector valve cannot be controlled, for an exceedingly small capacity is required; but with the H.F. valve neutralised the state of affairs has been completely altered, and in Fig. 6 reaction from the detector valve with a suitable reaction winding L_3 and condenser C_5 becomes feasible.

I am still far from complete in my experiments on this circuit, but I

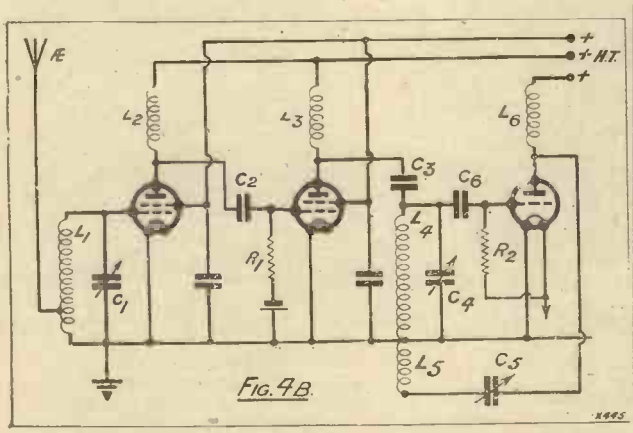


FIG. 4B.

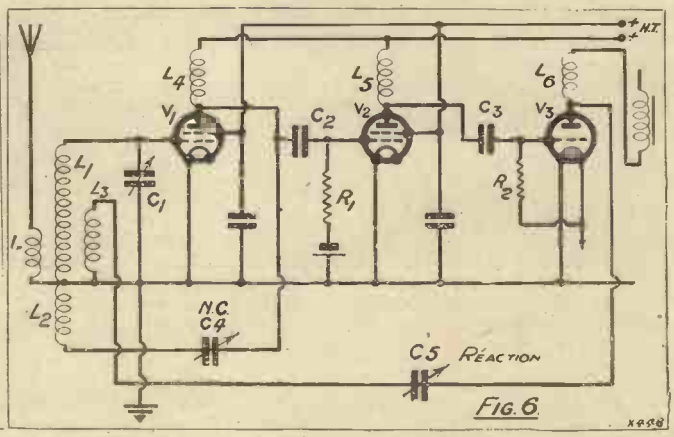


FIG. 6.

grid condenser may be the usual ·0003. The grid leaks R_1 and R_2 may be the usual 2 meg., though the detector leak R_2 may be chosen to have a value to suit the valve and L.F. coupling used.

previously shown how the high plate-filament capacity of the S.G. valve is a serious matter when using aperiodic H.F. coupling.

Now I must ask you to take something for granted, and that is this.

thought some advance details would be of interest to the readers of "M.W.," because something may crop up to-morrow to delay the completion of my work on the subject for weeks, if not for months.

The following are the practical data with regard to this circuit: L, the aerial winding, is preferably interchangeable so as to allow selectivity to be varied, and the number of turns will be between 5 and 15 or 20, according to requirements. L_1 is again a 65- or 70-turn coil wound with Litz, while L_2, for neutralising, will be 6 or 7 turns. L_3, for reaction, will depend rather on the actual details of the set as made, its layout, the components used, and the valves used. Normally, I think you will find that 10 turns is as much as you are likely to need, and in some cases you will have to cut the number down quite a bit. It is easy, however, to determine experimentally just what it is you need.

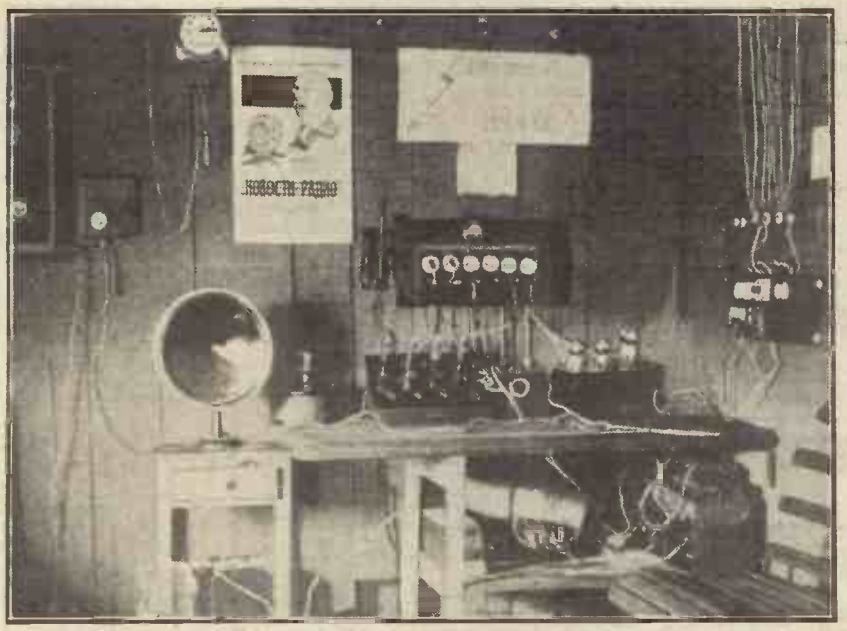
Further Stages

The two H.F. chokes, if two stages are used, as shown, must as before both be different; while the reaction choke in the detector plate circuit should be different again from the others. The reaction condenser C_5 will not need to be bigger than a neutralising condenser in most cases, though the best conditions for constant reaction are to use a small capacity between grid and L.T. as low as possible. The grid condenser C_2 may be anything between ·0001 and ·0003.

I have indicated transformer coupling between the detector and the first L.F., but if you intend using two stages of L.F. then the first one may be resistance-coupled with advantage as regards quality, followed by a low-ratio transformer.

In cases where interference from a powerful station is expected, or if it is desired to obtain a high degree of selectivity, then a further tuned circuit is added on in front of the set as in the Fig. 4 circuits.

SIBERIA'S STATION



Said to be the smallest transmitter in the world this Siberian broadcasting station has only 45 subscribers and is constructed at the Kemerow Chemical Works. In spite of its diminutive audience it relays programmes from places as far away as Moscow, Omsk, and Novosibirsk.

reaction winding and a largish condenser. Other considerations, however, do not always permit this arrangement being used.

The grid leak R_1 may be anything between 2 to 5 megohms, and the wiring of this and the grid condenser should be arranged to keep the

RADIO RECEPTION REMINDERS

One of the worst forms of interference, and one of the most difficult to dodge, is that from tramway systems.

* * *

If you have any spare fixed condensers on hand, no matter what the size, try the effect of connecting one of them in the aerial lead. (They cannot do any harm, and may improve reception.)

Large fixed condensers connected across the contacts will generally reduce interference from flashing advertisement signs or similar sparking electrical machinery.

* * *

One little-used method of dodging bad interference from electrical mains, etc., is to bury the aerial. (The buried aerial should be well insulated from the earth by means of rubber covering or similar protective material, placed just below the surface of the ground, and running for 25 ft. or so in as straight a line as possible.)

* * *

If you are spring cleaning your set, do not forget that battery acid can be renewed quite cheaply, and may result in lengthening the life of your battery.

* * *

Some H.F. chokes as used for capacity-controlled reaction are not efficient on the long waves, although they may be perfectly O.K. upon the ordinary broadcasting wavelengths.

* * *

If L.F. transformers are placed too close together in a set howling will often result, especially if their cores are not at right-angles.

* * *

The B.B.C. is always ready to listen to complaints of interference by electrical machinery, and will always do its best to take the matter up to the satisfaction of the listener concerned.

* * *

High-tension power lines must be avoided like the plague when erecting aerials, or a fatal accident may follow.

* * *

Telephones which have been dropped, and which consequently have lost their sensitivity, need not be thrown away, as in many cases they can be reconditioned successfully by the makers, or by firms specialising in telephone repair work.

* * *

Battery Leads

If your battery leads have been in use for twelve months or more, it is certainly time they were overhauled if your set is to remain free from crackling noises.

* * *

When a potentiometer is to be used for volume control at the low-frequency end of the set its resistance should be equivalent to that of a grid leak in the same place, i.e. a quarter megohm, half megohm, or so.

* * *

When making adjustments to an H.T. mains unit always take the plug connecting this to the mains right out of its socket, and do not trust to the switch being "off."

* * *

Do not throw away the little stiffening rods supplied with packets of Glazite, etc., as these rods make excellent spacers when winding coils.

* * *

A fuse should always be inserted in the leads from the mains when current is being taken from this source for the loud-speaker field, or similar purpose.

* * *

The L.F. Choke

The inductance value of a low-frequency choke partly depends upon the amount of current passing through it, and its inductive value decreases as the current increases.

* * *

One of the advantages of using a high-resistance potentiometer for controlling volume is that no distortion is introduced by this method.

* * *

In potentiometer-operated circuits carrying high-frequency currents, a ·001 condenser (or thereabouts) should always be connected between the slider of the potentiometer and that end which would otherwise be in the H.F. circuit.

* * *

If a piece of stiff paper or blotting paper is pushed over terminal shanks or wires when these are soldered, this will protect the surrounding panel, etc., from "spray" and flux.

The M.W. EASY-CHANGE CRYSTAL SET

Absolute simplicity is the keynote of this set, which can be changed over from one programme to another by the touch of a switch.

Designed and Described by the "M.W." Research Department.

To design a better crystal set is somewhat of a problem. A few years ago it was a simple matter to achieve results with even the crudest of schemes because there was only one station which could be tuned in, and that was the local. To-day, however, in some districts there are at least three transmissions worth receiving on a crystal receiver. These are the local, 5 G B, and 5 X X on the long waves. Soon, when the regional scheme comes into being, it may be that another station will be added to this list. Hence a modern crystal set must be selective. It should incorporate some wave-changing device, and, above all, it must be simple, otherwise its appeal is very limited, since the listener who prefers a crystal set is the very one who requires absolute simplicity.

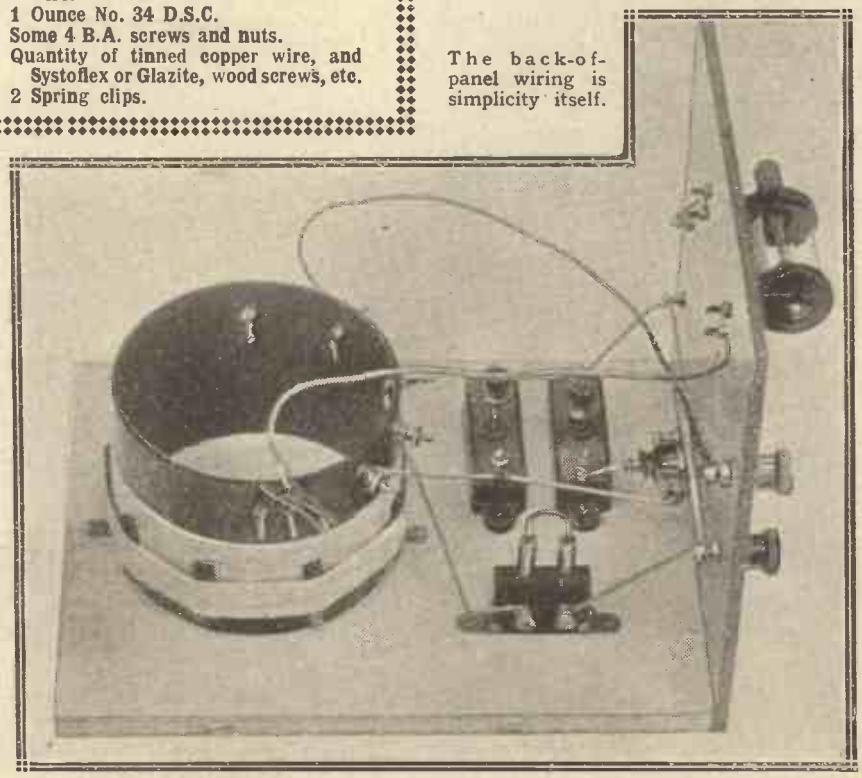
Obtaining Selectivity

Now, the problem of obtaining selectivity with any crystal circuit is in itself a difficult one, since the crystal detector exercises a damping effect upon the tuned circuit and in consequence lowers the selectivity. Secondly, the usual methods of obtaining selectivity involve a slight loss in volume because a crystal lacks the property of amplifying which is possessed by the valve, and therefore the drop in volume, due to the weaker coupling, cannot be made up.

Yet, notwithstanding these difficulties the "M.W." Research Department persisted in its efforts to design something in crystal sets which would be an improvement on what had appeared recently. The

COMPONENTS REQUIRED

- 1 Panel, 7 in. × 7 in. × $\frac{3}{16}$ or $\frac{1}{4}$ in. (Becol, "Kay-Ray," Resiston, Ripault, Trolite, etc.).
- 1 Cabinet to suit baseboard 9 in. deep (Pickett, Raymond, Camco, Bond, Artcraft, Caxton, etc.).
- 2 Semi-variable condensers (·000025 to ·0003 mfd.) (Formo).
- 1 Baseboard-mounting coil holder with short-circuiting bar (Lotus, Peto-Scott, etc.).
- 1 On-off switch.
- 1 Crystal detector (G.E.C., or other good make).
- 4 Terminals.
- 1 Coil former 4 in. diameter by 3 in. length (Pirtoid, Paxolin, etc.).
- Half a pound of No. 24 gauge D.S.C. wire.
- 1 Ounce No. 34 D.S.C.
- Some 4 B.A. screws and nuts.
- Quantity of tinned copper wire, and Systoflex or Glazite, wood screws, etc.
- 2 Spring clips.



The back-of-panel wiring is simplicity itself.

most difficult feature was the attainment of selectivity without the frequent accompanying loss of volume.

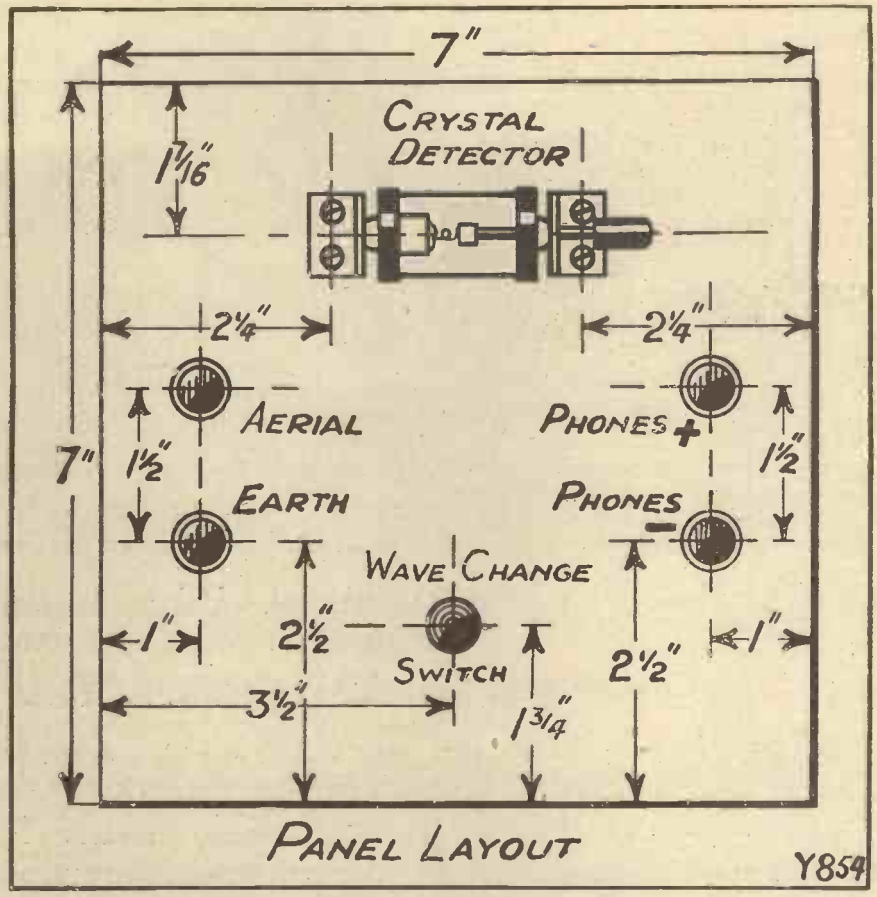
About a year ago, in the course of some experiments in the "M.W." Research Laboratory, a special crystal circuit was evolved with which it was possible to receive 5 G B at clear headphone strength on an extremely badly screened and generally inefficient aerial. So bad was this aerial for testing crystal sets that such a test had usually be conducted elsewhere. The reception of 5 G B in these circumstances was proof of the extreme efficiency of the circuit used.

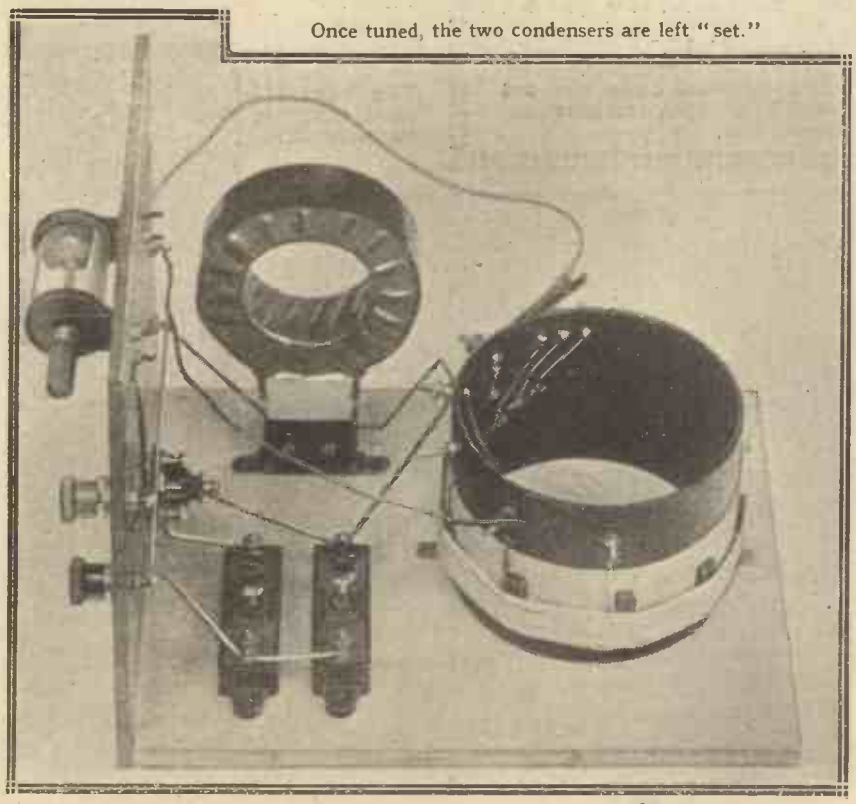
The "Inducto-Crys"

The original circuit was called the "Inducto-Crys." and the basis of the arrangement was in the interweaving of a coil of fine wire with the secondary coil. The crystal and telephones were connected across this interwoven coil, whilst the secondary coil was tuned with a variable condenser in the usual way. This tight inductive coupling, when suitably proportioned, was in effect equivalent to tapping the 'phones and crystal across a portion of the main tuned winding, and resulted in a receiver of high sensitivity and good selectivity; the selectivity being achieved without the loss of signal strength usually regarded as more or less inevitable in a sharply tuned crystal set.

It was therefore decided to employ this scheme as the basis of the "M.W." "Easy-Change" Crystal Set.

The original "Inducto-Crys" utilised a single tuned winding with tappings to which the aerial lead was fixed. In the case of the "Easy-Change" receiver it was decided to use a separate aerial coil, thus employing three windings in all. Hence we have a tapped primary winding, wound over a tuned secondary winding, with which is interwoven a number of turns of fine wire with tappings to which one side of the crystal detector is attached.





Once tuned, the two condensers are left "set."

The Tuning Scheme

This scheme has the advantage of permitting varying degrees of selectivity to be obtained, and it is possible to suit any given set of conditions. There is a loading coil socket into which a suitable size coil can be plugged when it is desired to receive 5 X X. It was realised that in the main only two stations would be listened to. These would be either the local and 5 G B, or 5 X X, or 5 G B and 5 X X only, since in some cases listeners might not be within the crystal range of a B.B.C. main station. It was therefore desirable to include some form of tuning device which would allow the receiver to be pre-set for the chosen transmission.

To do this two condensers of the semi-variable type were connected in circuit so that either one or both could be switched in across the tuned winding. In this way it is possible

The set is of good appearance, as shown above, whilst the lower photograph illustrates its easy-to-make qualities.

by means of the switch to go straight over from one station to the other without making any other adjustment to the set. As will be realised, this is extremely convenient in practice.

Now we can commence the actual building of the set.

The first item of importance is the construction of the coil itself, and this must be undertaken with care since the successful working of the receiver as a whole depends largely upon the coil winding. The coil is wound on a former 4 in. in diameter, and 3 in. in length.

Winding the Coil

First of all a hole is punched near the bottom of the former and a 4 B.A. screw and terminal fitted. Then the bared end of a length of No. 24 gauge D.S.C., together with the end of another length of No. 34 D.S.C., are twisted and secured beneath the terminal (L.C. in the diagram). Next commence to wind on the turns together so that you have the thin wire interwoven with the thick wire turns. At the 20th, 25th, and 30th turns along the thin wire winding take tappings, joining these taps to the 4 B.A. screws marked "tappings on L_3" in the diagram. This completes the fine wire winding, but you must now continue with the thick wire winding until you have wound on 50 turns in all. This is the secondary coil L_2, and the end is joined to the terminal "V.C." on the coil former.

The Primary Turns

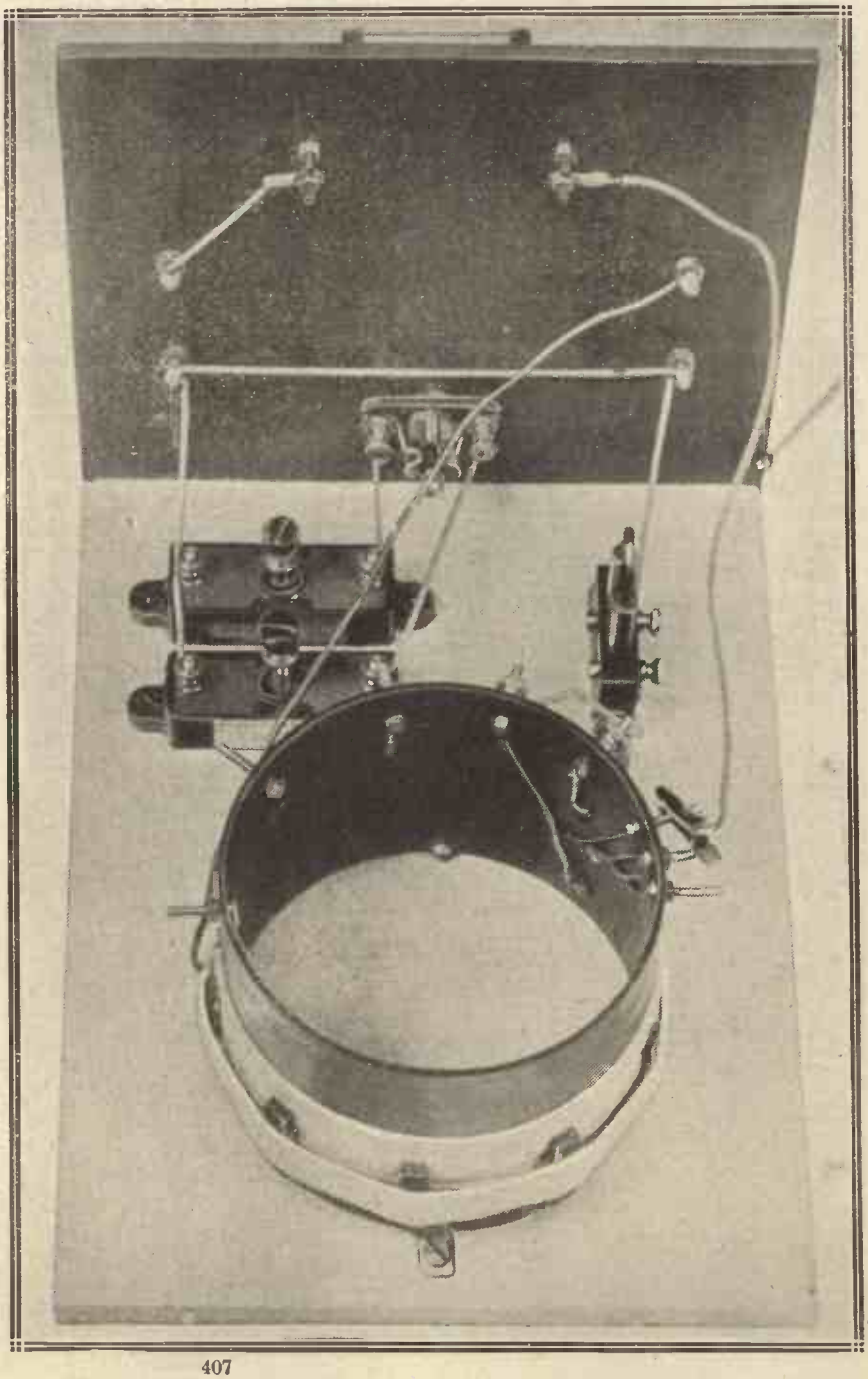
You are now ready to wind on the primary turns L_1. You will need nine flat strips of wood or ebonite about $\frac{1}{8}$ in. by $\frac{1}{4}$ in. to space the primary from the secondary. Commence the primary turns near the beginning of the secondary (see photographs) and join the start of the winding to L.C.

Wind on 10 turns and take a tapping, then wind on another 5 turns and take a second tap at the 15th turn. Then complete the primary by winding on another 5 turns, making 20 altogether. The end of the winding goes to the terminal on the former marked 20 ("tappings on L_1"). The general scheme can be seen from the wiring and theoretical diagrams. The primary winding can consist of No. 24 gauge D.S.C. wire.

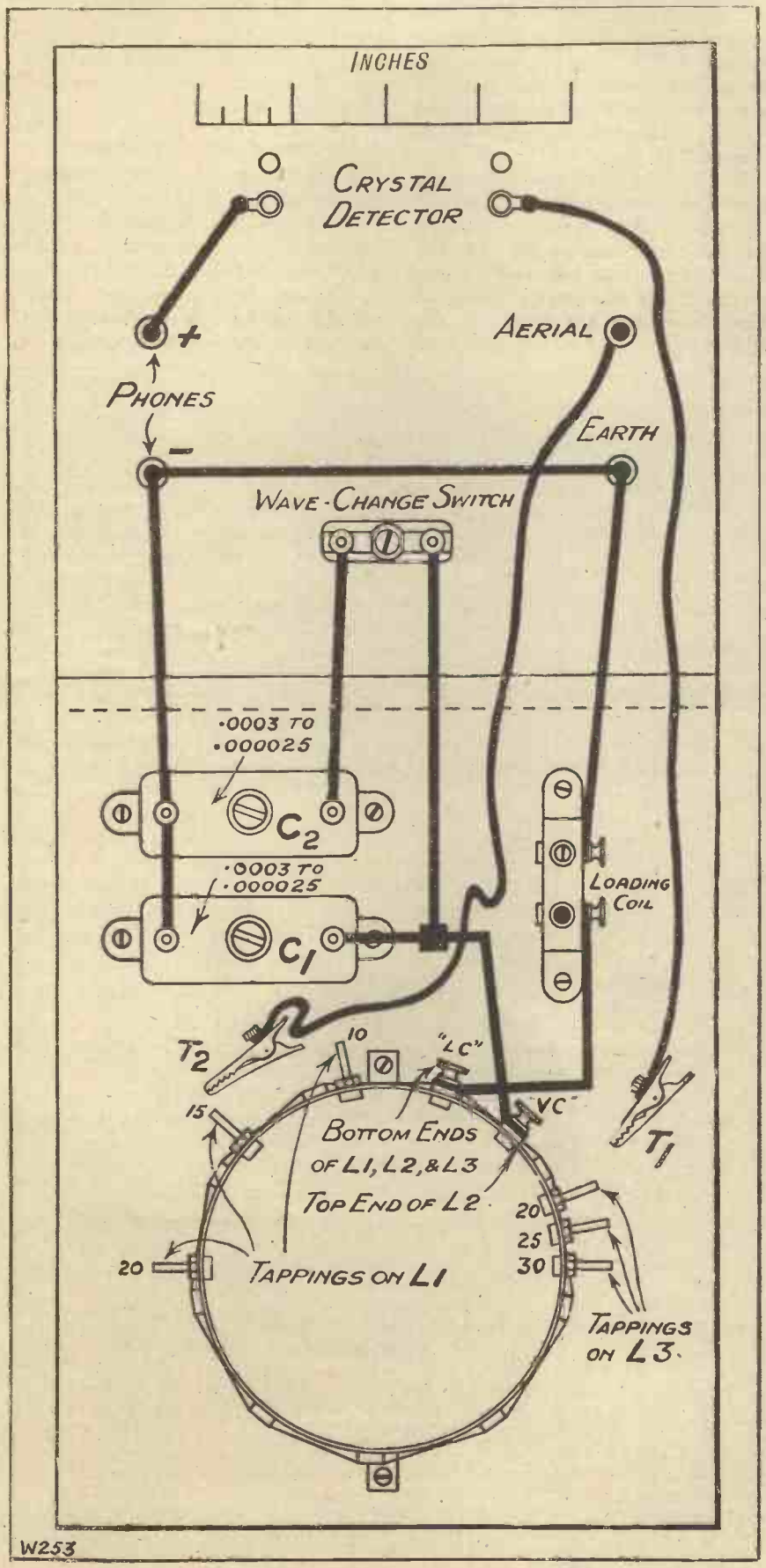
Having completed the coil you can now turn your attention to drilling the panel. Four holes are required for the terminals, one for the condenser switch, and either two or four for mounting the crystal detector. The dimensions are given on the drilling diagram, but the difference between centres for the crystal detector supports is likely to vary according to the make of detector chosen, and it is inadvisable to drill these holes until the particular detector purchased has been measured up. With many detectors a drilling template is supplied.

Mounting the Components

Three holes are also necessary along the bottom edge of the panel in order to secure it to the baseboard. These holes should be countersunk to take $\frac{1}{2}$-in. wood screws. Then the coil, loading-coil socket, and two semi-variable condensers can be screwed down to the baseboard. You will note



that the coil is secured in position with the aid of two small angle brackets, such as one can make for oneself by bending a small piece of tin or copper. Do not forget that there are two flexible rubber-covered leads.

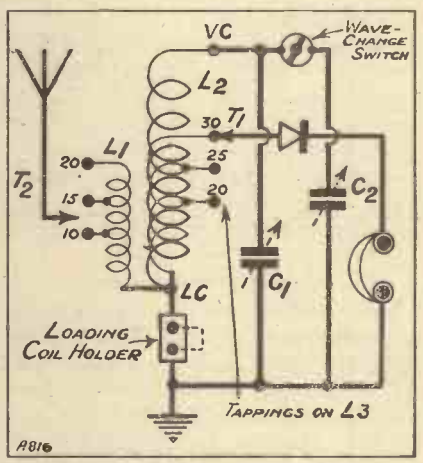


One is attached to the aerial terminal, whilst the other goes to one side of the crystal detector.

With the baseboard components in position, and the remaining parts secured to the panel, you will now be ready to wire up. The easiest method is to use 18-gauge tinned copper wire, and after it has been cut to the correct length to thread over it a piece of Systoflex tubing, leaving the ends of the leads free for soldering or otherwise attaching to the various terminals.

Operating the Set

Now for the operation of the set. First attach your aerial and earth leads to their respective terminals and also a pair of high-resistance telephones to the 'phone terminals. Now supposing you have a local station within range and that you wish to receive this with 5 G B as your



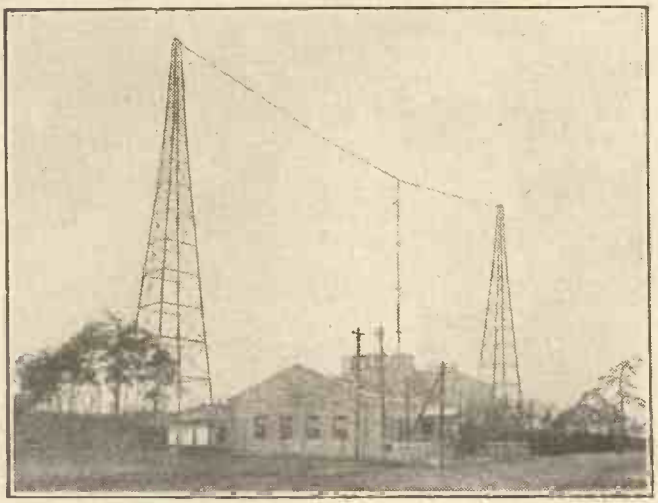
The diagram of connections showing how a separate tap is used for the crystal.

alternative programme. On the other hand, it may be that you desire to use 5 X X as your alternative, but, in any case, the procedure is the same.

Adjusting the Condensers

Push the wave-change switch in so that only one of the semi-variable condensers is in circuit. Now place the flexible lead from the aerial terminal on the No. 15 or 20 tapping on the coil L_1. Connect the flexible lead which terminates in a spring clip, the other end of which is joined to one side of the crystal, to a tapping on the fine wire winding. It does not matter much which tapping in the preliminary test. Now take a screwdriver or a length of wooden rod, with the end fashioned after the style of a screwdriver blade, and screw down the adjusting knob on the semi-variable condenser until you hear your local transmission. Of course,

(Continued on page 470.)



STATIONS THAT SHARE WAVE-LENGTHS

This interesting article deals with the distribution of one programme by different stations working on the same wave-length, as outlined recently in a paper by Capt. P. P. ECKERSLEY, M.I.E.E., and A. B. HOWE, M.Sc.

ON March 6th last the Institution of Electrical Engineers assembled in London to consider a subject which affects every listener in the land. The occasion was the reading of a paper by Captain P. P. Eckersley, M.I.E.E., and A. B. Howe, M.Sc. These eminent radio workers have collaborated in the investigation of some of radio's problems, particularly the problem of providing plenty of powerful programmes without interference.

The actual title of the paper was "The Operation of Several Broadcasting Stations on the Same Wave-length." In those terms it does not sound particularly interesting to the man-in-the-street. Nevertheless, although the subject is an involved one and was treated thoroughly and scientifically (as might have been expected from the authors of the paper), yet the results of the investigations seem to be so widely applicable and so opportune to the present state of broadcasting that many facts were elicited, and conclusions were arrived at which are of interest to everyone who is interested in the science of broadcasting.

Heaviside Layer Responsible

The following summary does not pretend in any way to be a complete one, but merely mentions some of the more interesting points raised by the authors and arising out of the experimental investigations into this fascinating subject. Right in the introduction we get an interesting statement. The authors lay the blame (scientifically, of course) for Europe's broadcasting troubles to-day upon the fact that waves sent out from a broadcasting station will not stick to Mother Earth and to the aerials erected thereupon, but go gallivanting off upwards and outwards through the clouds.

Those waves which are earth-bound are comparatively easy to account for and to legislate for. If all stations could send out only such waves interference problems would almost vanish, but the whole trouble lies with the indirect ray which, travelling upwards until it strikes the upper atmosphere, is there bent again earthwards, thus travelling enormous distances with little loss. Consequently these indirect rays, coming down to earth again anywhere up to a distance of two thousand miles or so away from where they started, and not being worn down by contact with the earth and all its barriers, arrive in a distant land with a punch like the local station!

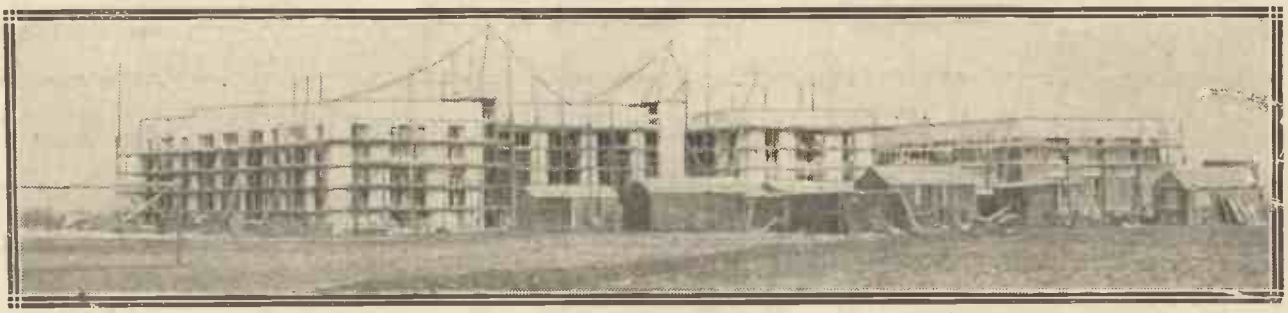
Curing the Trouble

There are several practical ways of getting over the difficulties attendant upon this interference, one of which is carefully to share the distribution of wave-lengths between the nations in the two hemispheres; another (an interesting one this) is to design the transmitting aerials of all the broadcasting stations so as to radiate as far as possible rays parallel to the earth's surface, and not upward at all; thirdly, to use a few higher-powered stations, instead of many low-powered transmitters; and, lastly, the method under discussion—to share one wave-length between several stations.

Much Research Carried Out

Geneva is already doing its best for the international aspect. Research into transmitting aerials is still going on, and most broadcasting authorities throughout the world are now substituting for their existing systems methods of broadcasting with fewer stations on higher power. (The B.B.C.'s regional scheme is largely based upon this principle). Finally, there is wave-length sharing,

LONDON'S NEW TWIN-WAVE REGIONAL STATION



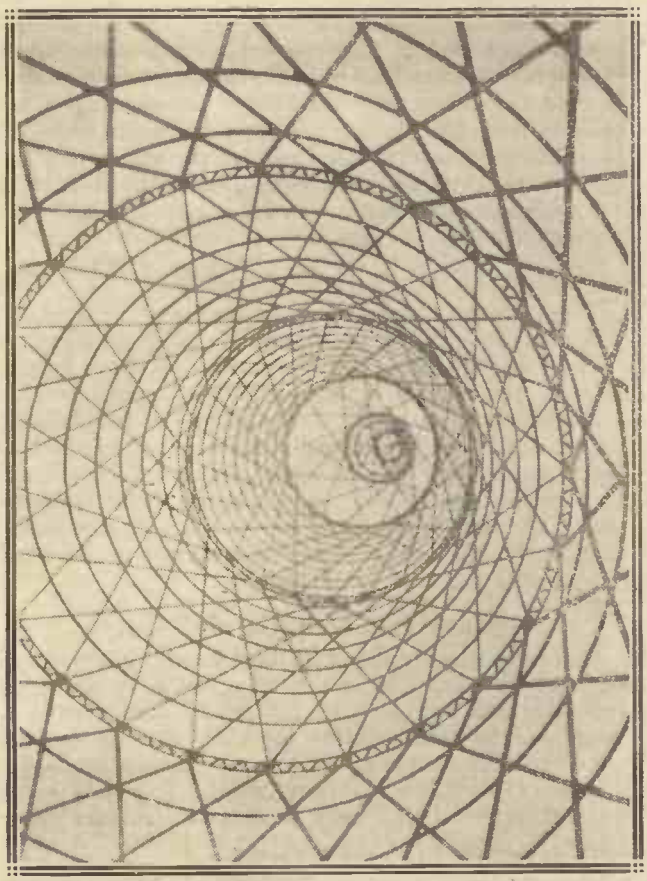
One solution to the interference problem is wave-length sharing by different stations. Another solution is simultaneously to send two different programmes from one high-power station. This photograph shows the first of the new twin-wave stations being erected at Brookman's Park, near London.

proposed in 1924 by Captain P. P. Eckersley as a further method of conserving useful wave-lengths.

Apparently Germany, America and Sweden have all done a certain amount of work upon the question of shared wave-lengths, but this country has taken a very decisive lead in the whole question, and nowhere else upon earth is there anything to compare with the wave-length sharing of 288·5 metres which arose out of the experiments detailed in the paper under consideration, and which has been in practice since January, 1929, at a number of British low-power broadcasting stations.

Peculiar Distortion Effects

The first section of the paper deals mainly with the theory of single wave-length working. It shows how in whole districts where the same wave is being received from different stations certain kinds and certain degrees of distortion are bound to occur. But although such distortion does arise and has experimentally been found to exist, such conditions occur in certain localities only, where signal strengths from interfering stations were approximately equal.



This curious view is taken from the base of the giant tapering aerial mast of the Komintern station, Moscow.

If you have a truly local station, five or more times as strong as any other station, reception under this scheme from that station is normal.

In that section of the paper dealing with the range of stations sharing wave-lengths we find that the Heaviside layer looms largely. The theory of the whole paper is so largely dependent upon the indirect ray which travels upwards and outwards until it is bent back to earth again that it treats the subject of the Heaviside layer as though it were so well known and as well authenticated as the Great Wall of China.

Estimating the range of stations is not an exact science, and therefore some somewhat wide assumptions have had to be made, and the confidence with which these assumptions were put forward seems to be well merited. For a comparison made between the theoretical value and the observed value of the indirect ray shows remarkable agreement, and the fact that the indirect ray appears to travel through space without much loss, i.e. it is independent of distance.

Two interesting points brought out in this section are the very long distances over which mutual interference can take place and the great reduction of service area consequent upon such interference, and also the fact that with a large separation of stations it is better to use long wave-lengths than short for single wave-length working. Where stations are close together, however, so that the indirect ray is no longer of much importance, short wave-lengths give a better service range.

One-Wave Relay Stations

A following section of the paper deals with the practical differences in synchronising stations which are to transmit the same programme. The authors state that the practical and theoretical investigation of single wave-length working appear to be so promising, while the interference situation is so serious, that the B.B.C. decided in 1927 to place nine of its eleven relay stations and one main station on the same wave-length, the synchronisation being carried out by Dr. Eccles' method of the valve-maintained tuning fork.

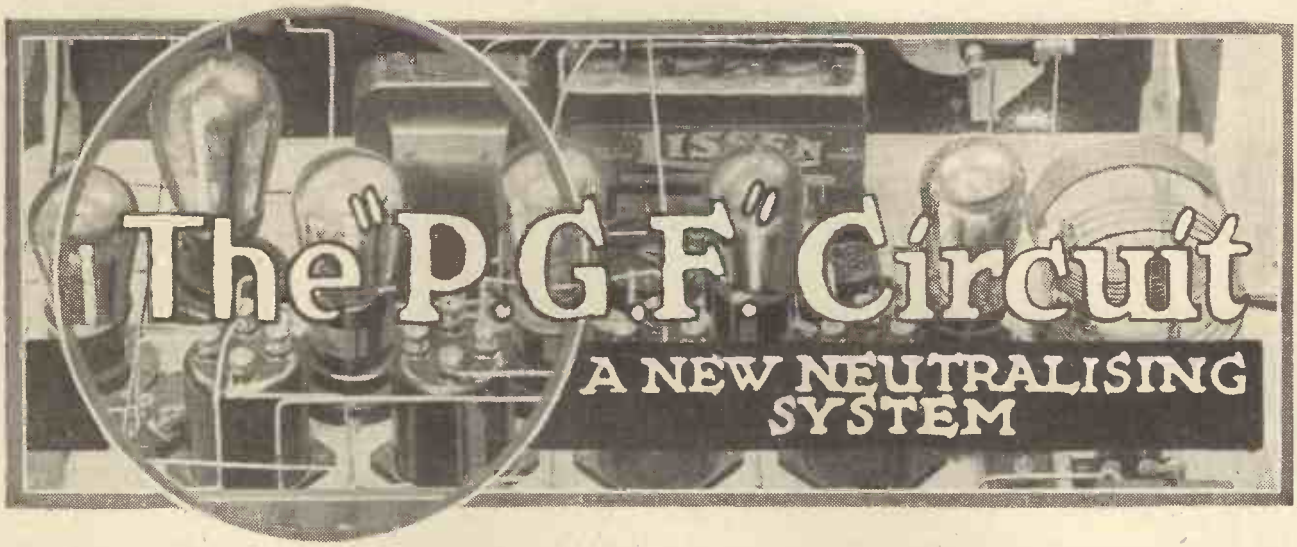
At the time that the paper was written only four sets of apparatus were actually working in Great Britain, viz., Edinburgh, Hull, Bradford and Bournemouth, but that it was the intention of the B.B.C. to equip ten stations with similar gear and to achieve thereby a measure of single wave-length working. There are two main points of interest in the practical application of this system, viz., the range of the stations and the degree of synchronisation that could be maintained under service conditions. In the case of Bradford this is particularly interesting.

This station, when sharing a wave with other European stations which were transmitting different programmes and were necessarily imperfectly synchronised, had a range for good reception from half to two-thirds of a kilometre. When sharing waves with stations doing the *same* programme, although they are much closer than the European stations mentioned above, the effective range was about ten kilometres. It will be seen that the number of extra listeners brought within range is simply enormous.

A Great Improvement

Thus the method appears to produce a very great improvement over the old conditions and it has the merit of making the relay station again a useful unit in the B.B.C. system of distribution. Synchronisation, always a bugbear, is shown up in a very interesting light by details of differences at Bournemouth and Edinburgh and Bradford. The divergence between two tuned forks, however, can have been reduced to an extraordinary degree, and, in fact, the paper claims: "One can guarantee the accuracy of the fork over sufficiently long periods to an accuracy of ten parts in one million, provided precautions are taken."

Even when regional stations are in full operation, single wave-length working may make for economy in use of wave-lengths and still continue service to isolated towns which are not sufficiently covered by regional stations.



The "P.G.F." Circuit

A NEW NEUTRALISING SYSTEM

Complete stability with a multiplicity of H.F. stages is the result of intensive research into the problem of H.F. amplification carried out by

C. P. ALLINSON, A.M.I.E.E., A.M.I.R.E., F. Inst. P. Inc.

IT is now over two years since I first started putting in extra time on research into the H.F. amplification problem. I was always keenly interested in the question of obtaining stability in H.F. amplifiers and tried all the various systems as they appeared from time to time. I continually came up against the same difficulty, however, that a system which was suitable for use with, say, two stages of high-frequency amplification when employed with three became difficult to handle, and with four became entirely unmanageable.

New Difficulties

With the advent of the split-primary and the split-secondary circuits I set to work with renewed hope on the problems of the H.F. amplifier. But now came new difficulties when attempting to apply these systems to H.F. amplifiers consisting

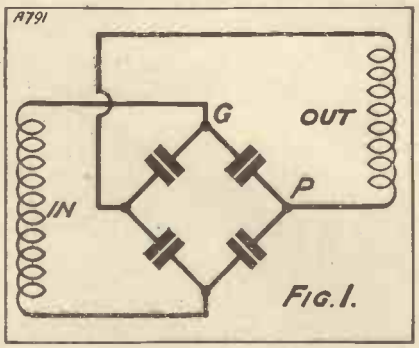


FIG. 1.

of three or four stages. It seemed to me, therefore, that there must be something fundamentally wrong with these circuits if they could not be used with multi-stages, since two stages is no real test of H.F. amplifying circuits.

The first H.F. valve is held down by the aerial damping, while the second one is held down by the detector damping, and it is only when you get to three or four stages that you can make a real test of the value of any particular circuit for high-frequency work.

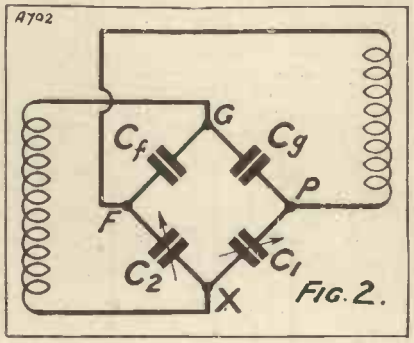


FIG. 2.

I therefore made a careful analysis of the stabilised circuits which were then in use, and made careful survey of the position, which showed that the neutralised circuits most in use, viz., split-primary and split-secondary, were not true but mixed "bridge" circuits.

The chief disadvantages of these circuits are as follow: The split-primary circuit, if very efficient, is difficult to handle with even two stages, while the split-secondary is unsuitable for use with a fully-tuned-anode circuit.

Trouble is also experienced with the split-secondary circuit from parasitic oscillation where a number of stages are used, though various schemes have been developed for avoiding this and have been used with more or less success.

Also, this circuit does not give a true bridge at all frequencies, and although it is good enough for all practical purposes where using, say, two, or at the outside three, stages only of H.F. amplification, where an attempt is made to use more than this number trouble usually results.

The Solution

I am assuming, of course, that with all the above circuits the usual precautions are taken to get the utmost efficiency, and that external damping is not introduced by any of the usual methods which are frequently resorted to in order to obtain stability in a multi-stage H.F. amplifier.

I therefore soon arrived at the point when I said: "The only

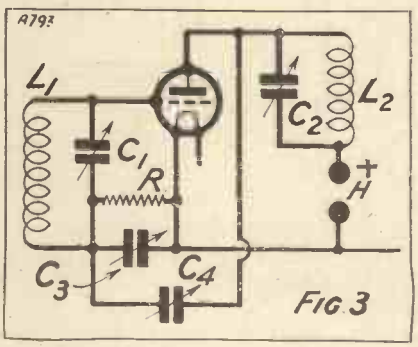


FIG 3

solution to the neutralising problem is to find a circuit which is a true bridge, and for this purpose it is necessary that all four arms of the bridge should contain capacities, or that all four

arms of the bridge should contain inductances."

We know, however, that one of the arms must contain a capacity, namely, the plate to grid capacity which we are desiring to balance out, and it therefore becomes clear that the other three arms of the bridge must contain capacities, and this therefore was the problem which I set myself to solve.

I therefore sat down with a fundamental Bridge Circuit before me. I drew the figure exactly as shown in Fig. 1, connecting the input and output circuit to opposite corners of the bridge.

The Basic "Bridge"

I looked at it with a perfectly open mind and did not assume anything except what I knew to be absolutely necessary. The two things I assumed were the connections to the input and output circuits, the fact that all arms of the bridge contained capacities, and that one of these capacities must be the grid to plate capacity.

Starting with this basis, it was clear that I must eventually evolve a circuit which would give the desired results, which, in fact, could not help but give the desired results, since it would have been evolved from one of the fundamental principles of electrical work. It would be of little interest to readers to describe the various circuits tried before arriving at the final one, and it will therefore suffice for me to say that I must have tried some dozen circuits, all based on one application or the other of the scheme shown in Fig. 1. Most of these circuits were more or less complicated, and very few of them gave anything like satisfactory results.

The final circuit was evolved as the result of two separate ideas, one of which I knew already, the other of which was new.

The first argument which I put to myself was this. So far it has been the practice to connect the input circuit between the grid and filament. Now, I have found in my own experimental work on high-frequency amplification that very excellent results are to be obtained with a free grid to the H.F. valve. We will therefore assume that the input circuit is connected between the grid and another point which we will call "X," which is not at filament or earth potential.

We have now settled on three of the corners of our bridge, and there remains yet the fourth unaccounted for. We know, however, that the inductance in the plate circuit is connected between anode and high-tension, i.e. to all intents and purposes for the purpose of the skeleton diagram between anode and filament. Let us therefore call the opposite corner to the corner marked "P," "filament," or "F."

The Final Arrangement

We now get the circuit which is shown in skeleton form in Fig. 2. We have thus determined all four corners of the bridge which are marked P.G.F., that is, plate, grid, and filament, and "X" for the last corner which we have decided need not be connected to low-tension.

We know that two of the capacities forming two of the arms, namely, the plate to grid and grid to filament capacities, are fixed, therefore the two other capacities which must be connected between the point "X" and filament, and the point marked "X" and plate must be variable so that the same ratio may be obtained between C_1 and C_2 as exists between C_g and C_f.

The circuit will then be such that it not only consists of a true capacity bridge, but will also do something that has never before been done, in that it will neutralise both inter-electrode capacities within the valve.

It will be clear, then, that there is no need to neutralise the plate to filament capacity, since this is in parallel with the output inductance, and it therefore has no effect on the stability of the system as a whole.

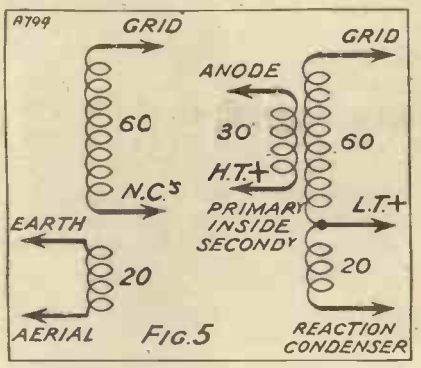


FIG. 5

On drawing this out in the form of a practical circuit we get the scheme shown in Fig. 3. This is identical with the arrangement shown in Fig. 2, with the exception that the resistance R has been connected between the bottom end of the input circuit and low-tension so as to avoid any choking of the grid occurring.

At the same time, although I have found it perfectly satisfactory to use a free grid, there are occasions when mains hum with a free grid results in a rather unpleasant noise being heard in the speaker, and I therefore concluded that it was best from all points of view to anchor the grid and prevent any choking resulting by the inclusion of the resistance as shown. Since, however, the value of this resistance can be of the order of 1 or 2 megohms, its effect on the balance of the bridge is entirely negligible, and I have even found in practice that as low as 50,000 ohms can be used for this resistance without any difficulty from instability resulting.

First Set Completely Stable

A receiver was immediately made up in which a stage of H.F. amplification using this scheme was employed, and it was tried using both fully tuned anode and also with loose coupling using an .F. transformer. In each case it was found that complete stability was to be obtained over the whole range, and that by getting the correct ratio between the two condensers C_3 and C_4 the usual zero point method of neutralisation could be employed.

In view of the fact that the two condensers C_3 and C_4 are merely to

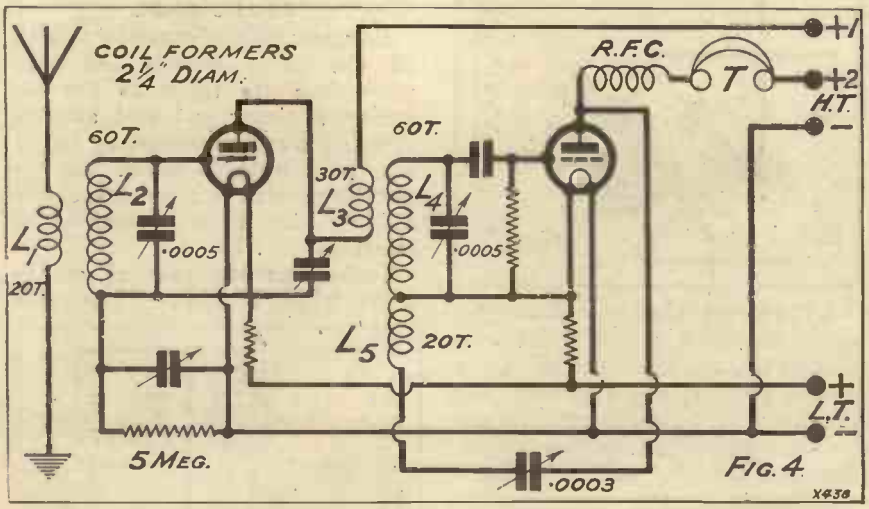


FIG. 4

give you a ratio, there is no need that they should have dimensions equivalent to those of the inter-electrode capacities of the valve, and, indeed, it is desirable that C_3 be fairly large so as to apply the biggest signal voltage between grid and filament.

"A receiver was made up in which a stage of H.F. using this scheme was employed . . . it was found that complete stability was to be obtained over the whole range . . . and the usual zero-point method of neutralisation could be employed."

I actually found that a most convenient type of condenser to use in this position was the balancing condenser made by Messrs. Peto-Scott Co., which consists of two sets of stator vanes and one set of rotating vanes moving between them in such a manner that as the capacity on the one side is decreased the capacity on the other side is increased. This gives a very simple method of obtaining the desired balance between the capacities C_3 and C_4 by the rotation of one spindle only.

It will readily be seen that the advantages of this system are numerous. In the first place, it is absolutely fundamentally sound in that a true capacity bridge is employed which gives complete balance at all frequencies.

The use of special inductances is entirely limited, the system preserves its balance no matter what inductances are employed and what wavebands are covered. The condensers used for obtaining the balance are not neutralised condensers in the ordinary sense of the word.

Parasitic Oscillation Impossible

The valve is made to balance itself and the only function that the two condensers serve is to provide the necessary ratio to complete the bridge, and when adjusted suitably the same ratio exists between them as does between the plate to grid and grid to filament capacities.

Since no tapped coils are used parasitic oscillations cannot develop, and no trouble whatever from this source has been experienced during the whole of the experimental work carried out with this circuit.

For the benefit of those who may wish to try this scheme out I show a circuit employing H.F. and detector valves in Fig. 4, and details of the coils are given in Fig. 5. The necessary values are marked, while for ordinary hook-up purposes the two condensers C_3 and C_4 may consist of two ordinary neutralising condensers, while those who have a balancing condenser of the type described by them will, of course, prefer to use this.

I have proved over many months practical experiments that my claims for this circuit are not exaggerated, and readers will realise this is so when I state that I have used and demonstrated a 4 H.F. amplifier working off a frame aerial with absolute stability.

It is no easy thing to be able to produce a set which, with four stages of high-frequency amplification, used in conjunction with a frame aerial, gives complete stability from 180 metres upwards. It must also be remembered that the coupling between anode and grid coils is made exceedingly tight, so as to enable the adjustment of each condenser to be made fairly broad, and so eliminate all critical adjustments, thereby reducing the skill required to handle the receiver.

Easily Balanced

No difficulty was experienced in balancing the set and stations were received from all over Europe at fullest loud speaking.

I have already described the fundamental circuit which was developed in order to provide a true bridge neutralising circuit which would remain constant at all frequencies and which showed two radical departures from the usual practice with regard to wireless reception.

In the first place, the reader should bear in mind that the input, instead of being connected between grid and filament, was connected between the grid and another point which was not necessarily filament potential.

Since, however, under the circumstances the grid of the H.F. valve was left entirely free, a point which might be of a disadvantage under certain circumstances, the inclusion of a resistance was shown in this practical circuit by means of which the fixed potential of the grid was determined so as to avoid any possible ill-effects from choking or induction from noisy mains, etc.

Main Points Summarised

For the benefit of those who do not wish to turn back to the foregoing pages I will now recapitulate the practical advantages of this scheme, and add such other advantages as have not been previously mentioned.

(1) The method employed for obtaining stability consists of a true capacity bridge which enables a perfect balance to be obtained, which balance holds at all frequencies.

No tapped inductances are employed, with their consequent variation of balance, or trouble involved in construction and connection afterwards.

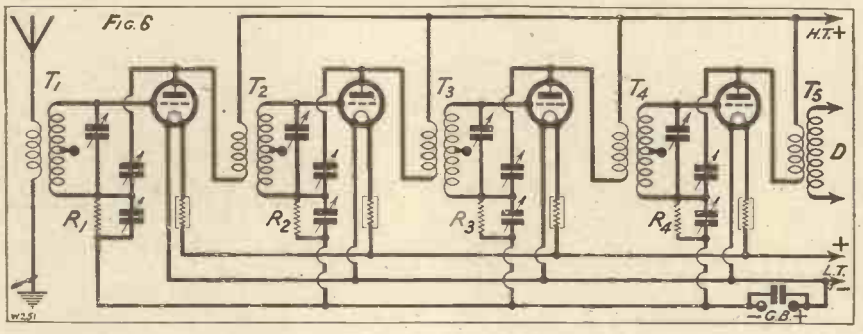
(2) Since no tapped inductances are used, either centre-tapped or otherwise, it is impossible for parasitic oscillations to develop, and complete freedom from this form of trouble is therefore assured.

(3) Once the correct balance has been found it remains set for the particular valve which is being used, no readjustment becoming necessary. The system, further, is perfectly suitable for use on the long waves and has so far been used successfully up to 3,000 metres.

(4) Since the obtaining of the balance is independent of whether the anode circuit is fully tuned or completely aperiodic, the coupling

Mr. C. P. Allinson (right) at work in his laboratory upon the earlier "P.G.F." circuits.

may be varied to any extent desired to give either an extremely tight coupling, and therefore broadness of tuning and superlative quality, or a very loose coupling and extreme selectivity.



(5) The degree of stability obtainable with the P.G.F. system is so high that the full voltage may be used on the H.F. valves, thus ensuring that the maximum of amplification be obtained from them.

Extremely Stable

(6) You can get an idea of the measure of stability obtainable with the method employed in view of the fact that I successfully used four stages of H.F. amplification in conjunction with a frame aerial, no damping resistances or positive bias being used. All inductances were wound to give a high degree of efficiency and nothing but the neutralising methods were employed to give stability. This set was stable from 180 metres upwards.

(7) No special valves are needed. I have successfully used power valves, H.F. valves, and high-mu valves in the set.

(8) Existing receivers of older type can easily be adapted to this principle with a minimum number of alterations. This is of special value where inductances are included in the set, since these do not have to be altered in any way.

After having carried out a number of experiments with a single stage of H.F. amplification, using the P.G.F. system, the next set to be built consisted of four stages of H.F. The circuit employed is shown in Fig. 6. The five H.F. transformers T_1, T_2, T_3, T_4 and T_5 are all identical as regards their primary and secondary windings. The only difference in one of them, T_5, is that a reaction winding was provided so that reaction could be obtained from the detector valve. Various forms of rectification were tried and all of them worked perfectly satisfactorily with this system.

The experimental secondary windings were provided with centre-taps to which the high resistances R_1, R_2, etc., were connected in the first place with a view to determining the most suitable position for them to be placed in the circuit.

In view of the number of stages employed it was, of course, absolutely necessary to screen the coils, and the usual screening box was therefore employed in the preliminary experiment.

The primary windings were placed within the secondary windings and consisted of about 40 to 50 turns, the secondary windings being of 65 turns on 2¼-in. formers. It will therefore be seen that extremely tight coupling was used in each case, and this was done purposely, as it gave the system a more severe test than the use of the normal number of turns used for coupling purposes.

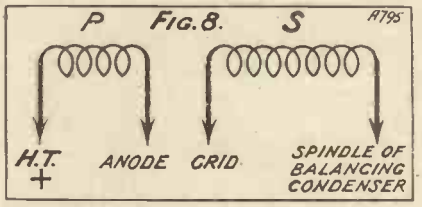
It will be seen that the four resistances providing the grid returns were brought to a common lead, so that a small amount of negative bias might be applied to the H.F. valves should it be so desired.

The first difficulty experienced was neutralising the set satisfactorily, in view of the fact that the valves were hopelessly overloaded when any attempt was made to neutralise on the local station. The various balancing condensers therefore had to be adjusted to what appeared to be the correct setting, and a distant station searched for and the final neutralising was then carried out on this transmission.

High Degree of Selectivity

The actual station employed was Radio Toulouse, this being a transmission which is very well received in the locality in which the laboratory is situated.

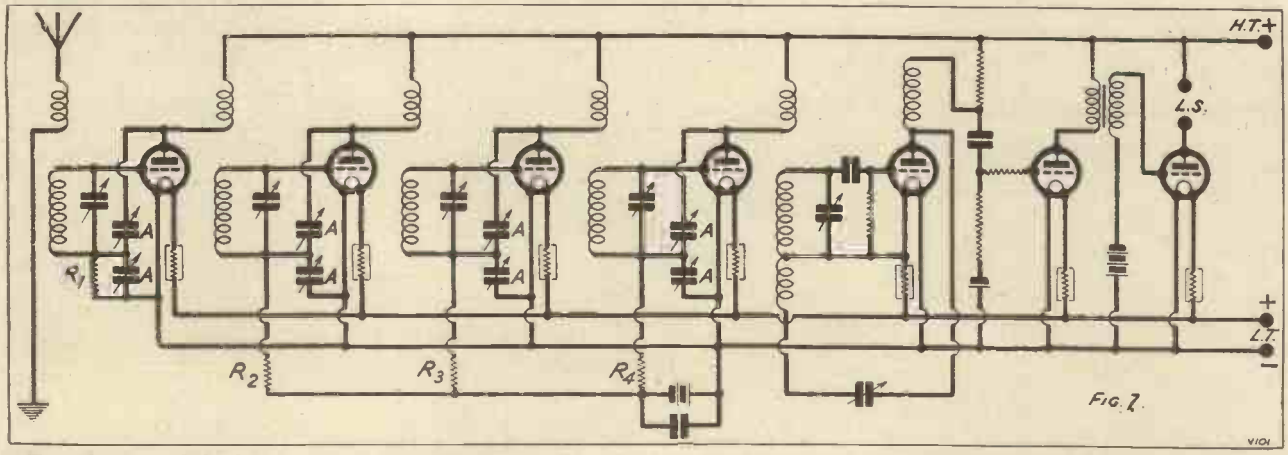
Notwithstanding that the set was located at about one mile from 2 L O, and that the coupling between the H.F. stages was exceedingly tight, no



difficul y owing to interference was found from the local transmission, 2 L O. Both Manchester and Cardiff could be received completely free from interference, and the set behaved in a most promising manner.

When, however, I attempted to receive the shorter-wave stations down below 300 metres, the set went into oscillation and it was instantly found very difficult to obtain a stable adjustment.

A careful test of the various components in the receiver showed



that the trouble lay in the coils, and that the position of the primaries was such as to give an unnecessarily high degree of capacity coupling between primary and secondary windings.

The coils were, therefore, re-designed, and instead of the primary being placed within the secondary the primary was placed alongside the secondary winding, and on placing these new coils in the receiver all trouble from instability vanished at once.

"The degree of stability obtainable with the P.G.F. system is so high that the full voltage may be used on the H.F. valves, thus assuring that the maximum of amplification is obtained from them."

Experiments were then carried out to determine which was the correct way of connecting the coils for maximum stability and amplification, and it was found quite definitely that there was only one set of connections which was correct, viz., as shown in Fig. 3, both windings being alongside each other, and in the same direction.

Having got the set working satisfactorily on an outside aerial, various types of valves were next tried in the H.F. stages. It was found that, owing to the very heavy load carried by the last stages, that a very decided advantage was obtained by the use of power valves in these positions instead of the usual H.F. valves.

It was rather curious that this should be the case, and that the difference in signal strength was so very marked, since one would imagine that, owing to the tight coupling giving a very high primary impedance to the H.F. transformers, a very high impedance valve would be necessary for maximum amplification.

Improved Signal Strength

This, however, was not found to be the case, and notwithstanding the coupling existing between the two windings and the H.F. transformers, a very marked improvement in signal strength was to be obtained, certainly in the last two stages, and frequently in the second, by the use of a power valve such as the D.E.5 or P.M.6, instead of the D.E.5b or the P.M.5X, whichever happened to be in use.

The first valve was still found best when having a high impedance, though a high-mu valve, though perfectly stable, was not found to give any appreciable increase in signal strength. If anything a slight reduction resulted, though an improvement in selectivity was noted.

Further modifications were, therefore, carried out in the circuit with a view to obtaining the utmost efficiency from the low-impedance valves, together with economy in plate current consumption, while certain small detailed modifications were made with a view to improving the performance of the receiver.

The final circuit is that shown in Fig. 7. This shows the circuit diagram of the set which is almost identical, to all intents and purposes, with that which I have used for many months for long-distance work.

The small balancing condensers shown at AA in the circuit actually consisted of components of the type previously described, in which the rotation of one spindle gives the desired balance between the capacities of each half. Since the use of power valves in the last three H.F. stages was found to give a marked improvement in the performance of the set, the three resistances used to stabilise the grid potentials of these valves were connected together so that the same value of grid bias might be used with all three valves, while the first valve, which worked best when having a high impedance, was connected direct to its resistance and to L.T. negative.

Smooth Reaction

Capacity reaction was used in conjunction with the detector valve, and this was found to function in the normal manner, notwithstanding the four stages of high-frequency which were used in front of the rectifier.

Two stages of low-frequency amplification followed, the first being resistance coupled and the second transformer coupled.

The values of the high resistances R had to be modified somewhat from those originally found suitable in the case of a single stage of H.F., since otherwise a certain amount of grid-leak howl was experienced when using power valves, especially on strong signals. The following values were found suitable:

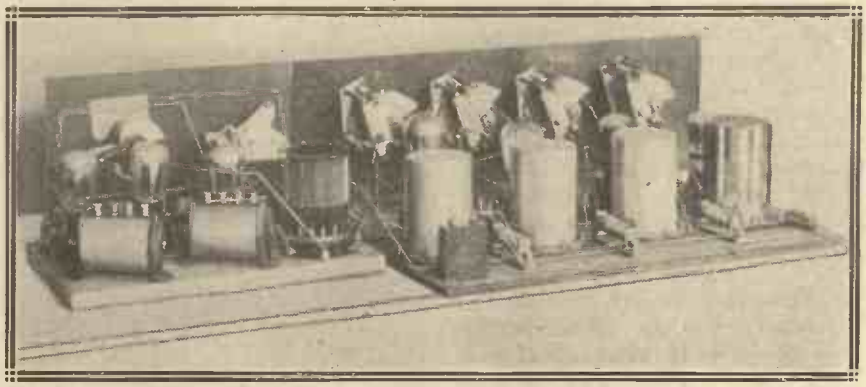
R_1	250,000 ohms.
R_2 .. .. .. } R_3 .. .. .. }	100,000 ,,
R_4	60,000 ,,

When using 120 volts on the plate of the H.F. valves a suitable value of grid bias was found to be in the neighbourhood of 4½ to 6 volts.

After having completed the receiver and carefully tested it out on an outside aerial and found everything satisfactory, the next attempt was to work the set on a frame.

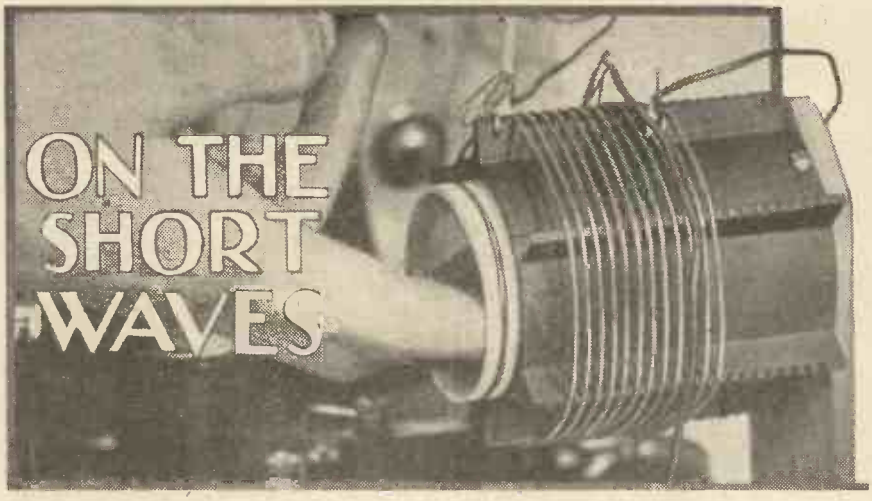
Efficient With Frame

To my great surprise I found that the efficiency of the receiver on the whole was very nearly as good on the frame as it was on the outside aerial, and in some respects its behaviour was far preferable in that it did not pick up so much interference, and that interference from atmospherics and similar sources was considerably reduced as compared with that obtained on the outside aerial.



A multi-stage H.F. receiver which was made completely stable by means of the system of neutralisation described in this article.

The next step to take was to construct a set in which all possibility of stray capacity coupling between the various H.F. stages and each other, or even the frame, was entirely eliminated, and I therefore decided to make it up from a number of screened units, each unit consisting of a complete stage of H.F. in a metal box. This resulted in a very marked improvement in performance, since the inductances were no longer damped by the pot-screens; capacity coupling between adjacent circuits was also eliminated, and the receiver was one of the most powerful and selective I have ever handled.



Notes of Interest on Short-Wave Receivers and Reception Conditions.

By W.L.S.

CONTRARY to my expectations, there have been no startling changes to report this month in the activities of the short-wave broadcast stations. The most notable feature of the month has been negative, i.e. the complete absence from time to time of the American stations. They are, however, improving again at the time of writing, and I have no doubt that they will be in good form once more by the time this is in print.

A telephony station at Monte Grande, Chile, is now working on about 15 metres, giving everyone with a short-waver a chance to log a broadcast station in every continent. To my knowledge there has never previously been a station of this kind in South America.

Peculiar Aerial Effects

February was an extraordinarily good month for the reception of Australians, chiefly referring to the amateurs, who were to be heard in good numbers every afternoon from the 2nd till the end of the month. 3 L O and 2 F C were always good when they were on, but their wave-length is not suitable for really good reception in the afternoon or early evening. I am convinced that if one of them were to start on 22 or 23 metres we should all wake up very suddenly to the possibilities of programmes from the Antipodes.

I have been experimenting lately with a fairly long indoor aerial, arranged in a loft above my own room, and parallel with the outdoor aerial, the only difference being in the slope. Very extraordinary results have been obtained from this at various times, and it seems to me that the question of the slope of an aerial must be far more important even for reception than the average listener ever realises.

For example, on one particular day the outside aerial brought in swarms of American amateurs at

VIA THE BEAM

A picture received from New York during recent tests of the latest Marconi facsimile receiving system in conjunction with the Beam.

11 p.m. one night, and a change over to the other revealed a complete absence of the "Yanks," with a few Brazilians and Chilians coming through quite strongly. Not one of these latter could be found at all with the outside aerial!

Before I say too much about it I am going to try another indoor aerial with yet another angle of inclination to the roof, and see what happens.

I have already tried putting the transmitter at the bottom of the garden in a box, so as to be able to run a vertical aerial up the side of the mast, and have been very successful with the first few tests. My next idea is a frame which is adjustable for elevation as well as direction, and then we may get something really solid to go upon.

Of course, as far as transmitters are concerned, much indisputable data has been compiled on the subject of the various angles of propagation obtained with different aerial systems. The same does not apparently hold good with a receiver at all.

Another "Howl" Cure

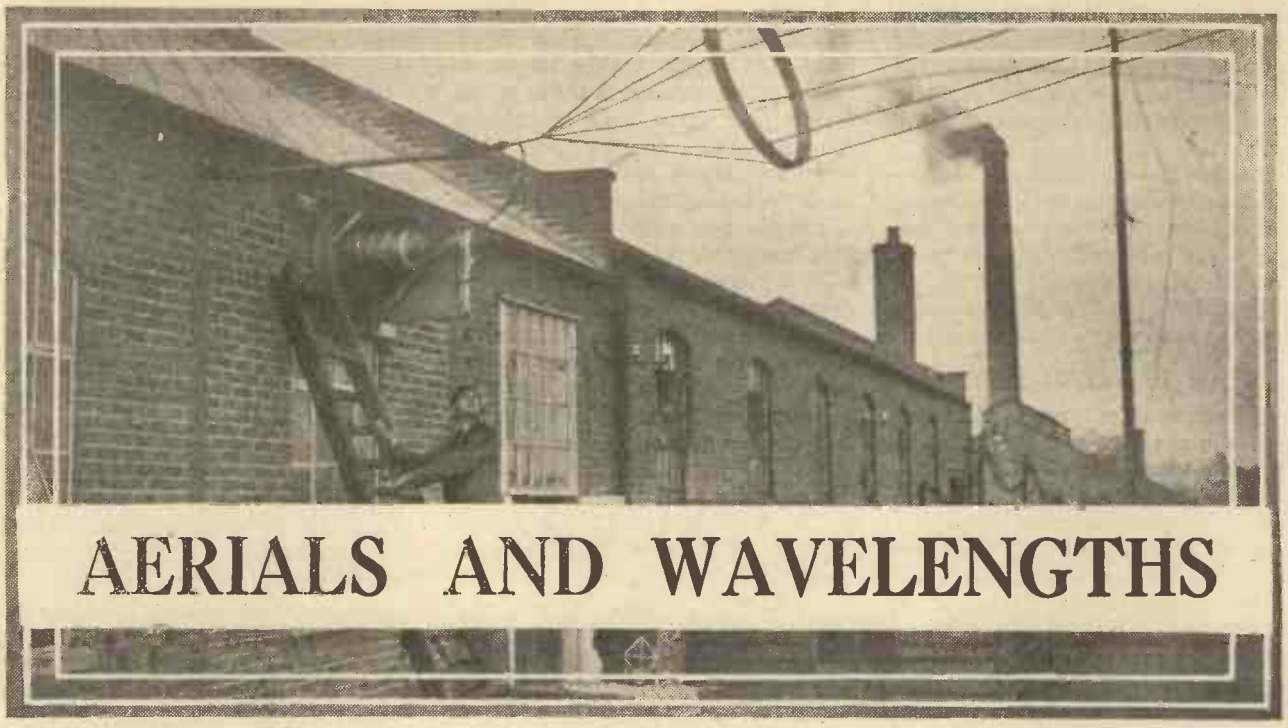
And now for the inevitable remark on threshold howl! I have found yet another "cure" for this delightful effect, consisting simply of a 2-mfd. fixed condenser across the *L.T.* terminals! In one case of howl from which a friend of mine was suffering this particular thing effected an immediate cure, while none of the other usual remedies had the least effect.

A correspondent asks me to name a really silent slow-motion dial. I am sorry, "R. G. S.," but you probably know that the editorial policy of MODERN WIRELESS does not allow me to discriminate between, or criticise, commercial products of this nature. I can tell you frankly, however, that not one of the dials I have used this year (and these include every make advertised in "M.W.") has given me the least trouble on the score of noisiness.

Dials want cleaning occasionally, you know. Also, I *have* before now put down noises to the dial which have really come from the condenser. The end bushes always pay for a clean and a tighten up if the condenser is becoming at all ancient. One word of warning, by the way.

A Bad Practice

To clean the dust from the plates of a condenser, *do not* blow a violent solo between them! This usually makes matters worse. Use a clean, dry brush of suitable size. A child's paint brush is usually just the thing. All these remarks refer to short waves only, since condensers that are dead silent in operation on the broadcast waves are capable of making the most appalling row anywhere below 60 metres.



AERIALS AND WAVELENGTHS

A practical article which should prove of particular interest to those troubled by inselectivity.

By G. V. DOWDING, Grad.I.E.E.

You can have an aerial that at no point in its horizontal length is nearer than 40 ft. from the ground that has an *effective* height of only a few inches. Such an aerial might run along a roof throughout the whole of its length.

By " effective height " is meant the average distance between the aerial wire and all earthed objects such as roofs, trees, and walls. An aerial near to such things will have a higher H.F. resistance than it should, and will not possess a good pick-up. (Not a gramophone pick-up! The term indicates the active nature of the aerial; its power to pick-up signals from the ether.)

In these days of powerful valve sets the aerial is being very badly neglected. This is a pity, because it is by no means the unimportant item that many modern radio enthusiasts may be led to think.

A Lucky Listener

There is a listener in north-east London who has a very high aerial. He has a tall mast at the end of his garden and another fairly tall mast on the roof of his house. The aerial wire suspended between the two is many tens of feet above all surrounding objects. The arrangement can be seen from a great distance, towering above all houses and trees.

This listener has a two-valve set he built himself in the very earliest days of broadcasting. It is an assembly of rocky variables and shaky coils which relies for its effectiveness on nothing more potent than 72 volts H.T. and four-year-old valves.

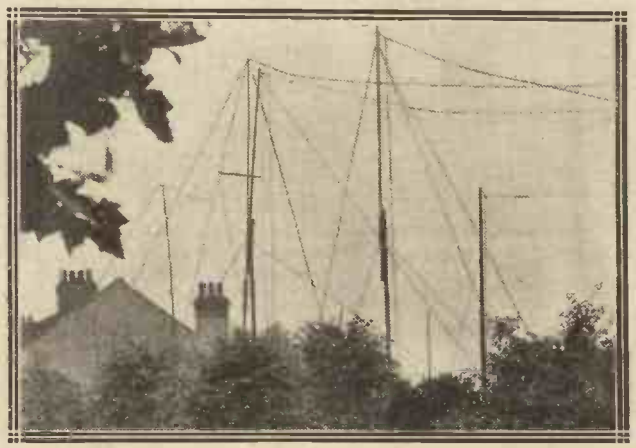
"Poor Local Conditions"

Yet on this prehistoric outfit this Londoner can tune in quite a large number of stations direct on a loud speaker—stations that four-valve owners boast about.

In the very next road is another wireless adherent who builds all the new sets and yet habitually complains of " poor local conditions." Of course, they are poor. His aerial is 30 ft. of wire buried beneath the roofs of houses and trees.

One of the reasons why ships can communicate over such long distances with relatively low powers is because their aerials are high and unscreened. The statement was once frequently made that every foot of aerial height gained is of enormous value. And so it is, but you may not notice much improvement in results if you only raise your aerial 12 in. at one end. If you can put it up 12 ft. throughout the whole of its length, then you may add as many more stations to your nightly collection.

There has been of late a tendency to advise the deliberate use of inefficient aerials in the interests of selectivity. Personally, I should say



Here are some nice high aerials, although their closeness probably leads to considerable mutual interference.

that this is rather an unhappy solution to the jamming problem. Far better it would be to add to the efficiency of the aerial and to do the same in regard to the selective qualities of the set.

Possibly listeners right in the so-called swamping areas of broadcasting stations may find that nothing will give their sets sufficient selectivity in such circumstances, but I am inclined to think that the swamping area has been exaggerated in size.

An Important Point

If a census were taken of the types of sets in use I am sure that it would be found that over 90 per cent are of definitely inselective natures. No doubt a goodly proportion do all that is asked of them in the way of station selection, but there must be a few tens of thousands which do not.

LOUD SPEAKERS AT THE ELECTION

Loud speakers are being used throughout the country by political agents in preparation for the coming election.

There is one important point that must be borne in mind, and that is that no set yet designed could pick out, free from interference, every one of the stations broadcasting in Europe or even in one country. There are literally dozens of stations that carry overlapping mush, heterodyning, and so on. And as for the Morse that penetrates 5 G B's programmes and a good many others, only the breaking down of the transmitters concerned could do away with that!

An aerial with a good "pick-up" might quite conceivably introduce less possibility of inselectivity than an inefficient aerial. That is a point that should not be forgotten. Don't, even if you are in the so-called "swamping area," go about an indiscriminate altering of your aerial as though it were merely a matter of taking off height and length.

You do not want to add to the H.F. resistance of the aerial as this will produce undesired damping effects, and you may find yourself with a reduction in sensitivity, accompanied by an increase in inselectivity. Also, it is not improving an inselective set to make the aerial incapable of picking up the jammed as well as the jamming stations. If this were the case, then a crystal set that could only bring in 5 X X could be said to have 100 per cent selectivity!

Actually, of course, selectivity as a desirable quality in a radio set is quite valueless unless it is accompanied by adequate sensitivity. The power to select is, in other words, only of use if there are things available from which to choose.

Extraordinary Results

No, if you want to try the desperate plan of reducing the "sensitivity" of your aerial, having tried wave-traps and other such devices, then reduce its length. I would even add, try the experiment of increasing its height simultaneously.

I have had personal experience of cases where extraordinary results have followed the shortening and raising of an aerial. I remember one where a 100-ft. wire, 30 ft. high, became a 40-ft. wire, 40 ft. high. It became a completely vertical aerial and some really fine D.X. results were achieved with it.

Directional Aerials

A vertical aerial is, of course, one of the most efficient of all forms of antenna, and as it has no directional qualities it is an excellent form for broadcast receiving purposes, although difficult to erect.

Another panacea for jamming frequently offered is a frame aerial, which you are told is so directional that you literally turn it away from interfering transmitters.

But a frame aerial really is an inefficient collector of energy, and you have to add two or three valves before you retrieve your lost sensitivity.

An outdoor aerial can be highly directional—a point you may have overlooked. Most outdoor aerials take the form of inverted "L's." That is, there is a horizontal or nearly horizontal wire or wires, which continue in a vertical wire, generally termed the "down lead."

Such an aerial receives best from the direction to which the down lead is pointing. Therefore, you can, within limits, add or take away the strength of the signals received from various stations by swinging the free end (the end farthest from the down lead) of the aerial round.

Indoor Aerials

Once upon a time double-wire aerials were very popular, and, indeed, there are still many of them to be seen. But for the reception of broadcasting stations a single wire not longer than about 70 ft. is now reckoned to be the better.

Quite a few people hold briefs for indoor aerials, but, in my opinion, the only merits of such are their inconspicuous natures.

If your set is of a fairly small type endeavour to erect your aerial out of doors, bearing in mind the dimensions mentioned previously. Some of the Continental stations come over so well these days that some indoor aerial enthusiasts may be misled into thinking that they are doing wonders when they might double their number of programmes available by stringing up their wire in the garden.

DRIVING the DIAPHRAGM

The author believes that there is no reason why the simple (and cheap) moving-iron type of unit should not be made to give "moving-coil" results and interestingly he gives his reasons.

By M. C. PICKARD.

THE trend of modern progress is all in the direction of better and better quality reproduction, and we are already in sight of that stage of development when reproduction will generally be indistinguishable from original. The advent of the coil-driven cone has done more than any other recent innovation to advance us upon that road, and it is the duty of all who have the future of broadcasting at heart to take off their hats to its inventors.

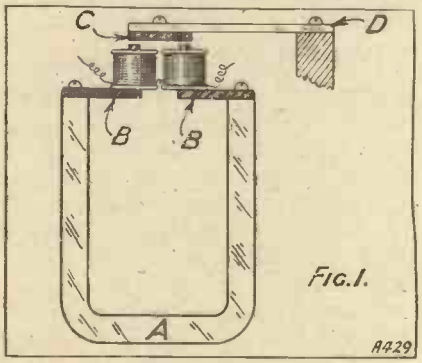


FIG. 1.

The moving-coil speaker has two serious defects, however, one practical and the other technical; the first the need for a comparatively large current to excite its field winding, and the second the circumstance that the moving coil itself must always have a considerable weight. This question of weight has not received the attention it deserves, and I hope to touch upon it later.

Coils and Magnet

As regards the sensitivity of the coil-driven cone, whilst this is admittedly equal to that of the majority of other types of cone speaker, there are considerable constructional difficulties to prevent its being augmented any further, whilst on the other hand there is nothing to prevent the efficiency of the moving iron type of drive from being greatly increased, theoretically. Also, contrary to general supposition, there is nothing, I believe, to prevent a moving iron type of drive from being designed to render at least as good quality reproduction as any coil-driven speaker, though this has not yet been accomplished.

The simplest type of what I have called the "moving iron" drive is illustrated diagrammatically in Fig. 1. Here A represents a permanent magnet fitted with soft iron pole shoes, BB, arranged so as to exert a continual pull upon a small iron armature C.

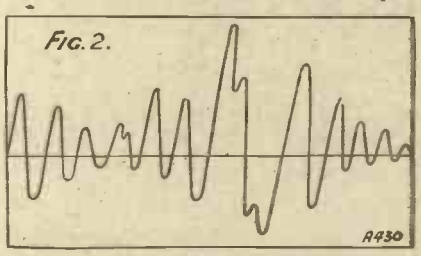
This armature is prevented from being drawn into contact with the faces of the pole shoes by a stiff spring, or "reed," D, which exerts a counter pull in the opposite direction to the pull of the magnet. The pole shoes, of course, are wound with coils of very fine wire, round which the output from the receiver is passed.

The effect of a signal is either to increase or decrease the pull of A, according to the direction in which it flows round the pole shoe windings. When the pull of the magnet is increased the armature C is drawn a little nearer to the poles; when the pull of the magnet is decreased it is allowed to retreat a little way, under the influence of the spring, D.


An excellent moving-coil speaker unit is the Magnavox handled by the Rothermel Corporation.

The Armature's Action

Thus, if an alternating current is passed round the windings a corresponding alternating motion will be imparted to the armature, and if the armature is connected to the apex of a cone diaphragm, this motion will cause the radiation of air waves, and will become audible as sound if its frequency falls within the limits to which the human ear will respond.



By far the great majority of cone speakers upon the market utilise a driving unit similar in all essentials to the one just described, and if certain precautions, to be enumerated shortly, are observed, quite satisfactory results are obtainable. This simple unit has one or two inherent faults, however, which must be set down together with their remedy.

It will be seen that the unit, considered from the electrical viewpoint, consists of an electrical circuit through the two pole-shoe windings,

connected in series, and a magnetic circuit, through magnet, pole shoes, and armature, the continuity of this circuit being broken at two points by the air gap.

When the unit is in operation, the armature, as it moves towards and

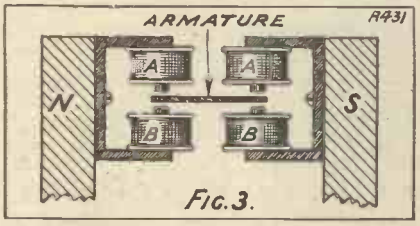
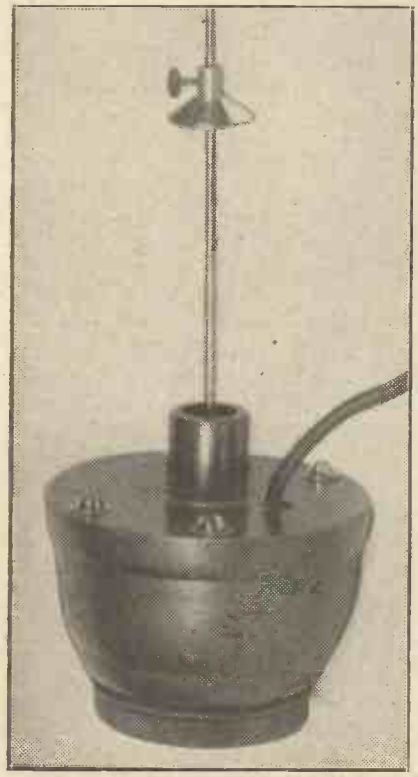


FIG. 3.

away from the pole faces, continuously varies the extent of the air gap, which as a direct consequence causes a continuous variation to occur in the magnetic resistance, or "reluctance," as it is called, of the iron circuit. This reacts again upon the pole-shoe windings and causes their effective impedance to vary in a similar way, so that the currents which flow round them will not conform accurately to the voltages being impressed upon the grid of the output valve. This leads to distortion.

"Balanced" Armatures

From the same cause arises a second fault, though not such a serious one. As the distance between armature and magnet poles increases, the pull on



A simple, satisfactory, and cheap cone drive is the Lissenola, which is shown above with its reed attached.

the armature due to the magnet falls off very rapidly; thus, under the impulse of a given strength of current, the armature will be displaced by a greater amount when the direction of the displacement is towards the poles than when it is away from them. This will result in an asymmetrical vibration of the armature, somewhat similar to that shown in Fig. 2.

Both these effects are negligible when the motion of the armature is small, and only becomes of consequence when the speaker is required to handle large volume. It then becomes necessary to employ some form of balanced unit.

The "balancing" is in the electrical sense, and refers to a special arrangement of the air gap. For this reason the term "balanced armature" which is sometimes applied to this type of unit is misleading. There are several types of balanced unit,

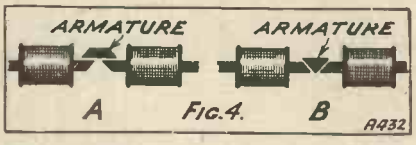


FIG. 4.

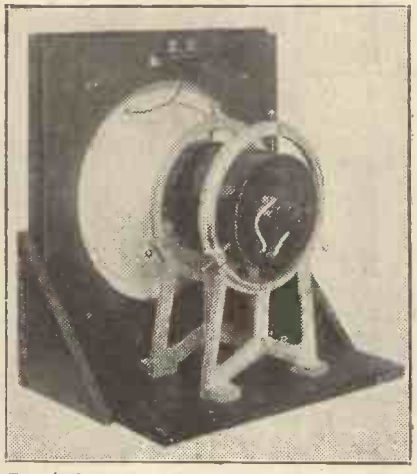
the simplest, if not the best, being that shown in Fig. 3.

Here each pole of the permanent magnet is fitted with a double-pole shoe, each limb of which carries a winding. These windings are arranged to work in opposition; thus when AA are aiding the flow of magnetism from the permanent magnet, BB are opposing it, and the armature will move away from BB towards AA. At the same time the total extent of the air gap does not vary, for as it decreases in one direction, it increases by a corresponding amount in the other.

Crisp Reproduction

Now in both the types of unit so far described the full force of magnetism from the polarising magnet flows through the armature, which must therefore be of certain minimum dimensions, to prevent magnetic saturation of the iron. This means that a definite limit is set to the extent to which the weight may be reduced.

I have already stated that it is desirable for the weight of the moving portion of a speaker to be kept as low as possible, and it now remains for me to explain the reason for this. Where weight is present mechanical inertia is also present. Most people are familiar with the effect of inertia in opposing any sudden change in motion, and as the movement of a loud speaker is continuously and rapidly changing its motion, the presence of inertia is obviously undesirable. The result is a general reduction in the crispness and bril-



The "Goodman" moving-coil unit incorporates a novel centring device which is very easily adjusted.

liancy of the reproduction and poor response to staccato impulses, such as the music of percussion instruments.

The Best Arrangement

In the case of the simple unbalanced unit there is no remedy but to reduce the weight of the armature, by careful design, to the minimum permissible. An iron of high permeability should be employed, and since the saturation point is determined by the cross-sectional area, this should be made adequate, whilst the length of the armature should be cut down to the smallest value practicable.

It will be seen from this that the design actually shown in Fig. 1 would not be the most satisfactory in use, as the armature is of considerable length and comparatively small cross-section. A more satisfactory arrangement is shown at A

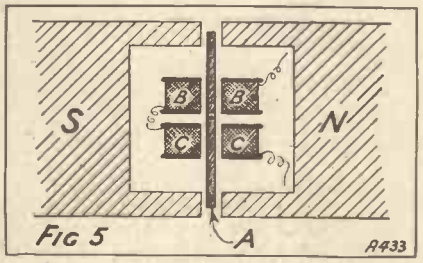


FIG 5

in Fig. 4, whilst what is probably the most satisfactory that could be designed is illustrated at B. Here, not only is weight reduced to a minimum, but flux leakage is also considerably reduced and, due to the shape of armature and poles, a given movement of the armature will not result in

(*Continued on page* 468.)

TWO ELECTRODE VALVES

The very first valve invented and used by Dr. J. A. Fleming, F.R.S., was of the two-electrode variety. That the type still has its uses and can provide material for useful and interesting experiments is proved by the following article.

By F. JACQUET.

OLD hands at the radio game will doubtless remember a few experiments in the home construction of two-electrode valves which used to be rather fashionable some years ago. An ordinary two- or four-volt electric bulb was wrapped round on its outside with one or two layers of tinfoil, and the resultant "valve" was placed in a suitable rectifying circuit, contact to the external tinfoil layers being taken in a manner similar to that illustrated in the photograph, Fig. 1.

A Simple Action

The result of these experiments was that this more or less impromptu device acted as a very crude type of two-electrode valve, faint reception being obtainable at short distances away from a main broadcasting station.

The *modus operandi* of the "valve" was simple—the aerial impulses being carried to the filament of the bulb, and being partially transmitted to the outer tinfoil layers (which latter constituted the "plate" of the rectifier)

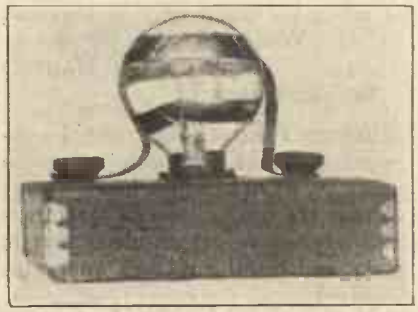


Fig. 1. An experimental home-made "valve" consisting of an electric bulb coated with tinfoil on its outer side.

in virtue of the one-way conducting nature of the electron stream emitted by the heated filament.

Now, although a "valve" of this nature is quite useless for anything but experimental purposes, there is quite a good deal to be said for the employment of a simple type of two-electrode valve when such an article is properly constructed. Two-electrode valves can now be obtained commercially at low prices, and a valve of this type is illustrated in the photograph, Fig. 2—a photograph, by the way, which in order to show its

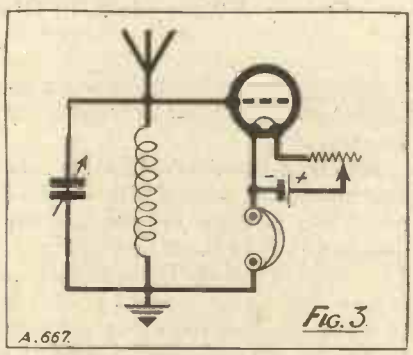


FIG. 3.

inner parts was made before the valve was exhausted, and provided with the usual base and legs.

As will be seen from the photograph, the valve consists of a filament, around which is placed a small metal cylinder. The electron stream from the filament impinges upon all sides of the cylinder, which latter, of course, constitutes the plate of the valve, and thus provides a conducting path for the impulses received from the aerial circuit of the set.

Two, Four, or Six Volts

Valves of this type may be of the two-, four-, or six-volt variety, but they are generally rated at two volts in order that they can be worked at a very low cost from one accumulator cell of 10 or 20 ampere-hours capacity. Thus, using a 20-ampere-hour accumulator cell, the filament of a 2-volt two-electrode valve will take one-tenth of an ampere, and the accumulator will last for 200 hours without recharging.

For working from alternating current mains, there is much to be said for the convenience of the indirectly-heated type of valve, worked from the secondary of a small cheap transformer. For simplicity and low working cost this type of two-electrode valve comes next to a crystal rectifier. It is, perhaps, merely the high price of the indirectly-heated type of valve which has proved a hindrance to its adoption for two-electrode working

Using Three-Electrode Valve

However, for experimental purposes, an ordinary three-electrode valve, no matter whether it be of the bright- or dull-emitter variety, can be brought into service for two-electrode working, and with very appreciable results. A valve of this type will give headphone reception of approximately crystal strength, such a valve,

Fig. 2. A two-electrode valve of low impedance manufactured by a North London valve company. The valve incorporates a two-volt filament.

of course, utilising merely filament current and no H.T.

You will probably remark here that, this being the case, you fail to see how the two-electrode valve in practical

use has any advantage over an ordinary crystal rectifier. Well, although the strength of reception in both cases is about equal, the two-electrode valve has at least one very great advantage.

It is absolutely constant and reliable—two properties which a crystal rectifier definitely does not possess. With the use of a simple two-electrode valve, it is merely a case of switching

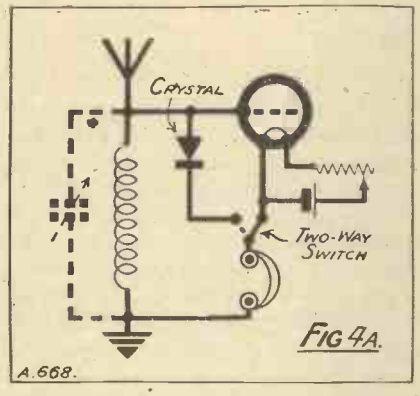


FIG 4A.

on the filament current and tuning in. There are no annoying contact-adjustments to be made and continually re-made!

Suitable Circuits

An ordinary three-electrode valve can be used as a two-electrode rectifier merely by joining with a small piece of wire the pins connected to the grid and to the plate of the valve, thus making the grid act as the plate of the two-electrode valve, and putting the former plate of the valve more or less out of action. Such a valve is then arranged in a circuit in the manner depicted in the diagram,

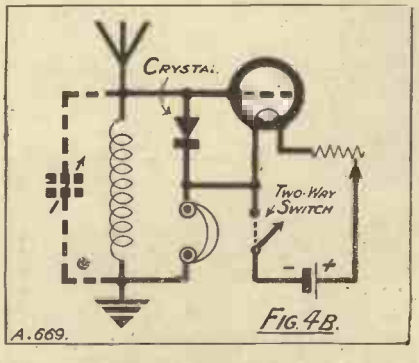


FIG. 4B.

Fig. 3, care being taken to ensure that the connection which is made from the headphones to the battery or accumulator is taken to the *negative* pole of the cell.

Good results may at once be obtained from the use of this simple type of rectifier, although it must be pointed out that the best results, with the loudest reception, come from the use of a two-electrode valve which has been specially constructed for the purpose, owing to the lower impedance of the latter article being more suitable for use with the average headphones.

Two-electrode valves can be employed in other convenient and interesting ways. The confirmed crystal enthusiast, for instance, can utilise one of these valves as a stand-by in the event of his beloved crystal failing him. A circuit for this purpose is shown at *A* in Fig. 4. Here it will be seen that the plate of the two-electrode valve is in contact with one side of the crystal contact, a two-way switch being provided for the purpose of utilising either the crystal or the valve.

Full-Wave Rectification

The use of such a circuit is highly convenient in many cases, but it should be borne in mind that the tuning of the circuit is not quite the same for the crystal as it is for the valve. The crystal throws a greater load on the aerial circuit of the set, and, therefore, when the receiver is switched over from "crystal" to "valve," or vice versa, a slight re-adjustment of tuning will generally be necessary.

Finally, a two-electrode valve may be employed *in parallel* with a crystal rectifying contact in the manner depicted at *B* in the diagram, Fig. 4. The object of this combined utilisation of two-electrode valve and crystal is to allow the high-frequency currents to flow in one direction through the crystal, and in the other direction through the valve. Thus under these conditions an attempt is made to employ both halves of the oscillating pulses of aerial current.

A switch is provided in this circuit in order to allow of the use of the crystal alone. Experimenters, therefore, to whom the use of a simple two-electrode type of valve makes an appeal will find much in this circuit to interest them, and they will be able to devise quite a number of modifications of it, as well as of the others which have been suggested.

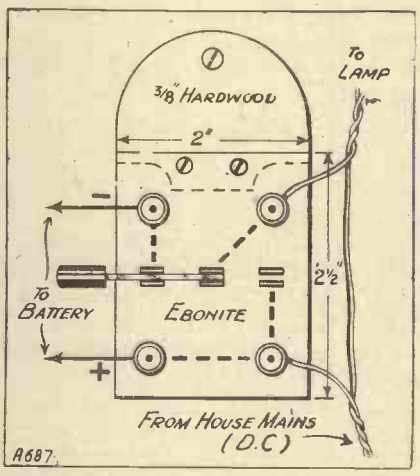
If the quality and volume of a multi-valve set falls off for no apparent reason, do not forget the possibility of one or more of the valves losing emission.

* * *

To test whether a valve has lost its emission, connect grid to L.T.—, and by means of a milliammeter in the plate lead ascertain if the plate current for any given plate voltage is in accordance with the figures given on the valve-maker's curve for zero grid volts.

A SIMPLE CHARGER

SIR,—In a recent issue of MODERN WIRELESS you describe a simple charger to work off the house mains. I enclose a rough sketch of a simple arrangement that anyone who has D.C. can use to charge an accumulator free of all cost (so long as the lamp to which it is attached is lighted), and can easily be made. All that is is required is a small piece of ebonite about 2½ in. by 2 in., four terminals, and a switch. The small piece of hardwood at the top may or may not be required, this depends upon how the arrangement is mounted. In use one strand of the flex to the lamp is cut and the ends connected to the right-hand terminals, while leads to the battery to be charged are taken from the left-hand terminals. The polarity of these terminals must, of course, be found in the usual way, and they can



then be marked. Wiring is shown in dotted lines, and by this arrangement the handle of the switch points towards the battery when it is on charge and away from it when shorted out or when the lamp only is required.

Yours truly,

H. J. SEATON WADE.

Tavistock, Devon.

EDITOR'S NOTE.—It must be remembered that *great care* is always necessary when handling house wiring, so that the novice in such matters is well advised to get an electrician to make and instal any such apparatus required.

The switch, as drawn by our correspondent, has no protective covering. Accidental touching of the contacts might give a nasty shock, though if fitted by an electrician it would be covered in.

The "M.W." LONG-DISTANCE TWO

This remarkable little two-valver utilises a well-tried and sensitive circuit arrangement. It is simple and straightforward and will bring in a large number of British and Continental transmissions at excellent telephone strength. An amplifying unit can be added when it is desired to operate a loud-speaker.

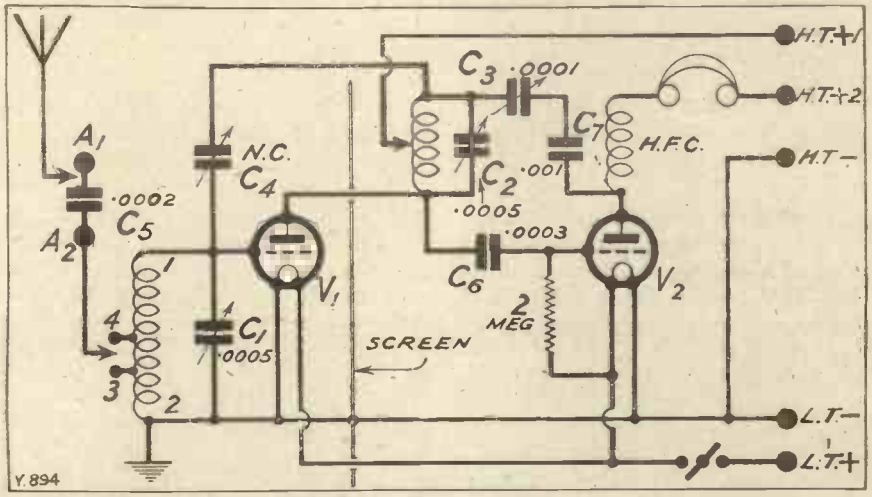
Designed by the "M.W." Research and Construction Dept.

THIS two-valve set has been designed to fulfil the requirements of the beginner in the art of long-distance reception. In their enthusiasm many listeners endeavour to run before they can walk. That is to say, they frequently attempt highly-sensitive, ultra-modern designs when they have had practically no experience either in set construction or in the operation of multi-valve receivers.

Practice in Tuning

It is because of this that so many such listeners are unable to obtain the results which these sets are capable of giving. This is only to be expected, since wireless reception, when carried beyond the stage of listening to the local station, requires a certain amount of skill. Now this skill can only be the result of practice in tuning-in, and it would be unfair to suggest to the novice that he should build some design which requires a number of different adjustments in order to obtain the maximum results.

It has been suggested that a single-valve receiver with reaction is a good set for a beginner with which to tune-in distant stations. Much can be done with a good single-valve set, but obviously the margin of safety from the point of view of signal strength is very small. A one-valve set depends almost entirely upon the use of reaction, and in tuning-in distant stations it is necessary to use reaction practically up to the oscillation point. As a consequence, the listener with little experience may cause a great deal of interference with his neighbours during the first weeks of ownership.



It is the policy of this journal to produce designs to suit every type of reader. The listener of several years' standing usually requires something ultra-selective, highly sensitive, and

COMPONENTS REQUIRED

1 Panel, 14 in. × 7 in. × ¼ or ⅜ in. (Becol, "Ray-Kay," Ripault, Trolite, Resiston, Ebonart, etc.).
1 Cabinet to suit with baseboard 9 in. deep (Raymond, Pickett, Bond, Camco, Lock, Gilbert, Caxton, etc.).
2 ·0005 mfd. variable condensers with slow-motion dials (Lissen, Burton, Igranic, J.B., Dubilier, Cyldon, Colvern, Ormond, Raymond, Utility, Pye, Marconiphone, Gecophone, etc.).
1 ·0001 or ·00005 miniature type variable condenser (a ·00005 is slightly preferable) (Raymond, J.B., Burton, Igranic, Ormond, Cyldon, Lissen, Dubilier, Peto-Scott, etc.).
1 On-off switch (Benjamin, Lotus, Lissen, Bulgin, Igranic, Wearite, Pioneer, Burne-Jones, etc.).
1 H.F. choke (R.I.-Varley, Igranic, Dubilier, Lissen, Climax, Cosmos, Colvern, Wearite, Burne-Jones, Bowyer-Lowe, etc.).
2 Valve holders (Lotus, Igranic, Lissen, W.B., Benjamin, B.T.H., Marconiphone, Bowyer-Lowe, Wearite, Burne-Jones, Ashley, etc.).
1 ·0003 mfd. fixed condenser (Burne-Jones, Lissen, T.C.C., Dubilier, Clarke, Igranic, Goltone, Mullard, etc.).
1 ·2-meg grid leak and holder (Dubilier, Igranic, Mullard, Lissen, etc.).
1 ·001 mfd. fixed condenser (Goltone, Mullard, T.C.C., Igranic, Lissen, Dubilier, Clarke, Burne-Jones, etc.).
1 Coil holder for baseboard mounting (Lotus, or similar type).
1 Metal screen, 7 in. × 6 in. (Magnum, Paroussi, Ready Radio, Wearite, etc.).
1 Six-pin coil base (Colvern, Burne-Jones, Bowyer-Lowe, Lewcos, etc.).
1 Neutralising condenser (J.B., Burton, Igranic, Bowyer-Lowe, Burne-Jones, etc.).
1 ·0001 mfd. fixed condenser (T.C.C. or other good make, see above).
1 Terminal strip, 12 in. × 2 in., and 10 terminals (Belling & Lee, Igranic, Burton, Eelex, etc.),
Quantity of tinned copper wire, Systoflex, wood screws, etc.

above all, capable of giving super-reproduction. More often than not he does not mind if it does cost him a lot of money to achieve his end. The newcomer, on the other hand, comes within a different class. He must have an efficient set, one that is selective and sensitive, but it must be very simple both to construct and to operate. Moreover, it should not be expensive.

In designing the "Long-Distance" Two, the "M.W." Research and Construction Department had these points in mind. The circuit actually used is a well-tried arrangement which has been employed literally dozens of times in modern sets of various types. Its selectivity is adequate for all normal purposes, it is trouble-free, and is extremely simple to handle. It was thought better to produce a two-valve set so that the listener could gain his initial experience in long-range work with telephones, afterwards adding an amplifier to bring the volume up to a strength suitable for operating a loud speaker. A one- or two-valve low-frequency amplifier can be added to the existing set without difficulty at any time.

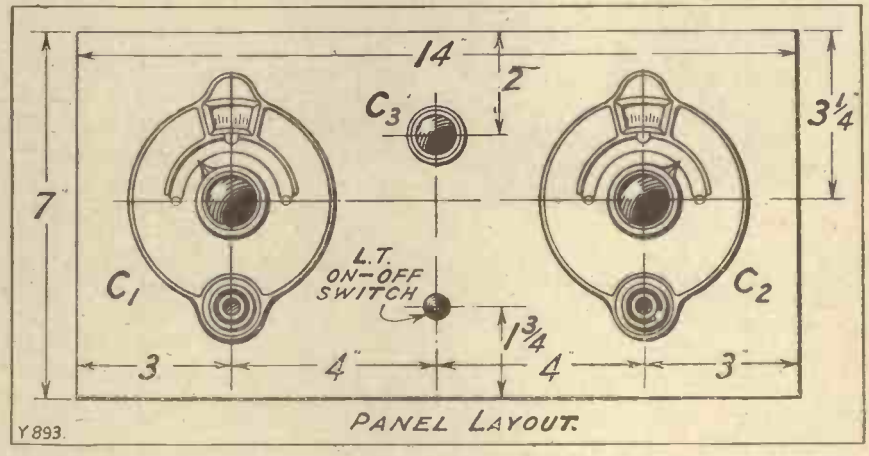
The Circuit Arrangement

Briefly, the circuit arrangement is that of a centre-tapped tuned-anode, the H.F. valve being neutralised. The object f the H.F. valve is to amplify the very weak long-distance signals before they are rectified, and such a valve adds greatly to the sensitivity of the set. Since the H.F. valve is neutralised, reaction can be used to boost up the long-distance signals with very little risk of interference being caused to one's neighbours.

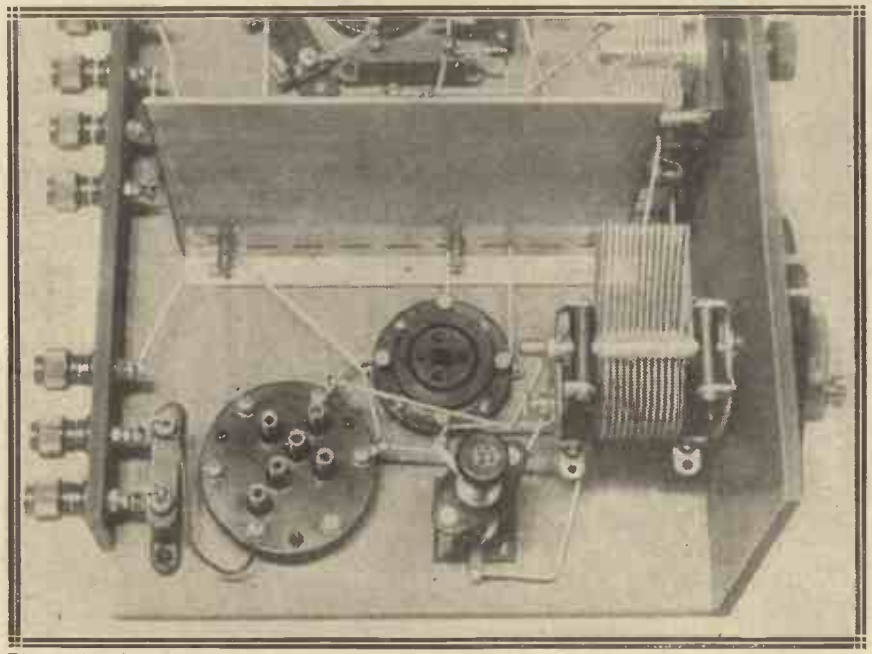
By changing two coils the set can be used on the long waves in order to receive such stations as 5 X X, Hilversum, Radio-Paris, etc. It is interesting to note that on test it was found that the neutralising adjustment for the ordinary medium waveband also held good for the long waves, a feature which although very desirable is not always attainable.

As will be seen from the photographs the actual construction of the set is quite straightforward. The first procedure in the actual building the receiver is to mark out and drill the panel. All the necessary dimensions are given on the drilling diagram, and these should be marked off on the back of the panel with the aid of a steel scriber or a sharp nail, and a rule. Then the drilling centres should be centre-punched, and the panel is ready for drilling.

If single-hole-fixing components are used, as is usually the case, only four holes will be required for the two tuning condensers, the reaction condenser and the on-off switch. The slow-motion dial may require special treatment, but if this is necessary the required instructions will be given by the makers in a pamphlet which accompanies the dial. In any case, the manufacturer always makes the finished article as simple as possible because he realises that all home constructors are not necessarily mechanics. You will also need four or five holes along the bottom edge of the panel to secure the panel to the baseboard.



PANEL LAYOUT.


The aerial side of the set is separated from the H.F. portion by a metal screen across the baseboard. This results in complete stability at all dial settings, when the receiver is properly neutralised.

The Baseboard Layout

Having completed the drilling, mount the various components on the panel and screw it firmly to the baseboard. Then commence to place the baseboard components in position, following carefully the layout given in the wiring diagram. The metal screen is placed roughly seven inches from the right-hand end of the baseboard looking at the back of panel. The coil holder for the centre-tapped anode coil should not be nearer than two inches from the metal screen, otherwise serious losses may occur. In the same way the six-pin coil base should be kept well away from the screen and near the right-hand edge of the baseboard, although sufficient space must be left between the coil base and the edge of the baseboard in order to clear the fillet in the cabinet.

Then you will be ready to commence the wiring. Connect up those terminals which are nearest the panel and work towards the terminal strip

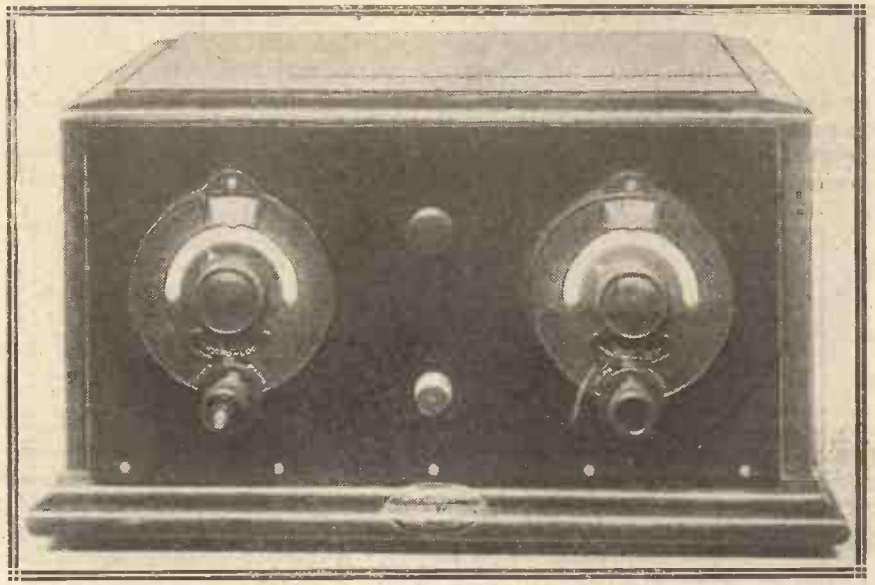
at the back. This is usually the easiest way. Note that there are five leads which actually make electrical contact to the metal screen, and there is also one lead which passes through a slot in the screen and must be insulated from it. There are also two flexible leads. One goes from the top of the ·0001 aerial condenser to the six-pin coil base, whilst the other goes from H.T.+1 terminal to the centre-tap on the anode coil.

Coils to Use

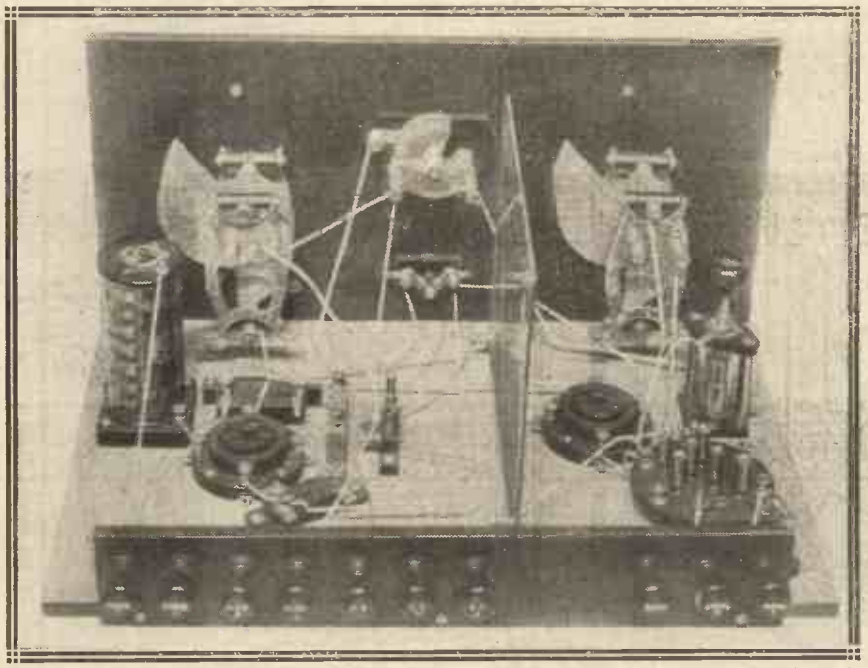
If you purchase a neutralising condenser of the Jackson Bros. type, that is, with a screw-down adjustment, it is convenient to cut a slot across the adjusting knob in order to obtain what may be termed a "remote control." If a length of wooden rod is taken and one end is fashioned somewhat after the style of a screwdriver blade, the rod can be placed in the cut and the neutralising adjustment made from some distance above the component. Thus any hand-capacity effects will be greatly reduced, and in consequence the neutralising adjustment simplified. Some neutralising condensers have long adjusting handles, and, of course, in these cases no modification is necessary.

Now for a few hints on the operation of the receiver. First of all you will require four coils, namely, two of the six-pin type and two of the centre-tapped plug-in type. The six-pin coils are standard split-primary aerial coils and you will need two. One is for the medium broadcast wave-band, and should be marked "250 to 550 metres," while the other is for the reception of 5 X X and the long-wave stations, and should be marked "1,000 to 2,000 metres." The plug-in coil should be a No. 60 for the medium broadcast wave-length range and a No. 200 for the long waves. Do not forget to purchase "centre-tapped coils." Those of the "X" type are not suitable for this set.

Next you will need two valves. These can be both of the same type, namely, both of the "H.F." class. The set will function equally well with two-, four- or six-volt valves, so that if when ordering you specify two valves of the "H.F." variety you cannot go wrong if you choose those of the leading makes. Connect up the low-tension battery to the two L.T. terminals, and the high-tension battery to the H.T. terminals. For H.T.+2 you will need about 60 volts, and for H.T.+1 something in the neighbourhood of 90 volts. These values can be re-adjusted afterwards for the maximum results. Join a pair of 2,000- or 4,000-ohm telephones to the 'phone terminals, and take the aerial lead to "aerial 2." Join up the earth connection and switch on the set. Do not forget to connect the flexible lead from H.T.+1 to the centre-tap terminal on the anode coil.



Here we see the set complete in its cabinet. The large dial on the left is for tuning the aerial circuit, whilst that on the right is for the H.F. tuning.



You will note from the above photograph that the coil socket for the centre-tapped anode coil is placed well away from the metal screen. The distance should be about two inches, not less, otherwise losses will occur.

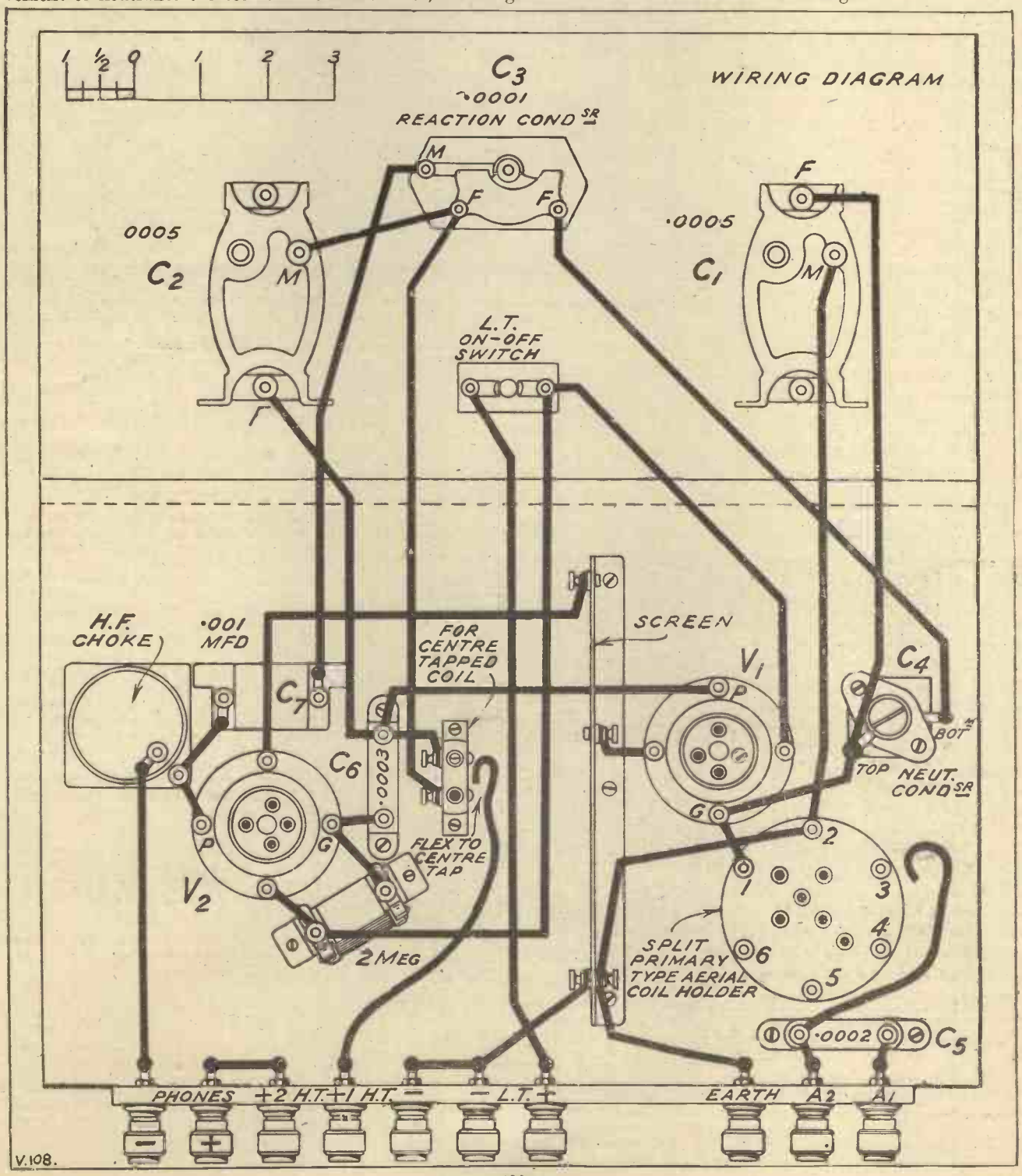
Preliminary Tests

It will be convenient for you to carry out the preliminary tests on the medium broadcast wave-band, and for this purpose you will need the two medium wave-band coils. Insert these and place the small reaction condenser at its minimum, that is, with the moving vanes all out. Now rotate the two tuning condensers until you hear a station, probably your local transmission. It is quite possible that the station will come in fairly distorted, and that as you rotate the tuning condensers you will hear a number of squeals. This denotes that the H.F. valve is oscillating and requires neutralising. The procedure to adopt is as follows:

First of all, set the neutralising condenser at minimum. A good method of testing for oscillation is to touch one or other of the sets of plates of the tuning condensers (this may be the fixed vanes in this particular circuit arrangement). You will probably find that the set will only oscillate under the above conditions when the two circuits are in tune with each other and this can be used as an indication. It is convenient to neutralise the set at some point near the middle of the tuning range. Now, increase the capacity of the neutralising condenser.

Neutralising

Test at intervals for oscillation as this is done and you will presently find that the set has ceased to oscillate and will not recommence even when the tuning dials are slightly readjusted. Now increase the reaction a little, until the set once more oscillates, and again increase the neutralising condenser setting until oscillation ceases. Slightly readjust the tuning condensers again to make sure that the set is completely stable once more. Proceed in this way until it is found that the correct adjustment of the neutrodyne condenser has been over-shot. Once this point has been passed it will be observed that further increases of the neutrodyne condenser setting no longer stop oscillation, but cause it to become stronger.



Having neutralised the set, the tuning of the various stations is merely a matter of practice in the manipulation of the two tuning condensers " in step " and the rotation of the reaction condenser to a point just below the self-oscillation mark.

Final Adjustments

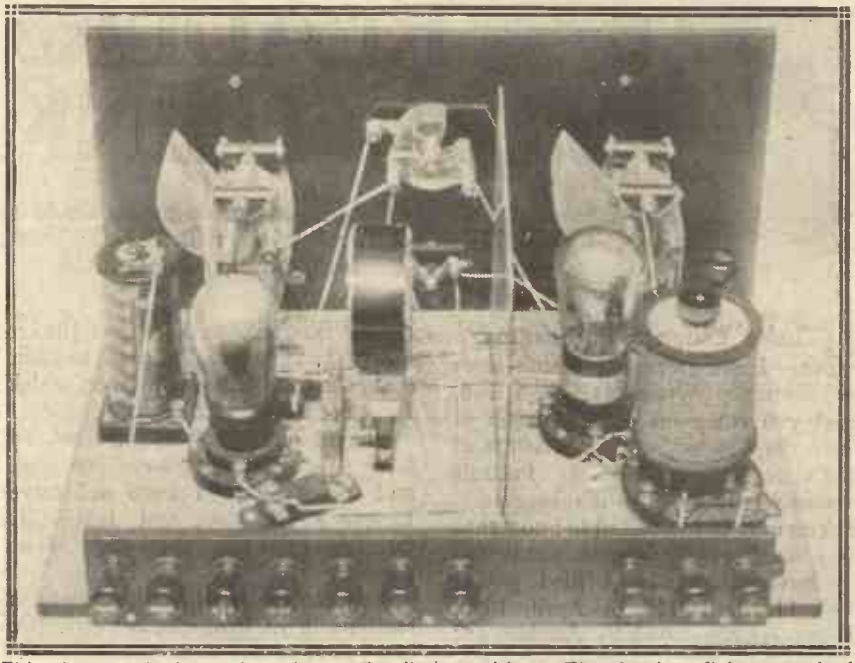
You will soon know when you are using too much reaction, because you will hear a rushing noise and it is probable that just before this signals will become distorted. When this occurs you must reduce the value of the reaction condenser slightly. Try various adjustments of the H.T. voltages until you find those which give you maximum signal strength together with very smooth reaction.

Do not forget to try the flexible lead from the ·0001 aerial condenser on tappings three and four on the six-pin coil base. The object of the aerial series condenser is to improve the general selectivity of the set. It may not be required in many cases, but it is particularly useful where a loud transmission, such as that of the local station or 5 G B, has a tendency to interfere with the reception of some weaker transmission.

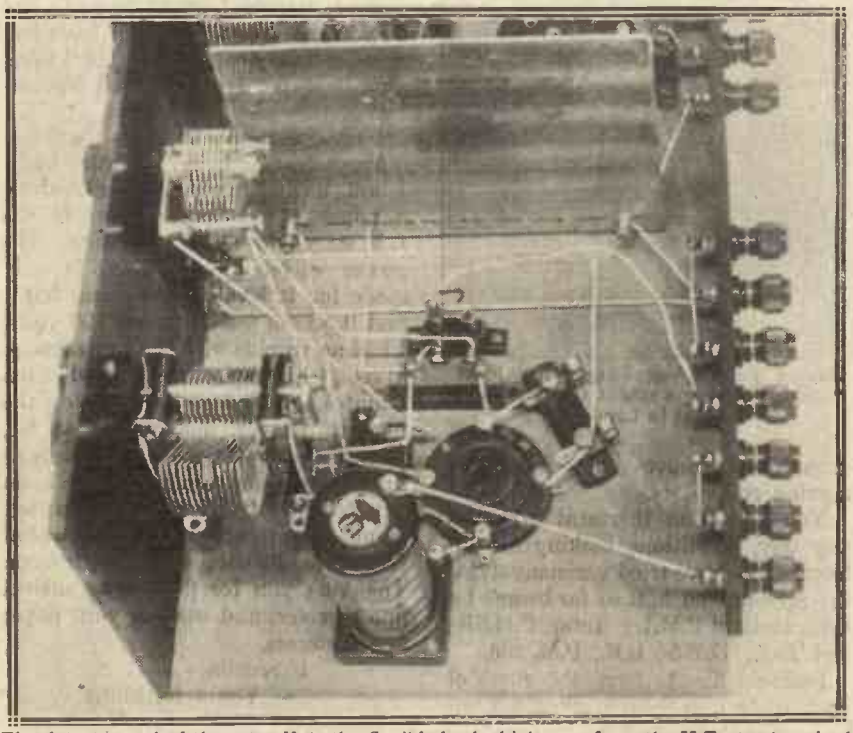
The Series Condenser

To bring this small series condenser into circuit, the aerial lead is attached to A_1 instead of A_2. On test, this set gave most excellent results, and practically all of the better-known Continental transmissions on the medium and long waves were received at good strength. The aerial used for the tests was a single wire of about 100 ft. long with an average height of approximately 20 ft. The set was tested at a distance of fifteen miles from 2 L O in a fairly open situation, and 2-volt valves were used.

The selectivity was found to be adequate without the use of the aerial series condenser, which, however, would have distinct advantages with an aerial of higher self-capacity.



This photograph shows the valves and coils in position. The six-pin coil is a standard split-primary aerial coil and the plug-in coil is of the centre-tapped type.



The detector end of the set. Note the flexible lead which goes from the H.T. +1 terminal to the centre-tap on the coil. This wire should be attached to the special terminal on the plug-in coil itself.

RADIO WRINKLES

Measuring instruments for checking the condition of batteries, etc., are essential where a three- or four-valve set is employed for good quality reception.

* * *

Good long-distance reception is absolutely impossible if the set is oscillating.

* * *

Many a good indoor aerial is spoilt by the fact that the lead-in wire from the aerial is placed too close to metal pipes or similar objects, which subtract a certain amount of the energy which should reach the set.

* * *

Generally sepaking, an aerial under the roof is much better than an aerial wound round the picture rail.

* * *

If you use an outdoor aerial it should be fitted with an earthing switch so that the aerial can be connected direct to earth outside the house when not in use.

* * *

When unwinding a new aerial wire be sure not to allow it to kink or bend sharply, as this will inevitably weaken it.

* * *

When received from a charging station the voltage of a 2-volt battery should be a little above two volts, the usual reading being 2·1.

* * *

When it is newly received from the charging station a 4-volt battery should show a reading of approximately 4·2, and a 6-volt battery a reading of approximately 6·3 volts.

WHAT READERS THINK

All Editorial communications should be addressed to the Editor, Tallis House, Tallis Street, London, E.C.4.

Those Linen Diaphragms

SIR,—I see from the March issue of MODERN WIRELESS, page 356, that you comment on the origin of linen diaphragms. I am unaware of the date and scope of Mr. Potter's claims regarding linen diaphragms.

You may be interested to know that as a result of experiments conducted in November, 1924, I filed patent Nos. 11,279, 16,139, in April, 1925. These related to cloth diaphragms. The number of the complete specification is 257,317.

The loud speaker in question is described in my handbook "Loud Speakers" (Iliffe & Sons, 1927), on page 78.

Yours sincerely,
(DR.) N. W. MCLACHLAN.
The Engineers' Club,
Coventry Street, W.1.

FL and 5XX

SIR,—In a recent MODERN WIRELESS you say you would be glad to hear if Eiffel Tower interferes with Daventry. Most of the people with receiving sets in this island are very much troubled, and I hear complaints from everybody, and in a great many cases they have to switch off while Eiffel Tower is on. Even my "Combine Five" suffers occasionally, and I fancy only sets of the *most extreme* selectivity are immune. As Daventry and Radio Paris are our only reliable stations now, wireless reception in the island is in a bad way.

Morse makes the shorter waves out of the question.

Yours faithfully,
M. LE BRUN.
(Paym. Capt. R.N., *Rd.*)
Jersey.

The "Shortradyne"

SIR,—I have very carefully looked through the pages of MODERN WIRELESS, hoping to see some remarks on a set that was published in the December number of that periodical —the "Shortradyne." I put the set in hand at once, but had to wait some time for the transformer, which I got soon after Christmas.

The set is really a wonderful set. I have a normal short-wave set—det. and 2 L.F.—and I have a 3-valve Igranic—H.F., det., and L.F.—but never have I had a short-wave set so good as this.

You can really bring the American stations in at loud-speaker strength, and sometimes they are powerful enough to move my Magnavox moving coil.

You can tune this station in on any day, conditions making no difference. I have tried various valves; the present and best so far being: 1st Det., Mullard P.M.1.; Inter, P.M.5B; 2nd Det., D.E.5; L.F., P.M. 256.

I should like to have the views of your readers on the set. Would it not be possible for one of your journals to publish the programmes of the larger American stations, and, say, 3 L O?

BOY BROADCASTS

Horace Palmer, aged 13, before the "mike" during a recent Church Army meeting in London.

I get very true readings in the "World Radio" under Pittsburg: Variety, music, talks, concerts, time and weather reports. This is repeated seven days a week for 52 weeks in the year, and then they repeat.

Yours faithfully,
F. A. B.
Kingston-on-Thames.

The "2.35 For Australia"

SIR,—I must congratulate your Mr. Kelsey for the design of "2.35 for Australia."

Candidly speaking, I was rather sceptical of the results, but having most of the components in my junk box, made it up and with a little practice tuned-in 5 S W, P C J J, 7 L O (Nairobi, Africa), and several others (faint), including one with a strong American accent in the neighbourhood of P C J J. Needless to say, dozens of Morse stations come in at terrific strength.

I have not been successful in tuning-in 3 L O.

Wishing "M.W." the best of luck and a prosperous New Year.

I remain,
Yours truly,
A. H. KHAN.
Assist. Elect. Engineer,
Tata Iron & Steel Co., Ltd.
6, Office Road,
Jamshedpur.

The "Invincible" Five

SIR,—I think I ought to write and let you know of the success I have had since I built the "Invincible" Five, published in "M.W." of last November.

I must honestly say it is the finest "five-valver" I have ever built. I am using 2-volt Mullard valves, a power and a super-power in the L.F. stages working on 120 volts. The power valve, by the way, is only made for 100 volts maximum, but I find it works far better on 120 volts. I had no trouble with the neutralising, in fact, I had my set neutralised in ten minutes. I have not tried it on the high waves yet, but I have, so far, picked up 22 stations, 17 of them at full loud-speaker strength, and I am situated in a badly screened district, 35 miles south of 2 L O. Only four of these are British, the rest foreign. Thanking you for publishing such a fine receiver, and wishing your paper every success.

I remain,
Yours faithfully,
Surrey. A. VINCENT.

P.S.—You may publish this if you wish.

In Our Test Room

A Pye Pentode Transformer—Cossor L.F. Transformer—A Fine Loud Speaker—Some Centralab Components, etc., etc.

A Pye Pentode Transformer

You do not get good results when you connect an ordinary loud speaker directly in the anode circuit of a pentode valve. The reason for this is that the pentode has a high impedance, so it becomes necessary to use a step-down output transformer. Of the several Pye tapped primary shrouded output transformers there is now a type especially suitable for use with the pentode valve. It is a compact though heavily constructed component and is of distinctive form. Its price is 20s., and it carries the usual Pye guarantee for one year.

The neat, plainly-marked terminals are arranged in a straight line on the top of the component, and there is a fifth terminal provided on the side of the casing for earthing purposes. We have tested the transformer and have found it perfectly satisfactory.

Indeed, after some experience of Pye components, we have no hesitation in saying that they rank among the most efficient and dependable devices of their kind on the market. Pye of Cambridge seem to have set themselves a high standard and, moreover, have consistently worked to it.

The Pye Pentode transformer

Cossor L.F. Transformer

It is certainly good news that Messrs. Cossor have decided to sell their L.F. transformer separately. It will be remembered that this component was produced especially for the Cossor Melody Maker set, and was at first only obtainable in the kit of parts. It is an excellent production and ranks among the very few that are really worthy of inclusion in a modern set.

Having a core of special iron and using a special wire for its windings, it was possible to make this transformer light and compact. For this reason it should particularly commend itself to builders of portable receivers. It is completely enclosed in a metal casing which is tastefully coloured a dark brown in crystalline style.

The terminals are arranged on the side of the casing towards the base of the component, thus enabling the constructor to keep the wiring well down on the baseboard. It is interesting to note that only two holes are provided for mounting purposes. These are ample to hold the component rigidly in position, for, after all, we wonder how many constructors use more than two of the four holes usually provided on this kind of component. The price of this Cossor Melody Maker L.F. transformer is 21s.

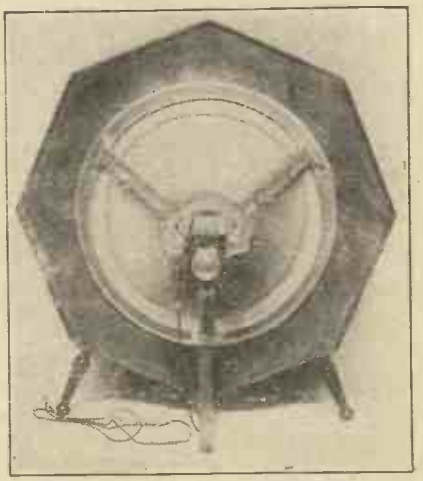
Manufacturers and Traders are invited to submit for test purposes radio sets, components and accessories to the "Modern Wireless" Test Room at Tallis House, Tallis Street, London, E.C.4. Under the personal supervision of the Technical Editor all tests and examinations are carried out with the strictest impartiality.

Readers can accept the Test Room reports published monthly under the above heading as reliable guides as to the merits and demerits of the various modern productions of the radio industry.

A Fine Loud Speaker

Some very excellent loud-speaker component parts and assemblies are being originated by Mr. F. Squire. of Stoke Newington—a regular "M.W." advertiser.

One of the latest is the type 99 assembly. This is a tastily finished aluminium casting carrying a 14-in. semi-free edged cone of triplex woven type.



A Squire model 99 loud-speaker cone assembly (back view) mounted on an artistic baffle-cabinet.

The assembly is sold together with the necessary parts for making and mounting a Kraft paper diaphragm

instead, if the purchaser wants this, and the inclusive price minus the loud-speaker unit is 35s.

A handsome cabinet-baffle of octagonal design is available at 50s. Thus for about five guineas a really fine instrument results—one that has " moving-coil " written all over it.

And the reproduction is not so very far from " moving-coil" quality either, and good moving-coil quality at that. Indeed, we would place it well above some such instruments we have heard.

Mr. Squire is to be congratulated on being in the van of the high-quality low-priced loud-speaker movement.

Some Centralab Components

Constructors of mains receivers and mains units should be interested in a number of components recently sent us for test by the Rothermel Corporation, Ltd. They are all Centralab productions and are representative of high-class American manufacture.

The Giant power rheostat is of normal size, but being constructed of heat-resisting material throughout, and having no fibre or light material to warp or burn out, it can carry heavy currents. Actually, it will handle a continuous current load through the entire resistance of 70 watts. And it is stated that it can be used in any radio power circuit without any danger of burning out, since the fusing point of the wire is the limit of capacity.

It is certainly the kind of rheostat one needs for L.T. supply circuits. It is available in nine resistances, from 25 ohms to 8,000 ohms, at 12s.

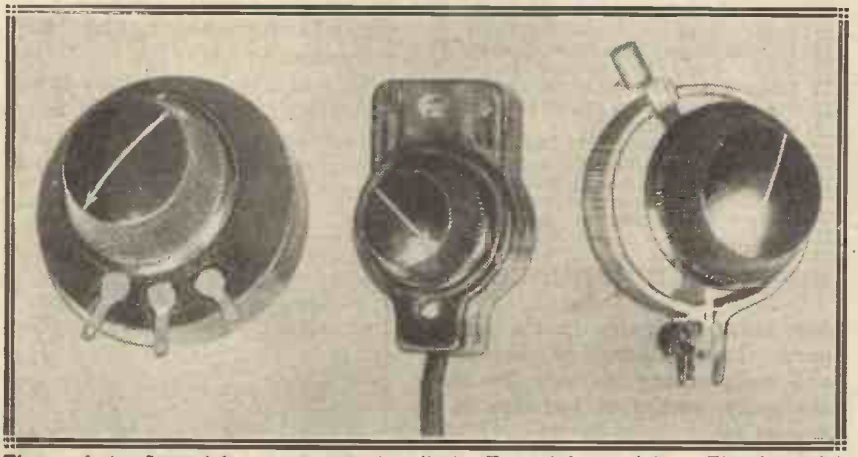
There is a Centralab heavy-duty potentiometer suitable for use in H.T. eliminators. This article will dissipate up to 50 watts in its entire resistance without burning out. This potentiometer is available in eight resistances from 2,000 ohms to 50,000 ohms, at 10s. 6d.

The Centralab four-terminal potentiometer is of a novel and extremely useful character. In addition to the normal variable contact it has an additional contact that can be adjusted from behind the panel. Thus this component enables two variable voltage taps to be obtained in an H.T. eliminator. It is constructed to carry heavy loads. The 3,000-ohm type costs 11s. 6d.

There is a Centralab potentiometer of low current-carrying capacity, suitable for volume control. This is obtained in varying resistances up to half a megohm, at 10s. 6d. It has a graphite resistance element, but contact to this is made by means of a rocking disc and not a rubbing member. Thus its resistance does not tend to alter and it is possible to return to settings correctly.

Of similar construction is the Centralab smooth volume control, as it is called, this being a non-inductive variable resistance. The price of this component also is 10s. 6d. All these Centralab resistances and potentiometers are designed for one-hole panel-mounting and have substantial milled bakelite knobs. They are stoutly-made articles and their movements are smooth and positive.

A further and especially interesting item is the Centralab Moduplug. This is a combined 'phone plug and volume control. You can substitute an ordinary 'phone plug for this device, which costs 10s. 6d. There is another type available which is also complete with a 2-ft. connecting cord and which is supplied for sets not equipped with jacks. You connect it direct to the loud-speaker terminals.



Three of the Centralab components described. From left to right: The Centralab potentiometer, the Moduplug, and one of the four-point potentiometers.

A Useful Reference Book

The 31st edition of " The Practical Electricians' Pocket Book," which is published at 2s. 6d. by " Electricity," is the first to be produced under the editorship of Mr. F. H. Robinson. This 1929 edition has been completely re-written and made even more useful than ever. Radio is covered, and there are tables of great value and interest to the users of mains units. Altogether it is a book of an indispensable nature to all connected with electricity from the power engineer to the wireless fan.

Short-Wave Coils

Now that summer is approaching, D.X. on the ordinary wave-lengths is going to be badly handicapped by natural conditions. But the radio enthusiast can turn to the short waves, which, if anything, become more easy to bring in. K D K A, 3 L O of Melbourne, and other such stalwarts, will prove quite powerful programme providers for those who have sets capable of tuning down to them.

Owners of 1928–29 Cossor Melody Makers should, therefore, be interested to learn that Cason Mouldings, of Lower Edmonton, N.9, are now making short-wave coils which are particularly suitable for that set. They make the Melody Maker a screened-grid short-waver of an efficient character.

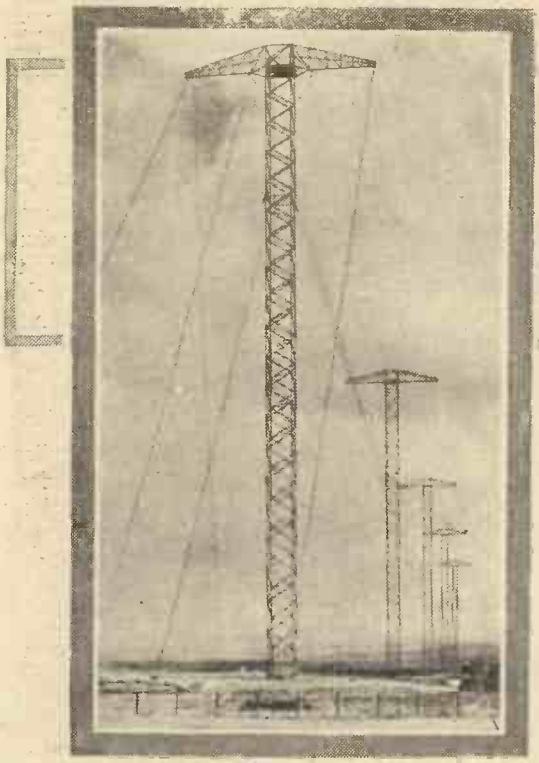
There are, of course, two coils in the set and these are arranged to cover that most useful band of 18 to 40 metres or thereabouts.

Short-wave work seems to be vastly different from normal reception, and those amateurs who have not yet ventured into the higher frequencies have a new and most fascinating field to explore.

Hunt's Polymet Condensers

The latest addition to the Polymet range of components, which are of American origin, and are handled in this country by A. H. Hunt, Ltd., is a fixed paper condenser of a non-inductively wound type. This condenser is remarkably compact and is made up in cartridge form. Nevertheless, it has a high electrical efficiency, its internal resistance being low and its insulation qualities high.

The type " A " is tested at 900 volts D.C., the working voltage being 300 volts D.C. or 200 volts A.C. Capacities of ·01 and ·02 mfd. are available at 1s. 6d. each, ·03 and ·04 at 1s. 8d., ·05 and ·1 at 1s. 9d., ·25 at 2s. and ·5 at 2s. 6d. The prices are remarkably low in view of the components' undoubtedly trustworthy character.



THE ROMANCE OF EMPIRE RADIO

A summary of a recent lecture by Dr. Eccles on Radio Discovery and Invention.

IN the course of a lecture recently given at H.M. Patent Office, Dr. W. H. Eccles, F.R.S., dealt with the development of Empire wireless communications from the point of view of its dependence upon discovery and invention, more particularly patented invention.

For those who have watched the progress of radio communication from its beginnings, he said that it was possible to pick out with some exactitude the inventions and discoveries which have helped towards the success already attained.

The Beginning of Wireless

In attempting to do this for long-distance radio-telegraphy as it is applied in the Empire scheme and, possibly, a few other similar systems, it is desirable to limit oneself strictly to the inventions and discoveries that are essential to the working of the most modern stations, and to ignore inventions that are not now being employed at all, however important they seemed in their day.

Senatore Marconi, who made radio a practical proposition by using an aerial and earth connection.

All wireless telegraphy is based upon the discovery made by Hertz, in 1888, of how to generate electric waves and detect their arrival at a distance. Crookes, in a famous article in "The Fortnightly Review," of 1892, dreamt eloquently of their possibilities. Oliver Lodge, in 1894, demonstrated at the British Association meeting at Oxford the first wireless telegraphic apparatus —a Hertzian oscillator for making electric waves, a coherer for receiving them at a distance of 100 yards, together with a Morse key and a relay for handling the dots and dashes. None of this apparatus was patented.

But in 1896 Marconi filed patents for wireless transmission, and for reception in 1897. Before Marconi's patents were published, Lodge filed another patent embodying certain fundamental elements that survive in all the wireless stations of to-day.

Early Patents

Marconi's patents, among other things, showed that only one half of the Hertz aerial, if arranged vertically, need be employed, the other half being supplied by an electrical reflection in the surface of the earth.

Lodge's patent included, among other things, the introduction of tuning coils into transmitting and receiving antennæ, and the use of high-frequency transformers — thus bringing the idea of "tuned" wireless telegraphy into the world.

Before the publication of Lodge's patent, no one talked of adjusting the wave-length of his transmitter by means of inductance coils, or of tuning his receiver to a distant transmitter—though nowadays every listener turns his knobs almost automatically.

This great work of Lodge's, written down in excellent scientific form, at a time when every other mind was dark upon the matter, led up to the next important patent, three years later, namely, Marconi's famous "four sevens" patent, dated 1900, in which the secondary circuits of both transmitter and receiver were all tuned to the working wave-length.

The Famous Atlantic Test

All these patents, though probably limited in the strict sense to spark telegraphy, passed some of their usefulness on to the continuous-wave era in which we live, and may, therefore, be included in our list of those contributing to the success of present-day long-distance radio-telegraphy.

Sir Oliver Lodge, F.R.S., to whom we owe tuning, a quality of incalculable value and one which makes it possible for large numbers of stations to operate at once.

The next step was unpatentable. Marconi proved in 1901 that wireless signals from Cornwall could travel one-sixth of the earth's circle in strength sufficient to be received in Newfoundland. This discovery made the possibility of spanning the Empire seem practicable. But many major and minor inventions were to be made before long-distance radio-telegraphy could be called commercially successful.

First came Poulsen's invention of the high-frequency arc, which made continuous-wave telegraphy, the ideal method, possible—at any rate, in moderate power. It was followed by the invention of a number of types of high-frequency alternators some of which, even to-day, work side by side in great wireless stations with the Poulsen arc they were born to rival.

The Three-Electrode Valve

The next step to be considered relates to the wonderful method of reception known as the heterodyne, which was due originally to Fessenden in 1907, but was subsequently improved by Lee and Hogan in 1913. Heterodyne reception is employed in one form or another in every modern long-distance station in the world, being literally indispensable in telegraphy.

Fessenden's conception of the heterodyne method of reception came to fruition very slowly, as time is reckoned in wireless circles, and, curiously enough, another great invention, one of vast importance, was at the same time lying similarly unhatched in the Patent Office. This was de Forest's invention of the triode—the three-electrode valve—filed in 1908.

It is hardly necessary to point out that the bulk of ordinary commercial radio-telegraphy, all broadcasting transmissions, and most broadcasting reception, is accomplished by means of the triode. The sales in this country alone must have run into millions since 1913, the date when its merits came to be recognised. And after 22 years, though improved and elaborated forms of electron control have been devised and tried, the three-electrode valve remains paramount.

A Valuable "Gift"

In 1912, the inventor endeavoured to find business men in London willing to help him in exploiting the invention. A number of large and small firms were approached, but none of them seemed to realise the value of the new valve. In fact, de Forest himself in 1912 failed to pay the first renewal fee, and the patent lapsed. It thus became the property of the British public—surely one of the most valuable gifts in the annals of the Patent Office.

Further Developments

De Forest's triode valve as used for transmission operates as a generator and amplifier of high-frequency currents of great power. In the receiving sets it appears as an amplifier and detector of the exceedingly feeble electrical oscillations picked up by the receiving antenna. But it is employed in these various manners by aid of circuits not foreshadowed in de Forest's original patent specification—circuits that were devised, at any rate in Europe, by other experimenters. Let us consider, first, certain transmitting circuits, and, later, some receiving circuits, based upon the use of the triode valve.

The earliest European patent for a valve transmitter is that of Arco and Meissner, two Telefunken engineers, who filed their application in Germany in April, 1913, and in this

Sir Ambrose Fleming, F.R.S., to whom we are indebted for the thermionic valve.

country in January, 1914. The British patent describes, among other things, the adaptation of the principle of "back coupling."

The principle of back coupling consists merely in taking from the high-power side of the amplifier a small fraction of its power and passing it back to the low-power side to be magnified again, with the result that once the apparatus starts oscillating it goes on doing so automatically and can deliver power to a radiating aerial.

In modern receiving stations the triode valve may appear in several capacities. First, it may be used, as originally described by de Forest, as a simultaneous detector and amplifier of faint signals; or it may be used as a mere amplifier for either low-frequency or high-frequency, as was shown by various experimenters in 1912 and 1913. Or, again, it may be used for heterodyne reception, in which case it is arranged to produce local oscillations of feeble power for mixing with the received signals in the manner already described.

Crystal Control

Another invention of wide application is that which utilises the triode for the mutual sustaining and linking together of electrical and mechanical oscillations. It is usually carried out at lower frequencies by aid of a tuning-fork, and at higher frequencies with the help of a slice of quartz crystal. In either case, the natural mechanical vibration, once started, produces an electrical current which is applied to the grid of the valve and is magnified, and this magnified current is turned back to the vibrator to keep it going.

In return for being sustained in motion, the mechanical vibrator imposes its own steady jog-trot on the electrical currents, and thus we get very well-timed electrical oscillations.

Meanwhile, something just as important as any of the previously mentioned inventions was emerging into the realm of knowledge during the years 1922 and 1923—something that will always stand out in the history of radio-telegraphy as an instance of how an unpatentable discovery may be just as valuable industrially as a patentable invention.

This discovery, put briefly, was that short waves—of 200 metres and less—could be transmitted over a large circle of the globe in greater strength than the long waves—several kilometres in length—which had always hitherto been used.

The Short-Wave Discovery

In December, 1921, a group of American amateurs succeeded in transmitting signals of 200 metres wave-length to England, and in December, 1922, hundreds of American, British, and French amateurs succeeded in similar transmissions. They would have achieved even more striking results if the international regulations and local laws had permitted them to use still shorter wave-lengths.

It may be that some of the successes of 1922 were obtained by utilising

(*Continued on page* 474.)

MY BROADCASTING DIARY

Under this heading month by month our Broadcasting Correspondent will record the news of the progress of the British Broadcasting Corporation, and will comment on the policies in force at B.B.C. headquarters.

The "Prisoner of Zenda"

THE adaptation of "Carnival" for radio by Holt Marvell is generally conceded to have been easily the best piece of work of its class produced at Savoy Hill. I now hear that Val Gielgud, the new Production Director, acting again in co-operation with his old chief, Holt Marvell, will put on a similar adaptation of the "Prisoner of Zenda" about the middle of May.

Incidentally, Holt Marvell's progress at the B.B.C. has been phenomenally rapid. About three years ago he became chief assistant to Gerald Cock, who had just taken over "Outside Broadcasts" from Roger Eckersley. Apparently Gerald Cock did not take long in initiating his apt pupil in the mysteries of the microphone.

After a few months we discover that the "Radio Times" has stolen Holt Marvell, whose real name, by the way, is Eric Maschwitz. Then, in due course, Maschwitz succeeded Walter Fuller in the editorship. Now, after eighteen months, this young man, who has just celebrated his twenty-fifth birthday, carries on his editorial work and does almost as much studio work as anyone else on the B.B.C. staff.

B.B.C. and Education

There are signs of dissatisfaction among the various educational bodies which the B.B.C. used last year to prepare a scheme for Broadcast Adult Education. Apparently Savoy Hill has come to realise that fantastic schemes of education are not good business. Therefore, with characteristic shrewdness, the B.B.C. has told the various educational committees to get on with the job themselves.

Last year over £5,000 of listeners' money was thrown away on pamphlets and other publications designed ostensibly to bring light into the ultimate darkness of the listener's home. No avowed scheme of education can possibly succeed. Work of this kind must be indirect and invariably incidental to the main function of entertainment. Now that the break has come, the various education committees will probably dissolve in a fiery controversy. Anyway, the B.B.C. has the public on its side, and that is the main thing, after all.

Fultograph Progress

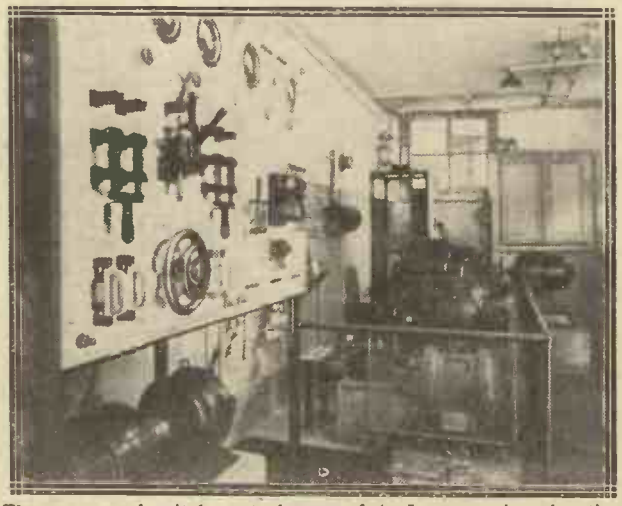
It is an open secret that the B.B.C. is impressed by the possibility of an early introduction of Fultograph into the main programmes. The recent addition of times of transmission and extension of facilities were probably a preliminary to much wider use. Anyway, when I met Captain Guest the other day he seemed much happier about Fultograph than the General Election! Meanwhile, the indomitable energy and restless genius of W. H. Lynas keeps Fultograph on the move.

The Television Position

There is, of course, a clear understanding between Fultograph and Baird television, which concerns are constantly coming together. Since the so-called secret test of television on March 5th there have been protracted negotiations about its inclusion in the Fultograph series of experimental transmissions outside programme hours.

Simultaneously, there has been a great revival of interest abroad. I hear that Captain Hutchinson has now actually secured control of the Baird television companies in France and Germany, and is pressing forward with his plans in the Dominions. I expect that the B.B.C. will begin experimental Baird transmission for the benefit of the public before the end of May.

THE LAUSANNE STATION



The power and switch control room of the Lausanne broadcasting station.

Hereafter, it will be only a matter of comparatively limited time before Baird Television and Fultograph, and perhaps some other companies as well, form a united front to counter the big American invasion of the radio field in Great Britain.

The New London Station

I was out at Brookman's Park the other day and found that the severe weather in February had seriously delayed progress. Nevertheless, I am told, with confidence, that the new London station will be really on the air in September.

This means that we are in for another autumn of general technical adjustment! Listening conditions in the London area will probably be much improved, but a great many sets will require some slight alteration.

Delays in the North

While there is not much fault to be found with the way in which the B.B.C. has gone ahead with the London station, the position elsewhere is not nearly as happy.

This man is inspecting the wooden framework of one of the masts at Munich, Germany.

There have been very long and quite unexplained delays both in the Pennines and in Scotland. I doubt if either of these places will be ready by the beginning of 1931.

As for the new station in the West Country—well, it just seems to be forgotten. There may be a reason for all this. If so, I wish Lord Clarendon would give another of his attractive informal discourses to the House of Lords. The Chairman of the B.B.C. has come very rapidly to the front as an able exponent of its policy, and he should be encouraged in this role.

Broadcasting House Too Small?

Alarming rumours are already current in wireless circles concerning the accommodation which will be provided by the contemplated structure in Portland Place. I heard a prominent B.B.C. official speak in terms of the greatest anxiety concerning what he believed would be the cramped and wholly inadequate accommodation according to present plans.

If there is anything at all in this criticism then now is the time to reconstitute the plans and make sure of a reasonable margin for the inevitable expansion of future years. Parliament would have a good deal to say if it eventuated that £500,000 of licence money had been expended on a building far too small for its purpose.

Free-Thought, Anti-Vivisection and the B.B.C.

Organisations of free-thinkers and anti-vivisectionists are profoundly unhappy with the B.B.C., which still declines to offer microphone facilities for their points of view. This reminds me that various elements of malcontents are trying to get together to form an anti-B.B.C. organisation to fight the renewal of any monopoly at the end of the present licence in 1936.

Several former members of the B.B.C. staff are mentioned as leading lights in this movement. When it gets sufficiently advanced to boast an office address, I for one would not relish the job of handling its correspondence.

The B.B.C. itself gets about 100,000 letters a year, a fair sprinkling of them critical and hostile. But a society formed for the specific purpose of smashing the B.B.C. would attract half a million letters a year at least. Of course, nothing serious can come of a movement of this kind; but I would like to see it develop if for no other reason than that it is always fun persecuting a public body so sensitive to criticism as the B.B.C.

Mr. Percy Pitt's Successor

It is now fairly definitely understood that Mr. Percy Pitt (musical director) will resist the overtures of the B.B.C. to induce him to stay on after this year, when he acquires the right to retire on pension. There has already been a good deal of angling behind the scenes for the succession. Sir Hamilton Harty, the first favourite of some months ago, now shares the betting with Mr. Adrian Boult, of Birmingham.

IN PASSING

WE are nearing the month when the incautious man casts a clout and catches his death of cold in a storm of sleet. Browning (a poet!) said that he reckoned it fine to be in England in April; I think that he must have been living in the Yukon or up the Persian Gulf when he gave vent to that opinion, for the theoretical English April is about as near to the real thing as is a cinema play.

The Goo-Goo-Eyed Female

I used to like the cinema in its young days, because it depicted realities in a crude and inartistic way. No fakes or trick photography, but good plain stuff! You sat on common wooden-seated chairs in pitchy darkness, while a piano tinkled—"Zampa" was a great favourite, I recall—and you actually saw a railway train enter a station. Marvellous! Real people, with jerky puppet-like movements, got out of the train and streamed along the platform. You saw early models of aeroplanes flickering uncertainly above the earth; you saw a waterfall, complete with "noise off." All most remarkable. A few modest plays appeared, mostly enacted in one room (a small room with ordinary

Enter the goo-goo-eyed female.

furniture and *no telephone*), by folk dressed in fifty-shilling suits and all paid about equally—badly.

But the cinema has long since been captured by the million dollar—penny dreadful—sob-stuff gang. A race of supermen has arisen, men who are so filled with genius that they can tell at a glance whether a girl has an attractive face or just a plain map, and whether if she is dressed up—or down—and taught certain motions expressive of various phases of the feminine ego she is likely to attract the male cinema-goer. Enter the goo-goo-eyed female, Eliza Bates, with brains and accent worth fourpence, becomes Vanessa Polaria, worth four million dollars and at least three divorces. The plots which Vanessa condescends to enliven are written by American ladies who would be more successfully employed in a laundry, washing *real* dirty linen. And it is notorious and shameful that the cinema industry has failed to produce a radio play.

Radio on the screen appears only incidentally and a poor appearance it is. The apparatus is generally obsolete and the operator a fool—to judge from his actions. When he receives an exciting message he jumps up like a startled rabbit, turns his back to the set and says, "My hat!" Then he rushes out, presumably to froth all over the skipper of the ship or to say "My hat!" to the hero.

Fluffy Asks the Time

I was once asked to supply the radio "effect" to a film company. I carted a large Rhumkorff coil and other necessaries to the studio, created a nice "fat" spark and awaited developments. A wavy-haired hobbledehoy, who seemed quite fit to do some real work, was the hero. Naturally he had a lot to do with a fluffy lady, and these two pranced and hugged in front of *papier mâché* scenery until Harold had to receive a wireless message from some unseen ass who had got on to Mars or the moon.

Harold entered my cabin, grabbed the 'phones and hustled them on to his head with the agitated manner of a baldheaded man putting on his wig before the chambermaid enters with his hot water. Then he shot his eyes out a full inch and said "My hat!" Business with the spark. Hurried exit. Next scene. Harold breaks the news to Fluffy. Very poignant. Electricians' mate, carpenter, painter and scene-shifters looking on and taking mental notes of producer's language. Fluffy breaks off the scene to ask the time. Producer curses her freely and camera-man bites his velvet cloth in silent passion. A clinging kiss. Harold and Fluffy break away, wiping greasy lips. As I dismantled my gear I overheard producer, behind cardboard tree, say to Fluffy, "Its no good, Millie! I've paid for two new hats already this month."

A Super-Radio Reel

I doubt whether it is worth my while to write them a real radio scenario. They would want to spatchcock Vanessa Polaria into it, with lashings of glycerine tears. For New York and the capitals of Europe they

Electricians' mate, carpenter, painter and scene-shifters looking on.

would produce "Ether Nights. A super-film of love and hate. Featuring Vanessa Polaria and an all-star cast." For the cheaper markets they would offer "Radio Rosie," in "Ten-tube Rube," a red-blooded screen drama, of which William Marconi said, "It's the sure-fire goods." Pah! And they would cater for the old folk who love a snivel in the dark, with "Somebody's Baby," or "Only a Crystal Set," a "heart-stirring scene which will make you hold hands and gulp."

I am now about to present my super-radio reel, a MODERN WIRELESS production throughout. Passed for exhibition by Jix O'Donnell. Valves by (Space to Let). Electrons by courtesy of Lord Birkenhead. Free of Income Tax and Royalty. Music by Jake Ache's Band, conducted by Jake Ache, by permission of Jake Ache; playing Beethoven, adapted by Jake Ache, for Jake Ache's Band, conducted by Jake Ache. Let 'er go.

Alfred Diggs .. .. *Radio "Fan"*
Ethel Nobbs .. .. *His sweetheart*
Steve Bung .. .. *Diggs' rival*
Maria Foxtootle .. *In love with Bung*
Angel Hokes .. .. *A radio dealer*

Over the radio world lay an unearthly peace, shed from above by the great mellow harvest moon. The radiance bathed the towers of 2 L O and annoyed a couple of cats who wanted to talk it over in the darkness. It crept into 5 S W and woke up the night-watchman It gleamed upon Oslo, Warsaw, 3 L O and J O A K. It tried to gleam upon Schenectady, but was beaten by the sky-signs. A holy calm all over the radio world except in the heart of

ALFRED DIGGS
(Radio Fan).

"Close up" of Alf; he leans over a nine-valve set, with a look on his face as though he were pumping up a motor tyre.

Love and DX have Alf in their grips—not their handbags, their *clutches*. Sweet Ethel Nobbs has that day promised to be his'n as

The only encouragement she had given him was to fall off the pillion of his motor-bike.

soon as he can afford a moving-coil loud speaker, so that she can listen in the luxury to which she is accustomed.

ETHEL NOBBS

is the protégée of

ANGEL HOKES
(Radio Dealer)

who has a down on Alf because Alf is a "dabbler" and pays no royalties. He sells Alf rotten components and bribes little boys to shoot at Alf's aerial insulators with air-guns. He trains rats to gnaw Alf's lead-in insulators, and crows to sit on Alf's aerial so as to decrease its mean effective height. A "close-up" of Angel makes the ladies say "Oo-er! the brute!" And now, on this glorious night, with 3 L O coming over like a ton of bricks—what is eating our Alf that he looks so chamber-musicky? It is the thought of

His rival—
STEVE BUNG.

Steven is not stainless, but he has never claimed 240 stations at full loud-speaker strength on a crystal set made out of a broken alarum-clock with a dinner-knife. He is not a radio fan. On the contrary, he is rich, possessing £50 in Savings Certificates, four suits, a motor-bike, and a bull-pup. Yet Ethel, "steel-true and blade-straight," has on more than one occasion urged him to boil his head. The only encouragement she has ever given him—and that was before Alf was squarely hooked—was to fall off the pillion of his motor-bike, after which feat she got up and blistered the enamel on the frame with the pungency of her remarks. But Steve is a trier. He has joined forces with Angel Hokes, who sees in the alliance some advantage to himself, because, firstly, he hates Alf, and, secondly, he loves

MARIA FOXTOOTLE,
who loves Steve.

The stage is now set for the drama. Steve buys a set from Angel Hokes and dazzles Ethel with its performance. He gets Langenberg, which has always eluded Alf's skill.

"What about
3 L O
on one valve?"

asks Alf pleadingly. "I never did like Hostralians," replies Ethel, "at least, not since that one in the war took me to Brighton and pawned me cloes while I was bathing." "Very well, then," answers Alf, a stern look on his face making him as near like John Barrymore as Chester Conklin is like Mr. Austin Chamberlain. "Very well, then! I will get Langenberg or bust." And so saying

He strode out
into the night.

Enter Maria Foxtootle. "Where is Steven?" she hisses. "Search me," replies Ethel, a smile of disdain playing round her lips. "Ha, ha!" cries Maria. "I know. Come here! Let me whisper. *He is attending a radio evening class.* That'll show you what your wonderful wireless wizard is."

"For my sake,"
sighs Ethel.

"He! he!" screeches Maria. "He doesn't know a res.-cap.-coupled hook-up from a magneto. Why, they assure me that Mr. Hokes does all his radio for him. Even tunes-in Langenberg for him."

"Go! Slanderous woman!" yells Ethel. "Go and tell that to the B.B.C., you slot-eyed, dough-faced, horse-haired——" And Maria backs out, hee-hee-ing haughtily.

"I have put a spoke in
her wheel!"

says Maria.

Alf has now made a super-set, so sensitive that it has to be kept on ice. "Ah, Alfred, how lovely," coos

They plan to enter Langenberg station disguised as Hindenburg and Little Willie.

Ethel. "I will get Langenberg for your birthday, darling, or never twiddle dial more," says Alf, most recklessly.

Ethel boasts of this promise to Angel Hokes in an unguarded moment over their supper. Hokes sneaks out and tells Steve Bung.

"You must stop Langenberg on that night!"

hisses Hokes. "I will," stutters Steve. They plan to enter Langenberg station disguised as Hindenburg and Little Willie. Maria Foxtootle hears of the plot from her maid, who is engaged to the wig-maker to whom Steve goes for his Hindenburg crop. Maria dogs them to Langenberg and denounces them. The culprits are chased by dachshunds, Steve Bung is chawed up, and while Maria tries to rescue him Angel Hokes rescues *her*. Langenberg transmits on trebled power and Alf triumphs. A double wedding takes place. As a wedding present to Alf, Hokes gives him a foot-warmer for late DX work.

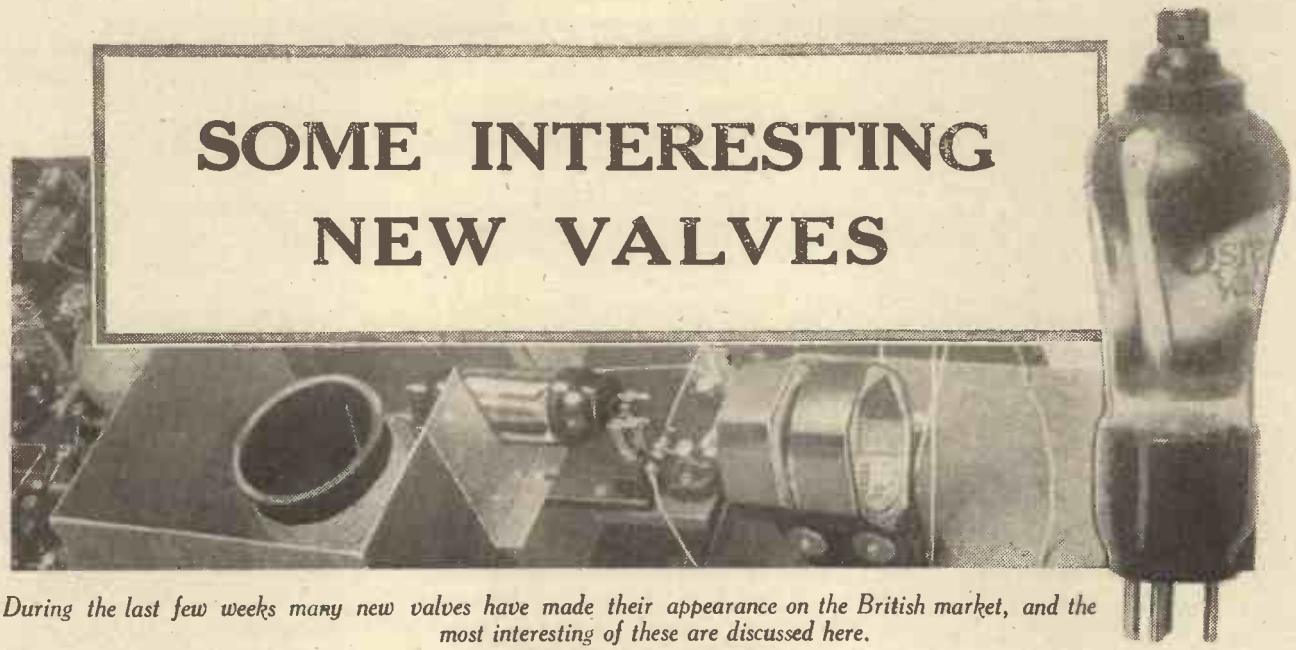
"Shall you need it,
ducky?"

languishes Ethel.

"Not till next season," says Alf, like a fool.

Ah, well! If young Anthony Asquith runs short of ideas this one is his for the picking. I know a man who could play Alf to the life. So do you, I'll bet!

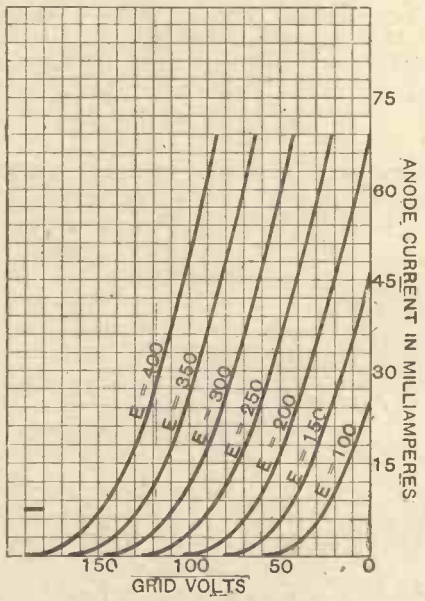
SOME INTERESTING NEW VALVES



During the last few weeks many new valves have made their appearance on the British market, and the most interesting of these are discussed here.

By KEITH D. ROGERS.

SINCE last month I have had a various assortment of valves sent in to me for examination and test, and of chief interest amongst these is the Mullard Pentone, P.M.26. This is a pentode valve for use with a 6-volt accumulator and is intended, of course, for the output stage of a receiver.



The L.S.5A in its redesigned form has a curve as shown above.

In operation the valve works exceedingly well, and has a greater input carrying capacity than either the 4- or the 2-volt pentode, so that quite considerable volume can be got out of it. The impedance is 25,000 ohms, and it has a magnification of about 50.

Therefore it is obvious that, although the impedance is so much lower than that of its brothers in the 2- and 4-volt ranges, it is still too high to enable it to be used successfully in a *ordinary* output circuit, and needs a proper output transformer.

This must be one with a high impedance primary if anything like true reproduction is to be obtained. Incidentally I have had this pentode working very well as a detector, though it is not intended for use in this position, and if the detector is to be followed by a stage of L.F. the old transformer or other coupling device trouble is once more encountered.

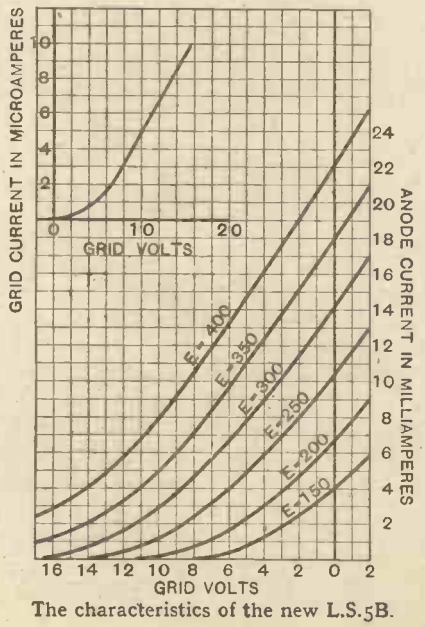
Suitable H.T. Voltages

A word about the H.T. voltages. It must be remembered, of course, that the maximum H.T. voltage is 150, and it is advisable that this voltage shall not be exceeded, otherwise one runs the danger of having an internal flash-over with this type of valve, with the complete ruining of the valve, and possibly other valves in the set, if this latter is not fitted with a fuse.

There is also a general idea that the priming grid terminal on the side of the cap should be taken to the *same* H.T. terminal as the plate circuit of the valve. In other words, the priming grid really gets more H.T. than the plate, because there is a drop of H.T. through the plate circuit through the transformer windings, and no such drop in the priming grid circuit.

I think you will find in most cases a noticeable difference will result if you take the priming grid to a separate H.T. tapping a little lower in voltage than the maximum tapping which is connected to the plate. It is also useful to have a choke and condenser anti-motor-boating device included between the H.T. and the priming grid. The Pentone sells for 25s., and though it is not light on H.T. current, yet if one can supply the H.T. voltage and current required it is a proposition very well worth considering.

This brings us to another output valve, the L.S.5A, a valve which is well known to readers but which has recently been improved and redesigned. It is, as you probably know, an Osram and Marconi valve, and is designed for about 400 volts



The characteristics of the new L.S.5B.

H.T., taking 4·25 to 5·25 volts on the filament and consuming a current of ·8 amp.

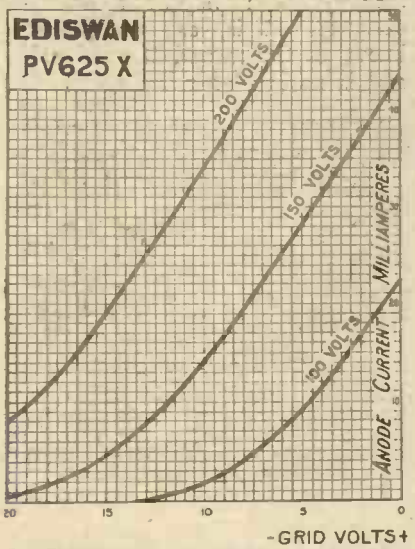
It is a SUPER-super-power valve, if one may use the expression, and is designed only for sets where large power has to be handled and large volume is required for the loud speaker. It is by no means an economical valve to use unless you want really big volume.

The valve dissipates about ten watts. In other words, the plate current works out at about 40 to 50 milliamps, and it has a grid swing of something like 100 volts in either direction. This, of course, makes it an excellent valve for large power output and where such speakers as the moving coil or very large cone type are employed.

Greater Volume Possible

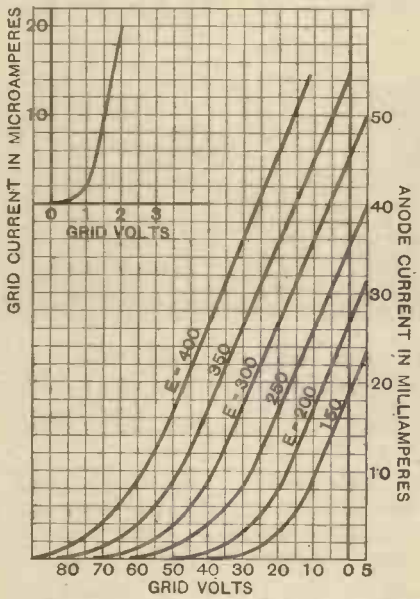
The impedance is 2,750 ohms and the magnification factor is 2·5. This is not a high figure, and those who take out their old super-power valve, especially should they be using a P.625 type, and replace it by an L.S.5A, will, of course, notice a certain drop in volume. This can be made up on a radio receiver by either higher magnification intermediate valves or else by tuning the station being received a little more strongly.

Then a much greater output strength can be obtained with the L.S.5.A than is possible with the P.625 and other types of super-power valves, simply because the L.S.5A will stand a far greater input without overloading than will the latter type.



The P.V.625X has excellent characteristics, as the above graphs show.

While mentioning the P.625 type of valve, I must remind you of the new Ediswan output valves, the P.V.625X and the P.V.625A. These two valves correspond very closely with the Marconi and Osram type P.625 and P.625A respectively. The P.V.625X in the Ediswan range has an impedance of about 2,500 ohms and a magnification factor of 7, so that its mutual conductance is of the order of 2·8 at 100 volts and 3·5



The third of the "L.S.5 series"—the L.S.5 gives the above curves.

with impedance of 2,000 at 200 volts. The other valve, the P.625A, is of much lower impedance—somewhere about 1,600 ohms—and has a magnification factor of about 4.

Taking a filament current of ·25 amp. at 6 volts, and having maximum H.T. voltages of 200 and 180 respectively, the P.V.625X and P.V.625A form very efficient output valves and certainly can be recommended.

It is not possible, of course, to carry such a high grid swing with the P.625X valve as it is with the P.625A, owing to the steeper slope, but the overall signal strength results in much the same volume.

An Excellent Valve

The P.V.625X is an excellent little valve, and certainly one of the best which has been turned out for a long time. The construction is extremely strong and the valve has long-life lasting properties. I personally have had one on test for a considerable number of hours now, running it as a matter of fact at an H.T. voltage in excess of that recommended by the makers, and it is still giving excellent service without the slightest sign of loss of emission or deterioration in any respect.

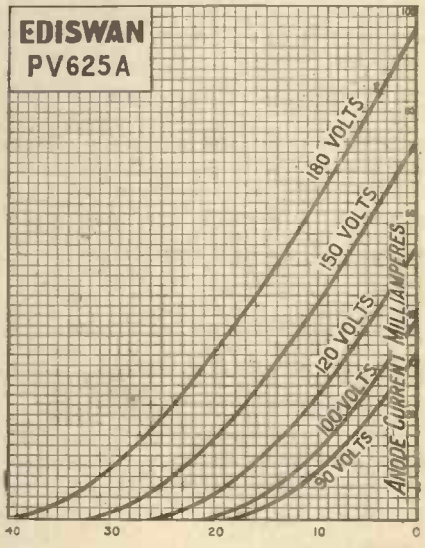
Finally, I should like to emphasise the importance of using such valves as I have mentioned here in their proper output circuits. Super-power valves with their large anode currents are not suitable for use if placed direct in the loud-speaker circuit. If you place the ordinary loud speaker direct in the plate circuit of your output super-power valve, you are almost sure to get trouble owing to the saturating of the core of the loud speaker; and the distortion and lack of bass, if you have anything like a good loud speaker, will be very noticeable.

It is essential that a good output transformer or an output choke having a reasonably low D.C. resistance and yet as high an inductance as possible should be used in the plate circuits of these valves if anything like the true magnification and the true balance between bass and high notes is to be obtained.

That Output Circuit

I find that although a large majority of constructors do use output chokes or output transformers nowadays, there are still quite a number who place their loud speakers direct in the plate circuits of their last valves. This may be all very well when the last valve is of the ordinary power type, having an impedance of not less than about 5,000 or 6,000 ohms, but when a big super-power valve of the P.625 or P.625A class is used, then things become really serious and severe lack of good quality is liable to ensue.

No matter where a valve is placed in a set, it must be treated properly



The curves of the P.V.625A—a low impedance output valve made by Ediswans

if it is to operate successfully, and you cannot expect the maximum from any valve if its output circuit is totally unsuited to it.

RADIO ABROAD

Radio "Echoes"

SOME very peculiar "echoes" were studied last year by Professor Stormer, of Oslo; these echoes were heard by Professor Stormer and his assistant while they were listening to a 30-metre signal at Eindhoven. The echoes were heard after an interval of between 3 and 15 seconds.

Stormer has made calculations on the theory that the waves were reflected from a reflecting layer *beyond* the Heaviside layer, and it is possible by this theory to form some notion of the position and properties of the supposed new "electronic" layer. If this is true, it would seem to show that the waves can pass through the Heaviside layer, and that the latter is not so complete a reflector to wireless waves as has been previously imagined.

Further Tests

It was noticed by Professor Stormer that when the sun is in the earth's magnetic equatorial plane (which occurs in February, March and October), the echo effect due to the supposed electronic layer is the most noticeable.

Further investigations are to be made into this highly interesting and very important subject by means of tests from several European stations in the immediate future.

Canadian Listeners

At the end of November, 1928, the number of licence holders in Canada was over 250,000, which was about 17,000 more than at the corresponding time the previous year. The Government tax is one dollar.

Wireless Pirates

In addition to the very large number who have paid their licence fees it is believed that there are more than 100,000 sets for which no licences have been issued. The income from the issue of licences is administered by the Department of Marine and Fisheries, and is devoted largely to the improvement of radio service. One interesting application of the fund is to the tracking down of interference causes, a number of special radio cars being detailed for this service.

Prague Conference

From April 4th to the 13th there is a special conference of representatives of European Governments to be held at Prague in connection with wireless affairs. Great Britain is represented by the Post Office, but also certain representatives of the B.B.C. will be present with the Post Office representatives in order to advise on matters connected with broadcasting.

The Washington Convention was concerned with very similar matters, and the forthcoming Prague Conference is in one way a continuation of the deliberations of the Washington Convention. The matters which will come up for consideration will include all manner of wireless questions, and even the question of the copyright of broadcast items will be dealt with.

Call-Signs

The question of European call-signs is being specially raised by the Austrian representatives, whilst Holland is taking up the question of the rights and privileges of amateur transmitters, especially with regard to the allocation of transmitting wavelengths.

The use of radio for police work and also for the transmission of weather reports is a matter to which the German representatives will pay particular attention. The Bureau Internationale de Radiophonie, Genoa, will also, of course, be represented.

Hilversum

The Brandes concerts, which have been taking place on alternate Sunday evenings and transmitted from Hilversum, began again on February 24th, at 5.40 p.m., on a wave-length of 1,071 metres. These concerts have been highly appreciated by English listeners, who, incidentally, have been very pleased with the English spoken by the Dutch announcers.

Italy

A new 50-kilowatt transmitter is to be erected in Rome, and the designs were recently approved by the High Commission which controls the Italian broadcasting system. The necessary buildings are being started forthwith, and it is confidently expected that the station will be in full operation before the end of October next.

Rome Beam

It has also been decided to install at Rome a short-wave beam transmitter of the Marconi type, intended for the transmission of broadcast programmes to the United States of America; this is a concession to New York Italians.

RADIO IN USBEKISTAN

Natives of Tchai-Kahn listening to broadcasting in one of their local tea-rooms.

Receiving Pictures

P. B. C. (Stoke-on-Trent).—"I am in possession of a four-valve broadcast receiver, and should be obliged if you would tell me what modifications are necessary in order that I can use it for the reception of fixed pictures. The circuit is quite straightforward, consisting of a neutralised H.F. stage, detector, and two L.F. valves (one R.C. and one transformer coupled)."

It will not be necessary to make any alterations to your receiver in order to receive picture transmissions, although for the sake of convenience it is a good scheme to include a change-over switch in the output circuit. All that is required for this purpose is an ordinary double-pole, double-throw switch, and the two centre contacts of the switch should be joined direct to the output terminals of the set.

By using the two contacts at one end of the switch for the loud speaker and the two remaining contacts at the other end for the picture receiving apparatus, it becomes a very simple matter to make the change over.

Absorption Wave-Meters

L. J. M. (London, E.C.).—"I am in possession of a short-wave receiver with which I have had very good results. Having passed the circuit to a friend, I should be obliged if you could tell me whether there is any means by which I can transfer the station settings from my set to his so that he will be able to know where to find the stations. I seem to remember having read an article some while back in which it stated that an absorption wave-meter could be used for this purpose, and if I am correct, will you kindly give me details of the construction and operation of such a unit?"

You are quite right, L. J. M., in thinking that an absorption wave-meter can be used for calibration purposes, and all that you will require for the construction of a suitable unit is a ·0005 variable condenser and a short-wave plug-in coil consisting of five or six turns.

The moving vanes of the variable condenser should be joined to one side of the coil, and the fixed vanes to the remaining side, and the wave-meter is then ready for use.

First adjust your tuning condenser dial to a setting at which you have received a station, and increase the reaction control until the set just commences to oscillate. If you now hold the wave-meter coil about six inches away from the grid coil in your set and very slowly turn the wave-meter condenser from minimum to maximum, a setting of this latter condenser will be found at which your short-wave receiver ceases to oscillate.

It may be found that the receiver ceases to oscillate over about 10 or even 20 degrees of the wave-meter dial, in which case the distance between the wave-meter coil and the grid coil should be increased inch by inch until a position is found where a movement of only one degree on the new unit condenser dial is sufficient to stop and restart the receiver oscillating. This setting on the wave-meter corresponds to the wave-length of the station to which the main set is tuned, and the method of transferring the setting to the new receiver is a comparatively simple job.

Place the wave-meter coil as before, about six inches from the grid coil of the receiver that it is desired to calibrate, and adjust the wave-meter condenser to the setting at which it stopped the previous set oscillating. Next, with the new set just oscillating, slowly rotate the tuning condenser until a setting is found at which the new set ceases to oscillate.

As before, it will probably be found necessary to move the wave-meter away from the set in order to narrow the "dead spot" down to a degree or so, but after the "narrowing down" process the setting at which oscillation ceases corresponds to the setting on the original set.

In this way it is a simple matter to transfer the settings from your set to the new receiver, and once this latter has been calibrated it should not be a difficult job to locate the stations.

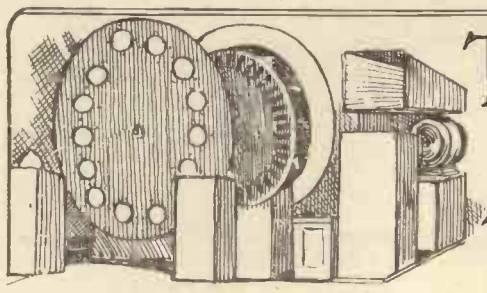
The "Transportable" Four

"WANDERER" (Hayes).—"I am building the "Transportable" Four, as described in the February, 1929, issue of MODERN WIRELESS, and since it is now nearing completion I should be obliged if you would tell me the most suitable types of valves to use in the set."

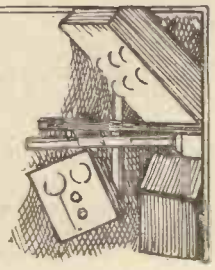
For the first position in the set to which you refer, you will, of course, require a screened-grid valve of the upright type. In the detector stage (V_2) we advise the use of a valve with an impedance of about 20,000 or 30,000 ohms, usually styled H.F.

An H.F. valve is also to be preferred for V_3, but we only advise the use of such a valve in this position if the L.F. side of the set is quite stable.

The ratio of the intervalve transformer is really the deciding factor, and where one of fairly low ratio is to be used, it will probably be quite safe to use a valve of the H.F. type for V_3. Otherwise an L.F. valve should be used. In the last stage a small power valve is required.



TELEVISION NOTES OF THE MONTH



ACCOUNTS from Berlin of wonderful television progress made by Dénes von Mihály were based simply on the young Hungarian engineer's success with apparatus to transmit cinema films by wireless. Von Mihály tells me, however, that his work on television has made this apparatus possible.

Improvements

"The new models are the same as those I exhibited in Berlin last August," says von Mihály, "except that the lamp, the transformers, and the optical equipment have been improved. The present success is the result of quiet and severe work during the whole time since August.

"The original dark red and flashing pictures, 1½ in. by 2 in., of the small receiving apparatus are now increased to 4½ in. by 6 in., and appear surprisingly clear. The picture in the large receiving apparatus is about 10½ in. by 11½ in., instead of 3 in. by 3 in. as formerly. A single head can therefore be shown life-size, and before the apparatus ten people can conveniently sit and watch the performance.

Narrow Band

"By realising that only about 1,400 dots are needed instead of 10,000, we are able to transmit over ordinary radio channels. We could send the picture and sound simultaneously, but owing to the scarcity of waves we preferred to arrange the apparatus so that we could switch from picture to sound and vice versa at will.

Long Distance

"What surprises our visitors most is the simplicity of our models in their construction and operation. We are busy now with long-distance transmissions. Judging by our experience up to the present we should have no difficulty."

Shall We See?

"Television will soon knock even the new beam wireless into a cocked hat"—thus said Mr. Cecil Malone, M.P., one of the politicians called in to end the squabble between those who do and those who do not believe that the B.B.C. should broadcast television. Some of the M.P.s, on the other hand, were against. As I am putting these notes together I am told that a party of B.B.C. engineers are to have another look at television. Will it be "wait and see"? Or just "wait"?

In U.S.

In America television is hovering. After a joyous experimental run television waves were told by the Federal Radio Commission to keep their interference to the short-wave spectrum. Now, however, they have been allowed to come back again—on probation.

On this page the latest Television developments are chronicled by WILLIAM J. BRITTAIN, our Special Commissioner.

It was deemed too severe to expect the public to tackle short-wave trouble on top of their television troubles. R. P. Clarkson, who was chosen by the radio manufacturers to tell the American public the real truth about television in a series of articles, suggests that on account of its difficulties television will become a commercial proposition long before it is a real home comfort.

Reaper Television

Monsieur L. Thurm, of Paris, has applied for a patent for a television idea of refreshing novelty. Have you seen the windmill arms on a reaper during harvest time? Well, M. Thurm suggests an arrangement like that. Along the horizontal arms are small neon lamps to which incoming television currents are fed—by a commutator, I suppose. The lamps are arranged along each arm so that as the apparatus turns each lamp covers a path of its own. The lamps, lit by incoming currents during part of their path, trace out the successive lines of the image.

An S.A. Visitor

A friend in South Africa sends me details of a meeting with Mr. I. W. Schlesinger, the "big noise" of radio in South Africa, on his return from a visit to England to see whether television was worthy of introduction into the dominion. "The Baird people are now apparently sending plant to South Africa for experimental purposes," said Mr. Schlesinger.

"When I was in England the Baird Company wanted me to float a company to cover television activities in South Africa, but I told them I could not at present see my way to be identified with such a flotation, because I was not satisfied that we could offer a successful service to the public. At the same time I told them that if they cared to consider further the possibilities of television in South Africa and came out to the country, we would give them a chance to demonstrate the apparatus, and reasonable assistance.

Value for Money

"Television has not emerged from the experimental stage, and after careful consideration I have concluded that it is not yet an attractive commercial proposition," Mr. Schlesinger told my friend. "If sets were sold to the public they would be getting something which would not give the value expected.

"I spoke to the General Electric Company in America, who are probably more advanced with television activities than the Baird Company, and they informed me that they regarded television at present as being commercially out of the question and merely a toy.

"I also spoke to Sir John Reith, of the British Broadcasting Company, and his technical advisers who have considered the Baird apparatus, and they were of the same opinion as the General Electric Company—that the thing cannot yet be commercialised successfully. I saw the Baird system at work myself and considered that the reproductions were distorted and unsatisfactory."

A RUSSIAN RADIO DRAMA

The story of a colossal wireless bribe.

From a Correspondent.

A RADIO episode which is almost melodramatic is recorded by Colonel Lionel James in his interesting book, "High Pressure," which has just been published by John Murray, 12s. net.

During the Russo-Japanese war, Colonel James was then temporarily in charge of a wireless set on a ship lying off Port Arthur. He was ashore one evening, at the local club, when a tall, distinguished-looking stranger, who described himself as Baron Lubavin, made himself known to Colonel James and, in the course of a conversation, stated that he was a Russian agent in the Czar's Secret Service. He then proceeded to sound Colonel James as to the possibility of a wireless cypher message being sent from the ship to Port Arthur.

"If you will send it for me," said the Baron to Colonel James, "I am authorised to give you these."

He then put on the table a wad of banknotes to the value of £20,000! Colonel James was naturally "hypnotised" by the sight of so much money, not to say flabbergasted at the proposal. But when he found words to answer the Baron's offer, he promptly told him to go "elsewhere"!

But the Russian was persistent.

"All I require is a few minutes' access to your wireless set," he said, and again he pointed to the notes.

Beating the Baron

Our author bade him a very abrupt "Good evening." But the Baron was not to be beaten, and he forthwith increased the amount of the bribe. But he was shown the door, and Colonel James thought that was the end of the matter.

Colonel James also had a wireless station on a hill ashore, and that evening he visited the operator. The latter was asleep, so James did not wake him, but, anticipating another visit from the Baron, he posted himself on the only road up to the hill with a revolver in his hand.

To quote Colonel James:

"In about half an hour I heard footsteps approaching, and then I saw two figures separating from the shadows.

"'Halt!' I said. 'You cannot come any nearer to the station, Baron. I am armed.'

"'Have you considered my proposal?' replied the Baron. 'Such a tiny message!'

"'There is nothing to consider, Baron,' was the answer. 'And I must ask you not to trespass on my station.'"

Nothing Doing

The Baron was then convinced there was "nothing doing," and he had to beat a retreat; but it is interesting to wonder what was the message he was prepared to pay £20,000 to have transmitted to Port Arthur. It certainly strikes one that it must have been of paramount importance; and one wonders what would have happened if the message had been transmitted. Perhaps it might have had a distinct effect on the Russo-Japanese War, and perhaps, if it hadn't been sent, Port Arthur wouldn't have fallen as it did, later on, before the Japanese assault.

A READER'S RESULTS

The Really "Invincible" Five.

The Really "Invincible" Five

SIR,—Seeing Mr. O'Leary's letter from Cork in your February issue regarding the "Invincible" Five set he has constructed and which I also made up shortly after the design appeared in "M.W.," I am emboldened to add my congratulations to his and to let you know how this very fine circuit has behaved in my own case. Employing a less than averagely efficient aerial-earth system (aerial only 15 ft. effective height and long gas-pipe earth), I have succeeded in logging every long-wave station from Kosice down to Leningrad, all at varying loud-speaker strength, and most of them, including last mentioned, calling for a good deal of volume control.

On the medium band I have heard every German and Spanish station on the speaker, as well as most of the more important transmitters in nearly every other European country—Rome and Milan being exceptionally loud at present, and unaffected by 2 R N on 411 metres. American stations never fail to come in after the English stations close down at night, the stronger ones generally at quite good loud-speaker strength. Of these I have occasionally logged as many as seven between 12 midnight and 2 a.m. in one night, having heard about twelve altogether. One 50-watt American transmitter (W Q A M, Miami, Flo.) to whom I wrote published my card in the local papers and told me it was "with amazement" that they learned of my reception of their programmes. Finally, I may honestly recommend the "Invincible" Five in the matter of purity of reproduction, although I live in the centre of a city and only a mile or two from the local station I can generally cut-out all but very bad static interference by employing anode bend in the detector circuit and by including the fixed condenser in series with aerial. Indeed I scarcely ever vary this arrangement. My valves are 6-volters, but I also tried 2-volt valves and the difference between these and my present ones seems more or less negligible.

Again offering congrats. and thanks for such an excellent design.

I am,

Yours truly,

MICHAEL RYNNE.

5, Fitzwilliam Square,
Dublin.

USEFUL HINTS

One common cause of the loss of emission in valves is the removal of grid-bias plugs whilst the H.T. and L.T. are left switched on.

* * *

When constructing your next receiver have an old shaving brush on hand for clearing up filings, etc. You will be surprised at how much mess this saves.

* * *

Variable condensers should not be mounted upon a panel until the filing of the terminals, etc., has been done, as otherwise there is a possibility of the brass dust getting under the vanes of the condenser.

* * *

Never forget that when a soldered joint has been made it should be wiped over with a clean duster and all superfluous flux removed whilst it is still hot.

* * *

When getting together the components for a new set do not forget to check up each one as it is received for continuity, etc., if possible, for if this is done when the components are bought the loss of time is practically negligible, whereas it may take hours to discover a fault when the set is built.

SOME D.C. CHARGING CIRCUITS

An experimenter who has his accumulators permanently in use is usually loth to disconnect them so as to put them on charge from time to time. Here are details for a simple switching scheme for charging the H.T. accumulator and trickle-charging the L.T. battery.

By P. C. BAKER.

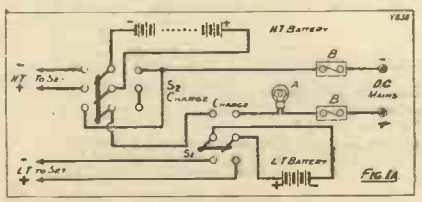
BEING the fortunate possessor of D.C. electric lighting supply, I do not have to worry about making-up rectifiers, etc., when I wish to charge a battery from the mains.

As regards my H.T. supply, although I frequently use the mains for this purpose, there are times when I need a silent and steady source of H.T. potential which can only satisfactorily be supplied by an H.T. accumulator.

The Best Arrangement

I worked out a number of schemes which would meet my purpose, and finally came down to the circuit which is shown in Fig. 1A as being the simplest and cheapest to operate and build. The first point I ascertained before carrying out the construction of this charging panel was to find out which of the mains was earthed. In many districts what is known as the "three-wire system" is employed, and it will be found as a rule that alternative houses have the main of opposite polarity earthed.

Thus No. 14 in the road will have negative to earth, No. 16 positive to



earth, No. 18 negative to earth, and so on.

It is important to know which main is earthed in order that you may put the lamp resistance, which is used for cutting down the charging current, in the correct lead, so that in the event of a short-circuit to earth occurring, no damage shall be done.

In the case of the circuit shown in Fig. 1A, I have assumed that the negative main is earthed and the lamp resistance A has therefore been inserted in the positive lead. Under these circumstances, should a short-circuit between that part of the circuit which is on the left of the lamp and earth take place, the lamp will light up to the full brilliancy, while the maximum current which can flow under those circumstances will be limited by the size of the lamp used. If, for instance, a 20-watt lamp is employed with D.C. mains having a voltage of 240 volts, the actual current flowing will be less than ·1 of an ampere, and there is therefore little risk of any damage being done to any component or other portion of the receiver.

"It is important to know which main is earthed in order that you may put the lamp resistance in the correct lead, so that in the event of a short-circuit to earth occurring no damage shall be done."

The Change-Over Switches

The switch S_1 is a double-pole, double-throw switch, by means of which the L.T. accumulator may either be placed on charge or else connected to the set. It will be noticed that when the L.T. switch is "up," the main circuit is broken, so that when it is desired to charge the H.T. accumulator, the L.T. battery must also be placed on "charge." This, however, is no drawback, since it is a most important point that the L.T. battery should be given a regular charge every day, while the H.T. battery will only require charging from time to time.

The switch S_2, by means of which the H.T. battery is put on charge or connected to the set, has therefore been provided with an extra pole, so that when the H.T. battery is connected to the set the main circuit is still through, to allow the L.T. battery to be placed on charge.

An Alternative Scheme

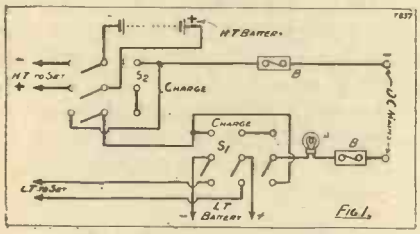
The simplest way of carrying this out is to obtain three single-pole, double-throw switches and a piece of ebonite drilled so as to fit over three arms, thus converting it into a three-pole two-way switch.

Constructional details showing how this is done are given in Fig. 2.

If it is desired to arrange the switching so that either H.T. or L.T. battery can be put on charge independently of the other, then two three-pole, two-throw switches will be needed and the circuit will be as shown in Fig. 1B. I do not consider the extra complication worth it, however.

Here is a "mains" valve which gets over charging troubles by dispensing altogether with an L.T. battery. But this type is designed to work from A.C. supply and is not an economical proposition where D.C. is employed, though it can be used if desired.

The layout of the charging unit is shown in Fig. 3. The lamp which controls the charging rate is shown near the mains supply terminals, while on either side of it are two fuse-boxes which are shown in Figs. 1 at B and B. Although the risk of a short, which might blow the house fuses, taking place is extremely low, I nevertheless



make it my practice invariably to connect a couple of fuses, one in each line, whenever any apparatus of any description is run from D.C. mains. The cost of these fuses is low, while it is a precaution which should always be taken.

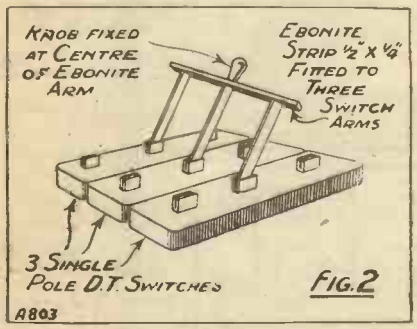
Below the resistance lamp and the two fuse-boxes are the two switches. The terminals for the connections of the various batteries are shown on the right-hand side of the panel, while the terminals on the left are connected to the correct terminals on the set to which the batteries in the ordinary way will be connected. The two mains supply terminals are shown at the top of the panel.

Checking Polarity

Fig. 3 shows the wiring diagram of the complete unit, and the connections are so straightforward as to require no comment.

The only thing to remember is this: that if in your house the positive main is earthed, then the resistance lamp A should be connected in the negative main lead, and vice versa.

Having completed the construction and wiring of the unit, the next



point to determine is the polarity of the various terminals, since it is most important, of course, that the batteries be connected the right way round, since otherwise instead of them being charged they will be discharged.

To find this, connect the unit to the mains, insert a 20-watt lamp in the batten holder, throw the switch S_2 over to the set side, and take two leads from the accumulator terminals on the charging board into a cup of salt water. Now throw the switch S_1 over to the charge side, so that the D.C. circuit is completed through the lamp and the salt solution. It will be seen that one of the wires is giving forth large quantities of bubbles of gas, the other wire only giving a few. It is this first wire which is the negative pole to which will be connected the negative pole of your battery.

Connecting the Accumulators

Having marked the terminals to which the L.T. accumulator is connected, wire this up to the board, and now carry out the same test as regards polarity on the H.T. terminals to which the H.T. accumulator is afterwards connected. While carrying this out, it is just as well to check over the connections to the two mains terminals, so as to make sure that the resistance lamp is in the correct lead. It is very annoying, after having marked your battery terminals, to find that you have got the lamp in the wrong lead, and you have to reverse your connections and reverse your markings; and it is therefore just as well to make sure before you permanently mark the terminals that you have got your resistance lamp in the right lead of the mains.

Having connected your batteries to the correct terminals on what one might call the input side of the board, the output terminals, by means of which the batteries are connected to the set, are connected to the receiver, care being taken here, again, to see that they are of the right polarity. It is easy, of course, to determine if you have connected the H.T. battery the wrong way round, because you won't hear any signals at all; but with the L.T. battery connected the wrong way round, you will still get signals, but unfortunately the resulting drop in efficiency may not necessarily be credited to the L.T. battery being connected the wrong way round. It is worth while, therefore, making sure beforehand that everything is O.K.

The Charging Lamp

The next point to discuss is what lamp to use for the charging resistance, and this will depend on the voltage of your mains. In view of the fact that this unit is to be used for charging an H.T. accumulator, the resistance of the lamp must be suitable so that the correct current is passed for charging the H.T. accumulator. Find out what the correct value is, and then choose the nearest wattage lamp which will give you that current. Take, for instance, the case of a 1,500 milliamp. hour H.T. accumulator, which should be charged, we will say, at ·1 ampere. When working with 240-volt mains a 20-watt lamp will pass a little over ·08 of an ampere, that is, 80 milliamperes, which is rather lower than the charging rate advised. It is safer, however, to be on the low side than on the high side, for overcharging an accumulator will do a considerable amount of damage. At the same time, we must remember that when charging a 120-volt accumulator the actual voltage drop

"It is most important that the batteries be connected the right way round, since otherwise, instead of them being charged, they will be discharged."

across the lamp A will only be about 120 volts, instead of 240 volts. The filament will, therefore, not be burning at its usual brightness, and its resistance will therefore be lower than when burning at its normal temperature. It will therefore allow a higher value of current to flow, so that for 200-240-volt D.C. mains a 20-watt lamp is advocated where a charging rate of ·1 amp. is indicated.

Parallel H.T. Batteries

For 100-volt mains, however, a 20-watt lamp will give too high a charging rate in the above case, and a 10-watt lamp would therefore be needed.

If, however, you want to charge a 120-volt accumulator off 100-volt mains, it will be necessary to charge it in two sections, since the voltage of a battery under charge must be less than that of the mains charging it. In this case, the best thing to do is to divide the H.T. battery into two 60-volt blocks for the purpose of charging, and charge them individually for convenience, or in parallel if you wish them to be charged as quickly as possible.

If the two 60-volt blocks are connected in parallel for charging, then a lamp carrying twice the

current will be required to charge them at the correct rate.

If you have some form of a milliammeter handy, it is as well to check up the current which is flowing when your H.T. accumulator is placed on charge, since it is most important that it should not be over-charged. If the charging rate is in the neighbourhood of ·1 ampere, then an

"Charging should be carried out until all cells are gassing freely, and the acid has a slightly milky appearance."

ammeter having a full scale deflection of 1 ampere will enable you to gauge fairly accurately whether the correct value of current is passing. Alternatively, and, of course, far more accurate, would be a milliammeter having a full scale deflection of 200-250 milliamps.; and since the addition of a small extra resistance under these circumstances will not affect the reading, one of the many cheap hot-wire milliammeters now at present available will prove quite satisfactory in this position.

The Correct Connections

As a guide to connecting up the board, I give in Fig. 4 a rough sketch which shows the batteries connected up to the board and the board connected up to the mains and set. Polarity, batteries and terminals have been marked so that the general scheme of the arrangement shall be clear at a glance.

We now come to a point of when and how much to charge, and this, of course, depends on the use you give your batteries and the amount of current that you take from them, as well as their actual capacity. The less robust battery of the two is the high-tension accumulator, and we will therefore consider this first, as being the most important one to keep in good condition, since it is liable to fall off more rapidly than the low-tension accumulator.

How Often to Charge

Let us take the case of a 1,500-milliampere-hour H.T. accumulator which is used with a 3-valve set drawing 12 milliamps. This should give approximately 120 hours' life from the H.T. accumulator before it requires recharging, which, if we use the battery on an average of four hours a day, will give a month's service before the battery will need attention. If the milliampere-hour capacity of the battery is higher than the figure quoted, then, of course, the battery would last longer, while if the current taken from it were greater, then it would not last such long time.

Under the conditions stated above, however, the battery would require charging every month. Since we are charging it at approximately ·1 ampere, the total charging period will need to be from 16 to 17 hours. If, therefore, the accumulator were placed on charge when switching the set off the last thing at night, and left on charge till the next evening when the set was going to be put on again, once a month, the accumulator would have had put into it the amount of electricity taken out during the month.

It is as well, however, with H.T. accumulators, to be on the safe side and charge it three or four days or even a week before it is really necessary, since with the small cells which are used in an H.T. accumulator the risk of sulphating is far greater in practice when the voltage has fallen a little than with a large low-tension accumulator.

Charging should be carried out until all cells are gassing freely and the acid has a slightly milky appearance. The positive plates should be a dark chocolate brown, looking very nearly black, while the negative plates should be a clean light-grey leaden colour.

Further, after the battery has been charged all the cells should be examined to see that the electrolyte is at the correct level, since owing to the gassing during the charging, as well as the evaporation during use, it will probably be found necessary to top up the cells with a little distilled water. About one fountain-pen filler full of distilled water per cell will usually be found to be the correct amount required after a month's use.

Preventing Corrosion

Any brass terminals on the H.T. accumulator should also be covered with vaseline periodically, in order to prevent corrosion from acid creep or spray, and it is a good plan to do this just before placing the accumulator on charge, since a small, fine acid spray is likely to come out of the vent holes when approaching the end of the charge, which if falling on the brass terminals would cause severe corrosion.

As regards the low-tension accumulator, this will need charging far

(*Continued on page* 448.)

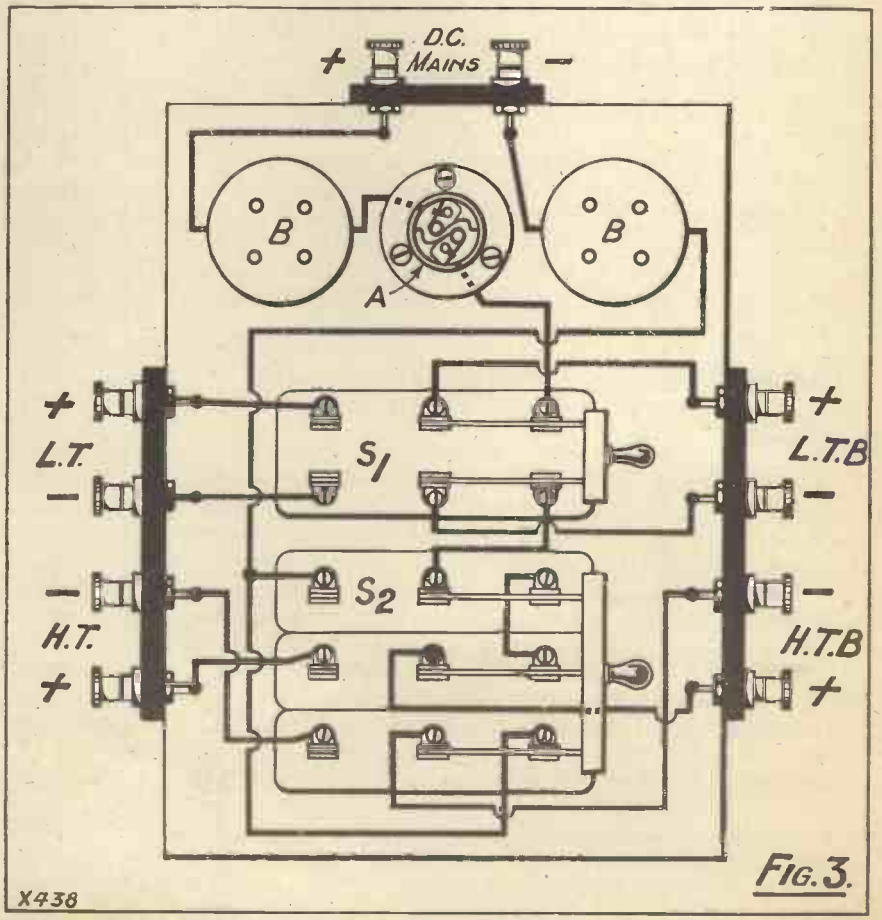


FIG. 3.

A GOOD EXAMPLE

A sidelight upon America's interest in the radio bulletins about H.M. the King's recent illness.

MOST of our readers have heard that when the King was critically ill there was as much interest and anxiety in America as there was in this country about the condition of His Majesty.

A glance at American papers will convince the average English reader that the people in America followed the News Bulletins with the gravest anxiety, and our correspondent in New York, in a letter to the Editor, says that the interest in listening to 5 S W, the Chelmsford short-wave broadcasting station which broadcast news of the King's illness, swamped interest in every other form of broadcasting in America for the time being.

5 S W Jammed

The trouble was, it appears, that 5 S W was considerably interfered with, and reception of the station's bulletins was almost ruined because of interference by another short-wave station, which was eventually located in Chile.

So great was the interest that there was an insistent demand that the United States Government should take steps to stop this interference. The United States Department of State was asked to make "representations" to the Government of Chile on the matter of this interference.

This, of course, from a diplomatic point of view, was a very grave step, for "representations" are seldom made by one government to another unless matters of vital importance are concerned. In fact, representations sometimes lead to a breaking off of diplomatic relations, and that usually leads to war.

However, America seemed to regard this interference as so serious, in view of the widespread importance of receiving the bulletins broadcast by Chelmsford, that the Government officials concerned made no bones about it. They did not ask the Chilean Government to prevent the interference, they *demanded* that it should cease!

From the point of view of international law, it is doubtful whether America had the right to make such a demand, but nevertheless it is interesting to note that the Chilean Government took "immediate steps," and the interference stopped! And so American listeners were able to receive the news of the King's progress via the Chelmsford broadcasting station without interference.

Unprecedented Action

This incident is extremely interesting in view of the fact that it is the first occasion on which a Government has taken diplomatic action to prevent interference from a foreign broadcasting station in order that another station in a foreign country could be clearly heard.

We wish "immediate steps" could be demanded by the International Radiophone Bureau for some of the Continental stations who are disregarding the terms of the Brussels wave-length plan! Certainly America knows how to put a stop to selfish and uncalled-for radio interference.

SOME D.C. CHARGING CIRCUITS

—continued from page 446

more frequently, since we are drawing much heavier current from it. In the case of a three-valve set which we will assume is using an H.F. valve for the detector, a small power valve for the first L.F. and a super-power valve for the second L.F., the total filament current will be in the neighbourhood of ·45 ampere.

The L.T. Battery

If the set is used on an average for four hours a night, the total discharge will be 1·8 ampere hours.

If now we charge at a rate of ·1 ampere, this current should be allowed to pass for 18 hours in order to replace in the low-tension battery the current taken out during the evening's use.

It will, therefore, be seen that if the low-tension accumulator is placed on charge at the end of every evening's programme and left on until the set is switched on again, it will be given approximately the correct charge to keep it in good condition.

Always Up to Scratch

This will mean that not only will you get the maximum performance from your set, owing to your batteries being kept up to their full voltage, but also the life of your batteries will be considerably extended, so there will be far less risk of disintegration of the plates, sulphating and other troubles of this description.

The small outlay involved in making up this panel, a matter of 10s. or 15s. at the outside, is more than repaid, not only by the money you save in not having to take your batteries to be charged, but also in the much longer and satisfactory service that your accumulators will give you.

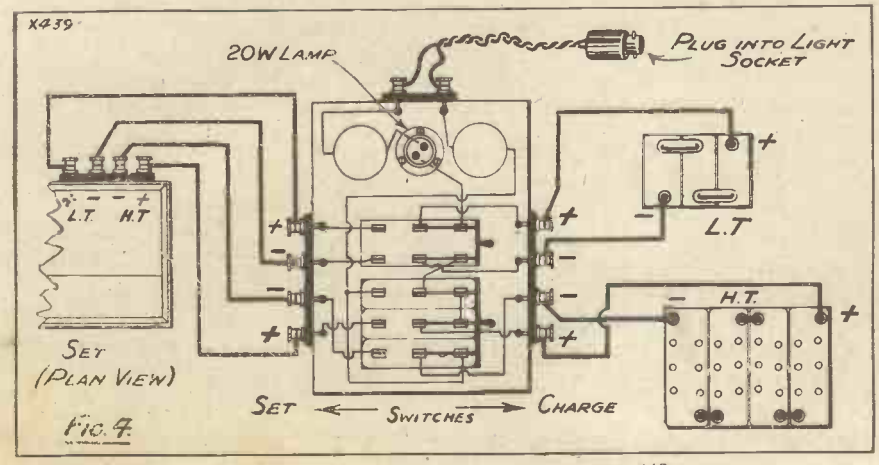


FIG. 4.

Radio and the Gramophone

In this section of MODERN WIRELESS each month will be discussed both technical and other data of interest to the set owner who is also interested in gramophones.

Besides articles of a practical nature, a brief survey and critique of the latest gramophone records is included, making the section of vital interest to all music-lovers.

Conducted By KEITH D. ROGERS.

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How to convert the four-valve portable set recently described in this journal so that it can be used as a radio-gram receiver.

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A representative collection of items specially chosen for their suitability for pick-up reproduction.

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Our regular review of some of the records published during the month, written from the point of view of their suitability or otherwise for electrical reproduction.

Portable Radio-Gram Receivers

THE time is fast approaching when the enthusiast will be turning his attention to outdoor radio, and portable and transportable sets will be under construction in great numbers. Open-air dances and radio concerts will be possible, and here the radio-gram receiver will come even more into its own.

Many portable sets are easily adaptable for pick-up work, and though the quality of all of them is not above suspicion, yet many are capable of providing excellent gramophone as well as radio reproduction. Such a set is the "M.W." "Transportable" Four, which is no plaything, but is designed for really serious work, and which can be converted to take a pick-up without much difficulty.

The Elusive "Ideal"

Details are given in this supplement for the alteration of this receiver, so that either radio or gramophone can be switched on at will, and owners, or prospective owners, of "Transportable" Fours will do well to consider the possibilities offered by the conversion of the set to give both types of programmes.

The question of the ideal set for combined radio and gramophone reproduction is discussed in these pages, and forms an extremely interesting article, in which all owners of radio receivers will find useful hints as to the operation and design of their sets, and their suitability for pick-up reproduction.

Readers' Experiences

Readers' experiences with electrical gramophone reproduction are many and varied, and the different troubles encountered are reflected in the page of queries and answers included in page 3 of the supplement. Letters from readers describing their experiences are always welcomed, and not infrequently are of value to other radio-gram set owners.

Queries on the various points and difficulties encountered in electrical gramophone reproduction should be addressed to the Query Department in the same way as ordinary radio queries, and those reprinted in this section of MODERN WIRELESS are typical examples that are chosen as the most representative, and as likely to be of the most help to other readers.

THE IDEAL SET

What is the best set to use for radio-gram reproduction? The writer discusses this often repeated question.

By G. W. EVANS

I AM often asked what is the ideal receiver for the man who wants both radio and pick-up reception, and I think this question is probably the most difficult one concerning radio that I am ever asked—and unfortunately it is one of the most frequent.

The so-called ideal in any branch of life depends so much upon personal taste and personal ideas and comparisons that it is almost impossible to aim at any definite goal, or to lay down any particular rules concerning the ideal receiver when one considers how extremely varied and how uniformly successful so many types can be.

The Most Popular Set

Probably the most *popular* receiver is the straight three-valver, with detector and two low-frequency valves. It has undergone several changes as regards small details, components, etc., but with regard to the general principles it has changed little through the whole six and more years of broadcasting. This receiver, as a rule, is easily adapted for use with a pick-up, and when used with a good loud speaker forms an efficient electrical reproducer of the gramophone.

The more elaborate sets such as the straight four- and five-valver, using one or two high-frequency stages, are also easily adapted, while even a straight two-valver, utilising detector and note-magnifier, can be used in many cases with great success.

It must, however, rest with the individual whether he will consider the results obtained from his present set, perhaps the three-valver already mentioned, or any particular set he has in mind, efficient for his needs when a pick-up is applied to the low-frequency portion of the receiver.

A Question of Volume

In the case of the three-valver the pick-up is applied to the detector stage, so that we have three L.F. stages in action when the gramophone is introduced. The same number of L.F. stages are available when the four- or five-valver is used, since the pick-up is still inserted in the detector stage.

In the detector–1 L.F. set, however, this has only two stages, and in many cases these are hardly sufficient unless fairly high magnification valves are employed, and a sensitive loud speaker is used.

It must depend upon the individual in every case, however, for if he is absolutely satisfied with his results from the set when used as a radio receiver, then it is likely he will be satisfied when used with a pick-up provided he has at least two low-frequency stages (counting the detector) to amplify the impulses from the pick-up.

The more ambitious listener will find the five- or six-valver to have great opportunities, but the point which must be borne in mind is that the L.F. side of the receiver must be really good if anything like quality of reproduction from the gramophone is to be obtained. Too often one comes across receivers, which, when anything like a strong signal is passed through, give most horrible distortion, sometimes explained away by the owner as being due to the fact that the station is "so close."

Inherent Distortion

It may be overloading, but in many cases this distortion is really always present, and, if a pick-up is used, is even more noticeable, especially if this is not controlled by a good volume control.

The distortion which appears to be overloading is often really due to bad low-frequency design, causing interstage back coupling, or else to the use of bad H.T. batteries, giving rise to a variety of motor-boating which is above audibility, but which makes itself felt in the quality of the receiver. Smothering the pick-up output with a greatly "reduced" volume control may mask such distortion but does not cure it.

With gramophones in their present state of perfection, the pick-up amplifier must be almost without fault if electrical reproduction is to be superior to that obtained from ordinary gramophones.

Since the great majority of wireless receivers constructed nowadays are without volume controls other than that of "detuning," it is essential, if a pick-up is to be employed, that a volume control be added, preferably across the pick-up, or between the first valve and the second valve.

The writer uses two volume controls, one across the pick-up, controlling the output from that instrument to the whole of the set, and the second volume control between the first and second valves. This latter comes into use when radio is on as well as when the pick-up is being employed, but the first one is only in use when the pick-up is in use.

Controlling the Strength

As a rough control the first one is very useful, while the second one is used to control the final volume as provided by the loud speaker. That, in the writer's opinion, is the ideal; it may not meet with the same approval amongst readers, but it gives the general stability which a volume control across the pick-up often provides, with a very fine control which can only really be obtained with two such instruments.

Most people will agree that the moving-coil loud speaker is the best, but amongst other types it is a matter of opinion what class of reproductive quality is preferred. Similarly, resistance-capacity coupling has many

A good four- or five-valve portable is often capable of providing enjoyable gramophone "broadcasts."

adherents, while transformer coupling, or a combination of transformer and resistance, has many more adherents.

Here again the owner of the set must decide for himself as to which is his ideal. The great criterion is whether the set will give good, strong signals on radio without distortion. If such is the case then it can be considered to be efficient and really worth while to use a pick-up with it, and so when the writer is asked what

(Continued on page 458.)

REPLIES TO READERS

A selection from the many queries received from radio-gram constructors.

Pentode or Super-Power?

W. L. T. (Bromley).—"I have a Det.-2 L.F. receiver which I use sometimes for gramophone reproduction and in which I should like to include a pentode. As I already have a large super-power valve in the output stage, should I benefit by the pentode in one of the intermediate stages?"

We do not advise the use of a pentode in an intermediate stage at present, such use of this valve being different from that for which it was designed and a special circuit to suit it would have to be devised. In your case we doubt whether the use of a pentode even as an output valve would assist you very much unless you employed one of the 6-volt variety.

As you do not say what H.T. voltage you use and what valves you are employing, except that the last stage has a super-power valve, we cannot say for certain whether the pentode would give you better results than the super-power, or vice versa. We certainly would not advise the use of the pentode in any position but the last, although in certain circumstances it can be successful as a detector.

If you decide to use it as an output valve in your set do not forget that you have to use a special output transformer, and that just plugging it into the valve holder of the set as it remains at present will not give you the best results. Similarly you will have to look out for motor-boating, and it is advisable to have an anti-mobo device in the priming grid circuit of the pentode. Whatever you do, do not plug the valve direct into the valve holder and expect good results. It is essential that a high-impedance primary output transformer be used with this type of valve. On the whole, if you are getting big volume now we would advise you to keep to the super-power valve.

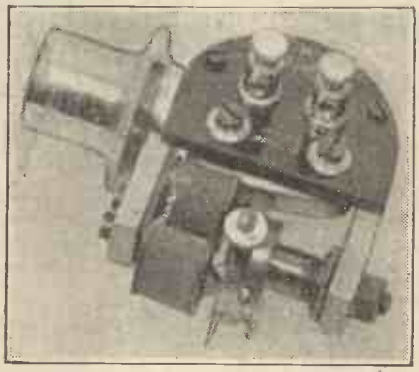
Adjusting Pick-ups

B. P. K. (Macclesfield).—"What is the best way to adjust a gramophone pick-up?"

This is a very difficult question to answer because there are so many types and makes of gramophone pick-ups. Many of them have an adjusting screw similar to the old reed earpiece, while others have adjustment of the damping which can easily be carried out and which is obvious. The more complicated ones, such as the Woodruffe, need more careful handling.

This pick-up is adjusted by means of the two screws set through from the back to the face of the pick-up and round which and on to which is connected a strip of thick rubber. This has a slot through the centre holding one end of the stylus.

The stylus is mounted by a cushion device on to a portion of the magnet which is held in position by a nut and lock screw to one end of the pick-up. This is usually set right by the makers, and it is generally only the rubber which gets in any way out of position. We do not advise you to attempt altering the distance of this main



The Woodruffe pick-up showing the centring device for the needle stylus and the rubber band which holds the armature at the top end.

piece, but just centre the pick-up carefully by means of the two screws which are connected to the rubber damping device at the back of the pick-up.

The R.I. pick-up has four points of adjustment which, however, are sealed by the makers, and we do not advise you to break the seal and attempt the adjustment of the pick-up. It is a difficult job, one which should be done by an expert, and if the seals are broken the firm will take no further responsibility for its adjustment. In every case where the adjustment is at all tricky, we would strongly advise you to return the pick-up to the makers and ask them to do it for you.

Do not forget that, when adjusting pick-ups, if you get the moving stylus arm too close to the magnet the pick-up is almost sure to distort, specially on loud notes, and very often causes horrible distortion because the stylus keeps on touching the magnets and momentarily sticks to them. Similarly, if it is out of centre one end of the stylus is very likely to touch the magnet and cause distortion that way, while if the whole of the stylus is too far from the magnet insensitivity will result.

What Type of Motor

A. T. F. asks whether it is advisable to use an electric or gramophone motor for a gramophone pick-up outfit, and how much it should cost.

This will depend largely upon the position of your outfit with regard to the set. If the receiver is near the pick-up drive then you are likely to get noises direct from the motor induced into the set. It will be necessary in practically every case to screen the motor completely, or as completely as possible, and also to earth the motor as an added precaution.

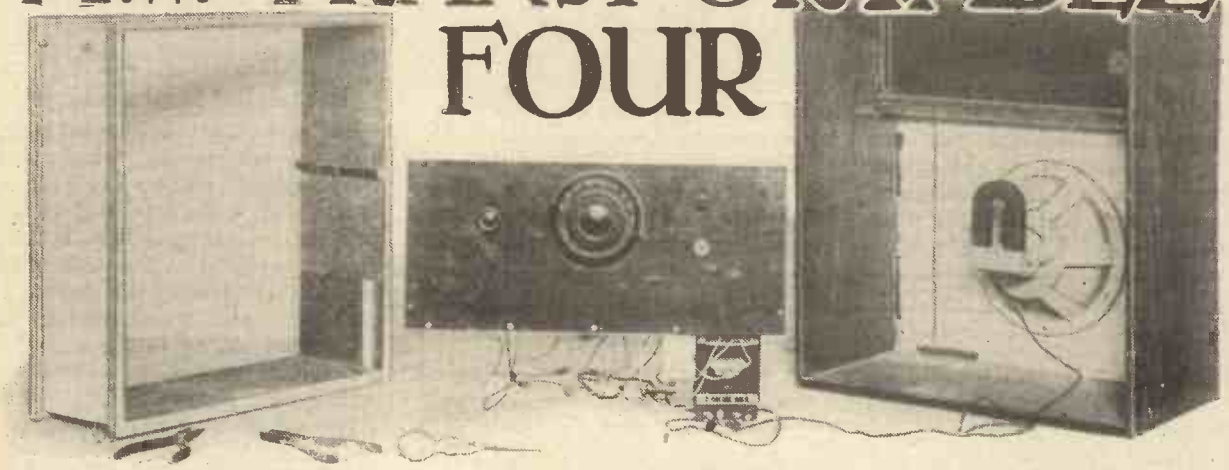
From the point of view of simplicity and of cheapness the clockwork motor has it every time. There *are* good electric gramophone motors, but unless one is careful of the design one is liable to get all sorts of trouble, and they need more attention than the clockwork type. Cleaning of the commutator and adjusting of brushes are regular little jobs which should be done every month.

Even Running

For good running and evenness we think that the clockwork motor would suit your purpose better than one of the electric types, since it is far more likely to run smoothly, and needs far less attention, and it is obvious that unless the motor runs dead smooth it is going to play havoc with your reproduction.

You ask how much you should pay for your clockwork motor if you get one of this type. This, of course, we must leave to you. You can get either a single-, double- or triple-spring motor, just as you desire, though for average work the double-spring motor gives sufficiently long running time and is very easy to wind. You should be able to get a good one for between thirty and forty shillings. Practically every gramophone shop which sells component parts as well as complete gramophones will settle any questions you may have in mind as regards type and price of the motor.

USING A PICK-UP WITH THE M.W. "TRANSPORTABLE" FOUR



THE "M.W." "Transportable" Four has proved a very successful receiver and is enjoying great popularity—so much so that many readers have written expressing their delight with the set, and at the same time asking if it can be used with a pick-up to provide electrically reproduced records.

Obviously the whole design of the receiver is against the use of the usual plug-in adaptor in the detector stage, and a little alteration of the wiring is really necessary if pick-up work is to be carried out.

Here again the design of the receiver makes it a little difficult to carry out this alteration without a certain amount of trouble, although the whole thing can be done in two or three hours if a little trouble is taken.

A little alteration of the panel lay-out, entailing three extra holes, but not in any way spoiling the look of the panel, is necessary, but one has to decide first whether one will take the pick-up input to the set to the detector stage, or to the first L.F. stage.

Det. or First L.F.?

As you will remember, the set consists of a screened-grid H.F., choke coupled to a high-frequency valve used as a detector, followed by another high-frequency valve and then by a "power," the whole forming a very sensitive combination.

Now as the last valve is transformer coupled to the first L.F. valve, it is possible to obtain good strength of reproduction with a number of pick-ups by inserting the pick-up across the grid and filament of the first low-frequency stage, thereby using only two stages (instead of the three which would be available if the pick-up were placed across the detector), but owing to the design of the set and the fact that everything is so compactly arranged, it is inadvisable to disturb the detector wiring, which would mean taking a portion of the detector grid circuit off to the switch so that either radio or gramophone can be used. I would therefore advise that the pick-up be placed across the first L.F. valve and that a suitably sensitive pick-up be employed.

This article tells of the alterations necessary in order to convert the powerful four-valve transportable set which was described in "Modern Wireless" for February, so that it can be employed as a radio-gram receiver.

By K. D. ROGERS.

There are many quite sensitive pick-ups on the market, quite useful volume being obtained with 120 volts H.T., and using only the two stages of low-frequency magnification. This arrangement must not be expected, of course, to give you enough volume to fill a large room for dancing purposes, but the moderate-sized room will be quite adequately supplied with music.

There are two problems which confront us when we start to arrange for the alteration of this set for use with either radio or a pick-up. The first of these is the fixing of a pick-up switch on the panel and a volume control, together with the necessary pick-up terminals, to enable us to switch over from radio to the gramophone and vice versa, and the second is to provide a second switch whereby the filaments of the unused valves (the H.F. and the detector valves) can be turned off and thus prevent wastage of juice.

Unfortunately, owing to the design of the set, unless we use a rather elaborate switch we cannot control the input of the pick-up and the radio programmes and also the turning on and off of the first two valve filaments in an efficient manner, and so it is proposed in this article that the extra filament switching be carried out in a different way.

Most readers will remember those little neutralising filament switches supplied by several firms, and which consist of a tiny baseboard-mounting gadget with a little screw-top which is loosened when the filament circuit is to be broken. One of these, suitably placed under or above the baseboard between the first L.F. and the detector valves at the back of the set, answers our purpose excellently.

Simple Switching

It is not difficult to open the back of the set in order to give the "switch" a couple of turns and thereby turn out the detector and H.F. valve filaments, and this appears to be infinitely better than to mount a complicated switch on the panel and then to carry the filament wires through the rather complicated system already existing in the set.

So what we have to do, first of all, in the alteration of the set is to break the back filament lead (which runs right along to the four valves and goes to the L.T. positive) between the first L.F. and the detector valve.

Filament Circuit Alterations

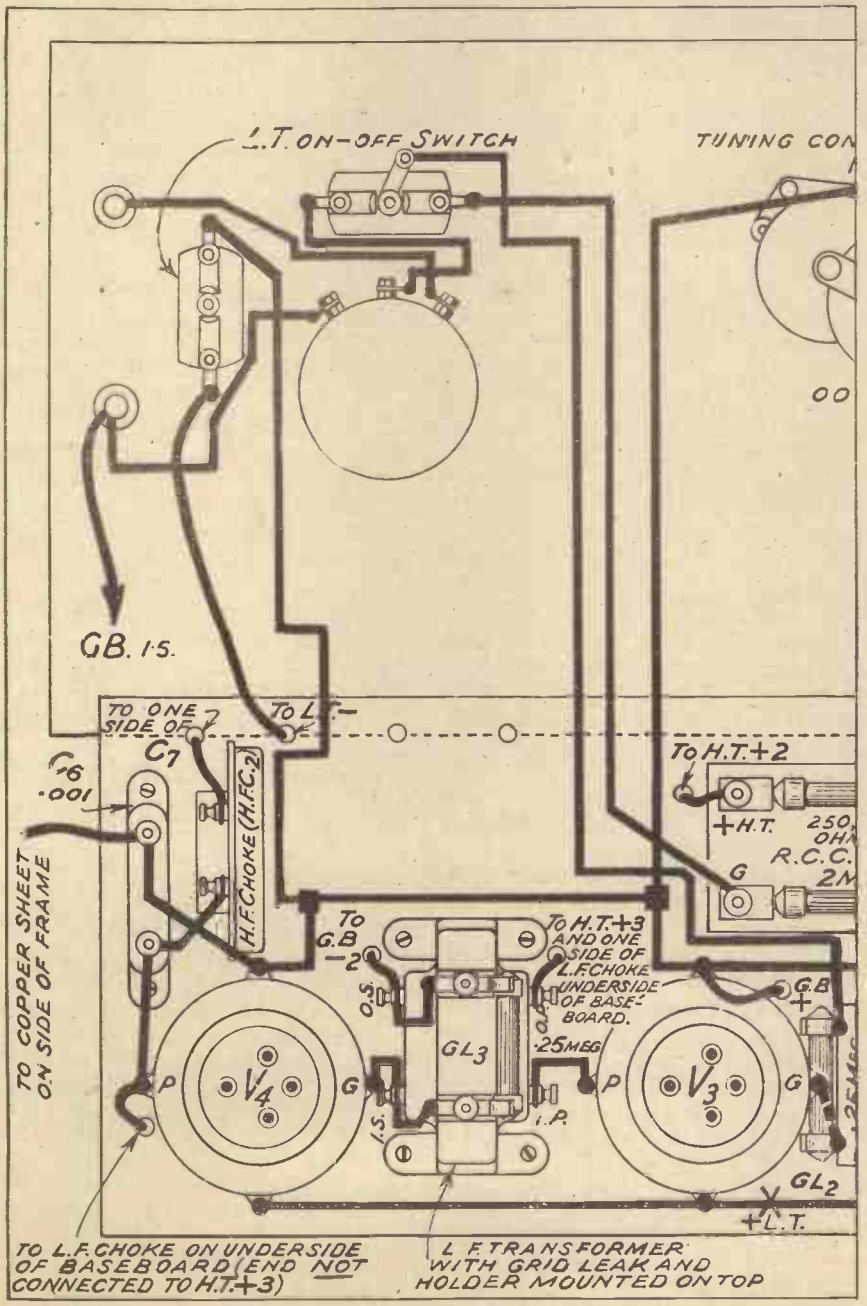
Take both the ends through the baseboard near the valve and thence by means of extra pieces of flex to the little baseboard-mounting filament switch, or, alternatively, if you mount it above the baseboard you can mount the switch on to the copper sheeting, screwing it right through on to the baseboard, and take the wires direct to the switch above the baseboard. All you have to do is to see that your switch is in series between the first L.F. positive filament and the detector positive filament connection. The place where it is done is shown marked X on the diagram.

The L.T. + from your battery should now be connected to V_3 instead of V_2 as in the diagram in the February issue of "M.W."

This diagram is reproduced exactly the same size as the corresponding section of the wiring diagram which appeared with the set when published.

Having done the filament part we can turn our attention to the other alterations. First of all, we must remove the main filament switch from its present position, replacing it by a three-pole switch, i.e. a single-pole double-throw of the push-pull variety.

This should have single-hole mounting, and the centre contact makes connection either with one or other of its side-spring contacts. I advise the use of a simple push-pull switch and not of a jack switch, as the latter's contacts are not always above reproach, and may give trouble.



Paste this diagram on to the full wiring plan given with the February article on the "Transportable" Four, and the alterations will be easy to carry out.

Remaining Replacements

Having replaced the filament switch with the new switch, which is to provide either "pick-up" or "radio," we now remove the little loud-speaker jack for the external loud speaker, which was placed on the panel of the original set (replacing it if desired by two terminals elsewhere on the panel), and placing in the same hole the volume control to control the volume from pick-up.

The old filament switch now goes on the right-hand side of these two, as you will see by the photograph and the wiring diagram, and two terminals for the pick-up are mounted level with the new pick-up switch and the volume control knob, but a little farther on to the right and one inch in from the panel edge. These complete the alterations on the panel.

It is essential that these pick-up terminals be an inch in from the edge of the panel, as otherwise they may foul the fillet on the front of the case when the panel is placed in position in the case. It is, of course, unnecessary to disconnect any wires except those which have to be altered, and the receiver is moved out of its cabinet as a whole, nothing being dismantled while the alterations are taking place.

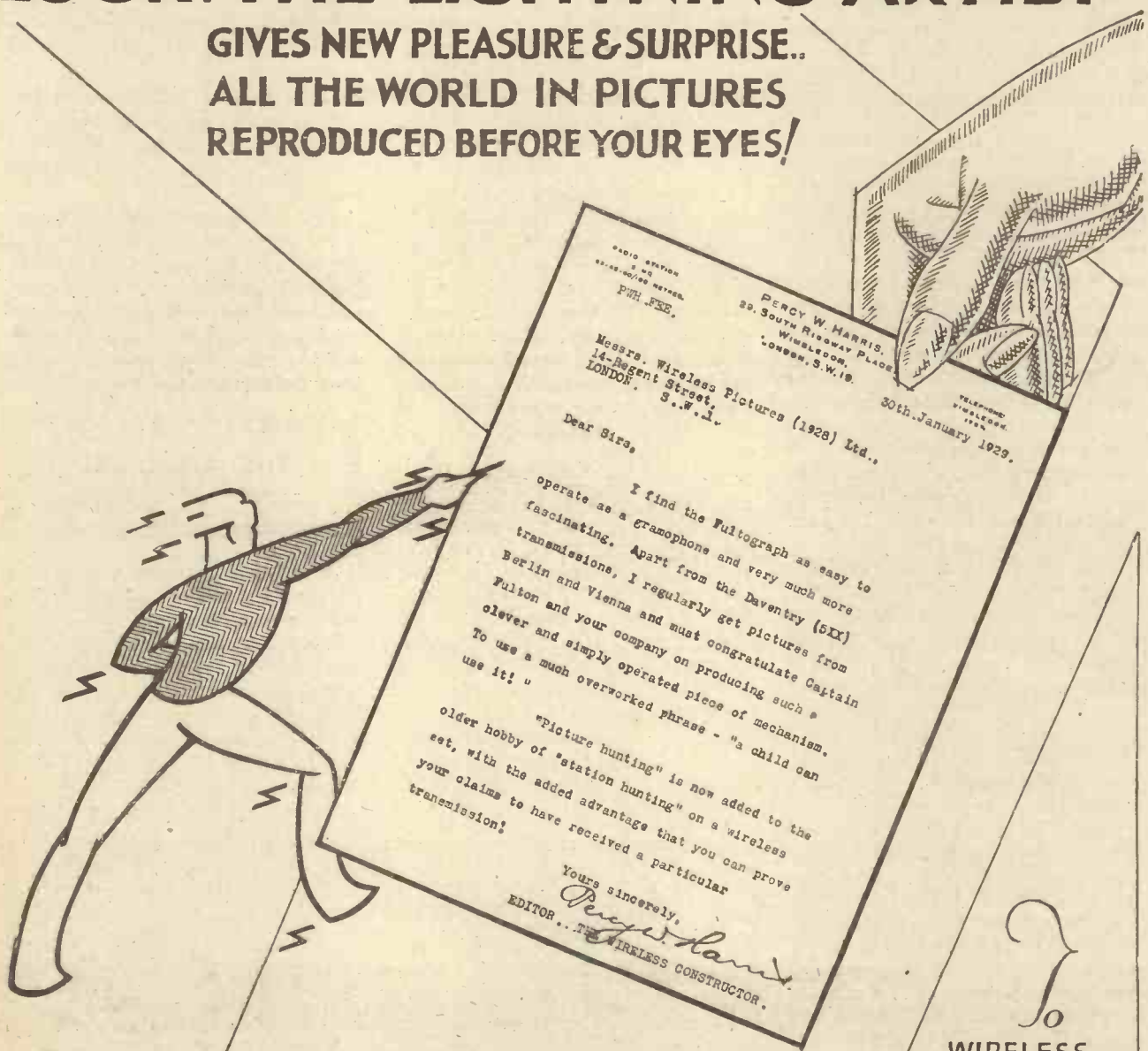
The wires from the little loud-speaker jack on the panel are disconnected altogether and removed, while the wires from the filament switch can be kept joined to their original connections, as they still connect to the switch in its new position.

The Volume Control

We now have to connect up the volume control, the terminals and the pick-up switch. The first thing to do is to disconnect the ·25-megohm H.F. stopper (which is connected in series with the grid of the first L.F. valve) from the G terminal of the resistance unit. This *latter* is now connected to *one* side of the pick-up switch. In the actual alteration which was done on the original set it was connected to the right-hand side of the switch looking at it from the back of panel.

LOOK! THE LIGHTNING ARTIST

GIVES NEW PLEASURE & SURPRISE..
ALL THE WORLD IN PICTURES
REPRODUCED BEFORE YOUR EYES!



"Here's this letter from Mr. Harris. He knows, anyway. Of course, he's an expert, while I'm only an amateur. But at least we're alike in one thing—we both speak from experience. I get pictures from Berlin and Vienna as well. Yes, I'm still using the same wireless set—gives me loud-speaker reception from Daventry, same as yours. No, it's unchanged—just the Fultograph connected to it in parallel with the loud-speaker. I made the Fultograph myself . . . bought the Kit of parts for £16. Assembly was quite easy by following the instructions. Yes, you can buy complete models—they cost £22 15s. in oak."

To
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PICTURES
(1928) LIMITED

Dorland House,
14/16 Regent St., S.W.1.

Please send me full particulars of the "Fultograph" together with Kit prices for Amateur Constructors.

Name .....

Address .....

.....

Please write in BLOCK Letters LA/MW.

FULTOGRAPH

A connection from the ·25-meg. H.F. stopper is now taken to the *centre* of the switch, while a lead is taken from the *left*-hand, i.e. remaining contact of the pick-up switch, to the centre of the volume control, which is just beneath it.

Completing the Connections

All that now remains is for the volume-control terminals (the two outside terminals) to be taken to the pick-up terminals. It does not matter how this is done, whether the right-hand volume terminal goes to the top or the bottom pick-up terminal, or whether the left-hand one goes to the bottom or to the top, but it must be remembered that the one which goes to the bottom pick-up terminal should also have a lead attached to it going to an extra grid-bias negative plug. This has to be inserted in the grid-bias battery at about – 1·5, and when this has been done the alterations are complete.

You will now find that with the pick-up switch either " in " or " out," whichever pattern is used (in the case of the original set it was with the switch " out "), the first L.F. valve is disconnected from the detector and connected direct to the volume control. With the pick-up switch " in " the L.F. valve is connected to the detector, and not to the volume control.

So with just a movement of this switch one can go from radio to the gramophone and back again in far less time than it takes to tell you about it. It will rest with the individual, if he is going to use the set for just a very short programme of records, say, just one or two, whether he opens the back of the set and loosens the little plug on the filament switch, to cut out the first two valve filaments; but no difference will result in signal strength if the filaments of the first two valves are switched on or off when the gramophone is in action.

No Grid-Bias Alteration

That little switch is only put in for economy's sake, as naturally with a portable receiver and its small accumulator one does not want to waste ·25 or ·3 of an ampere in the consumption of the set. All the H.T. connections remain the same and the grid-bias connections are unaltered.

As the first L.F. valve is completely disconnected from the resistance-coupled unit when the pick-up switch is in the gramophone position, the grid bias from that valve does not have to be altered when the switch is manipulated. Similarly as the valve is completely disconnected from the pick-up when the switch is in the radio position, the grid bias attached to the pick-up terminal does not have to be altered when a radio programme is being received.

To connect the pick-up to the set, all one has to do is to make the connections from the lead to the pick-up terminals and everything is ready. Naturally, manipulation of the variable condenser makes no difference to the volume and strength of the pick-up reproduction, while variation of the volume control makes no difference to the volume obtained from radio. These two are completely isolated from one another, and only come into action when radio and gramophone respectively are the order of the day.

An Extra L.F. Stage

Should the more venturesome decide that they would like to have another L.F. stage and decide to put the pick-up switch between the H.F. valve and the detector, I would advise them to mount the switch on the panel to the right of the variable condenser instead of to the left (looking at the back of panel.)

In this case, of course, the original filament switch can stay where it is, and only the loud-speaker jack has to be removed. The connections in this case would, of course, be very similar, except that one would have rather a long pick-up lead running inside the set. The grid of the first valve, the detector, now goes straight to the centre of the pick-up switch, one side of the switch to the grid leak and condenser (the grid leak in this case being the vertical one), and then the other side of the switch would be taken to the centre of the volume control as before.

There is, however, a tendency to upset the stability of the set when used on the radio side if one does the alterations in front of the detector, but the extra magnification obtained is useful in many cases, and those who wish to try it may find it worth their while.

This risk of upsetting the stability of the set on the radio side, owing to the fact that the grid of the detector has got to go right across to the panel and back again to the grid leak and condenser, is only slight, however, and the extra stage is worth trying from the experimental point of view.

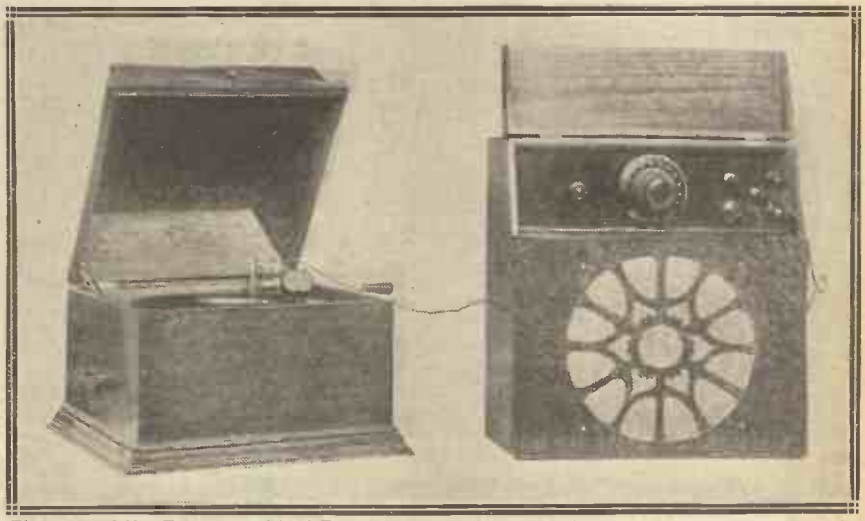
THE IDEAL SET

—continued from page 450

is the "ideal" set to use with a pick-up, he replies that it is the same as the ideal set for radio.

When once this question has been decided, then the answer is obvious, always provided, of course, that the set has sufficient L.F. stages to enable a pick-up to be used with real efficiency.

Quality in reproduction is the one essential, a good amplifier and a good loud speaker are always necessary, and given a good set and a good loud speaker, the " ideal " is more or less what you make it. So before you grumble at your present set, make sure you know all its faults—and then remedy them. It might quite easily turn out to be " ideal."



The "M.W." "Transportable" Four in use with a pick-up drive. The alterations to the panel of the set can be seen on the right—the symmetry not being spoilt in any way.

ROUND THE TURNTABLE

A page of odds and ends of interest and value to all radio and gramophone enthusiasts.

Amplifier Instability

L.F. instability in a gramophone amplifier shows up in many different ways, not the least annoying of which is that produced every time the hand is placed on the pick-up for the purpose of changing the needle.

In cases such as this it is often possible to cure the trouble by earthing the tone-arm of the gramophone. It is doubtful if this would be of much help though if the pick-up is fixed to the tone-arm by means of a rubber adaptor.

A Curious Fault

While on the subject of L.F. instability, I am reminded of a curious fault which but for the observance of a guest might easily have spoiled a radio-gram dance at which I was present. During the playing of each record a periodical howl occurred for no apparent reason whatever, and the annoying part was that the howl was of sufficient magnitude almost completely to spoil the tune being played.

One of the guests happened to notice that the howl was only produced when dancers were on the floor, and it was this observation which led to the location of the trouble.

The gramophone and the loud speaker were for convenience situated in the same room (the dance room), but the actual amplifier was placed in another room. The pick-up leads were carried round the floor on one side of the room, and out through the door to the amplifier under a stretch of linoleum.

The leads to the loud speaker trailed round the other side of the room, but they met, and ran parallel with, the pick-up leads under the linoleum. This, as was afterwards proved, was the cause of the trouble, for every time dancers crossed the linoleum the howl was produced.

I did not see the amplifier, and perhaps it was as well!

Jack Switching

There appears to be considerable misapprehension as to the best type of jack to use in order to make the broadcast set readily convertible from radio to the gramophone.

The actual type of jack best suited for this position is dependent upon whether the set employs H.F. stages.

THIS MONTH'S PICK-UP PROGRAMME.

ORCHESTRAL.

Wedding March (Mendelssohn) .. H.M.V. D1568
San Francisco Symphony Orchestra.

INSTRUMENTAL.

Album Leaf (Chabrier) .. H.M.V. DA812
Renée Chemet (Violin).
Shenandoah .. .. .. Col. L2186
W. H. Squire ('Cello).

OPERATIC.

E lucevan le stelle (Puccini) .. Col. 5211
L. Graveure.
Cavatina di Zerlina (Auber) Parlo. 10817
Margherita Salvi.

VOCAL.

The Blind Ploughman .. H.M.V. DA993
Theodore Chaliapine.
Columbine's Garden .. Col. 5212
Hubert Eisdell.

BAND.

Ballet Egyptien .. .. Zono. A354
National Military Band.
Wee Macgregor Patrol .. H.M.V. B.2924
Coldstream Guards Band.
Under the Double Eagle March Parlo. E6128
Massed Military Bands.

POPULAR ORCHESTRAL.

Gold and Silver .. H.M.V. C1617
International Concert Orchestra.
Mississippi .. .. .. Col. 9624
Jack Payne and the B.B.C. Concert Orchestra.
Martial Moments .. .. Parlo. R285
London Coliseum Orchestra.

POPULAR VOCAL.

All by Yourself in the Moonlight Col. 5238
Layton and Johnstone.
Sonny Boy .. .. H.M.V. B2948
Paul Robeson.

DANCE.

Shout Hallelujah .. .. Zono. 5270
The Rhythmic Eight.
It Goes Like This .. Parlo. E6131
Comedy Dance Orchestra.

With a straightforward "det.-L.F." arrangement, where it is desired to place the pick-up across the grid and filament of the first valve, a jack of the single-circuit-closed type is required. In sets where the detector is preceded by one or more H.F. stages, however, it is necessary to use a jack of the single-closed filament type in order that the H.F. valve filaments can be extinguished automatically when the plug is inserted.

The King's Gramophone

Considerable interest will be aroused in the pick-up world by the announcement contained in a daily paper recently to the effect that His Majesty's gramophone is played by means of a pick-up and loud speaker.

According to the report, the outfit consists of an electrical gramophone and pick-up, the output of which is passed through a two-valve amplifier to the loud speaker.

The Overloading Bogey

During the course of some recent experiments, I found that quite good 'phone signals could be obtained from a gramophone record by connecting the 'phone leads direct to those of the pick-up. Since the output from the pick-up was sufficient without any extra amplification to work the 'phones at good strength, it shows that there is a slight possibility of overloading in the first valve of the amplifier.

The danger of overloading is not great even with an output of this strength, but at the same time it is just possible that a loud needle passing over a particularly heavy passage might produce a variation of sufficient amplitude to cause slight overloading.

In this connection it is always a very useful idea to use a volume control connected directly across the pick-up winding.

Which Needle is Best?

Considerable doubt seems to exist as to the best type of needle to use in the pick-up. This question largely depends upon the sensitivity of the pick-up and the degree of amplification in the gramophone amplifier.

In exactly the same way as one can vary the volume from an ordinary gramophone by using a loud, medium, or soft needle, so the sensitivity of the pick-up can be regulated. The design of the pick-up also has some bearing on the choice of needle.

RECENT RECORD RELEASES

Broadcast Records

Last month we were unable to discuss the Vocalion "Broadcast" records owing to their arrival just as we were going to press. This month, therefore, we have two lots to deal with, and a very interesting selection they form.

Starting with last month's releases we have some excellent "Twelves," including items from Stainer's ***The Crucifixion,*** and consisting of two double-sided records, sung by the City Temple Choir (5043–4). Another pair of discs give us ***Vocal Gems from Lilac Time*** (5045–6); while ***Finlandia*** (Sibelius), by the Band of H.M. Life Guards, assisted by the Stoll Picture Theatre Organ, is worth hearing (5049).

This month's "Twelves" include the following: ***Gems from The Mikado,*** in four parts (two records) (5051–2); ***The Blind Ploughman*** and ***Friend o' Mine,*** by Ceredic Jones (Bass Baritone), on 5057, acc. by the Stoll Orchestra and Organ—an excellent record; ***Nirvana*** and ***Thora,*** by Frederic Lake (Tenor), with orch. acc., on 5058—two firm old favourites among the ballads; and ***The Merry Widow,*** played by the Band of H.M. Life Guards, on 5056—a brisk double disc.

Also we have Bidgood's Symphonic Dance Band playing ***A Hunting Medley*** (one-step) and ***Community Medley*** (one-step) (5054); and ***Popular Musical Comedy Waltz Medley*** and ***Popular Classical Waltz Medley,*** on 5053. Both interesting records. Finally, ***The Children's Overture,*** by the Metropolitan Symphony Orchestra, on 5055, is worth the attention of pick-up users.

Among the Broadcast "Tens" (1s. 3d. records) we have many interesting items, including:

Glad Rag Doll (S.F.T.) and ***Dusky Stevedore*** (F.T.) (351); with ***Nobody's Fault But Your Own*** (S.F.T.) and ***My Southern Home*** (F.T.), on 352; and ***A One-Man Girl,*** from "Mr. Cinders" (F.T.), and ***Spread a Little Happiness*** (F.T.) from the same show (350). All by the Original Havana Band.

Further interesting and excellent items are: ***I'm Crazy Over You*** (F.T.) and ***Misery Farm*** (F.T.). Bidgood's Broadcasters (355).

The Bugginses' Family Group and ***Grandma and Bert in Mixed History.*** Mabel Constanduros and Michael Hogan (357).

Salut D'Amour (Elgar) and ***Sanctuary of the Heart*** (Ketélbey). Stoll Picture Theatre Organ (359).

Men of Harlech and ***All Through the Night.*** The Cenydd Glee Singers (Unemployed Welsh Miners) (361).

H.M.V.

One invariably gets good stuff from the H.M.V. studios, and the numbers given below are no exception to the rule. Theodore Chaliapine gives us a delightful ten-inch disc, sung in English, and containing ***The Blind Ploughman*** and ***Oh! Could I But Express in Song,*** on DA993. This, as expected, is an excellent record, and should be included in everyone's gramophone library.

Among the orchestral classics one finds the London Symphony Orchestra, conducted by Albert Coates, playing Bach's ***Fantasia and Fugue,*** arranged by Elgar, on D1560, while ***Tales of Hoffmann*** and ***Mignon*** (Vocal Gems), recorded by the Grand Opera Co., on C1641, forms a bright and tuneful disc.

Getting a Wife and ***Getting a Motor,*** two scenes from "Our Betters," by Ronald Squire and Constance Collier, form a good light record on C1640.

For good reproduction on an electrical reproducer these H.M.V.'s are certainly hard to beat.

Parlophone Records

These are as interesting and excellent as usual and contain some extremely fascinating items for lovers of "hot" dance music. ***Just So-So!*** and ***Eniale Blues,*** by Boyd Senter (Clarinet), with Ed. Lang (Guitar) and Arthur Schutt (Piano), R283, both form excellent examples of "hot" clarinet playing. The famous dance trio are as good as ever.

Another "hot" item is ***Sentimental Baby*** (F.T.), by Frankie Traumbauer's New Rhythm Orchestra; while on the other side is ***Louisiana*** (F.T.), by Bix Beiderbeck and his Orchestra. Both good items and well recorded (R298).

Spread a Little Happiness (F.T.) and ***I'm a One-Man Girl*** (Yale Blues), from "Mr. Cinders," and played by Arthur Rosebery and his Kit-Cat Dance Band, are excellent tests for a pick-up outfit (R303).

Of the "variety" type we have Mona Grey in ***Entertaining Peter,*** in two parts (R292); while a really modern classic is provided on a twelve-inch by Elgar's ***The Selfish Giant*** (E10806). This is perfectly recorded, but rather uninteresting except to the more highbrow lovers of classical orchestral music.

Zonophone

From the British Zonophone studios we have a goodly choice of fare. Further Gilbert and Sullivan Vocal Gems, this time from ***Patience*** (Part 3), and ***Pirates of Penzance*** (Part 3), are provided by the Zonophone Light Opera Co., on A353; while the National Military Band has recorded an excellent disc of the ***Ballet Egyptien*** (A354).

Among lighter items must be mentioned the London Orchestra in ***Valse Memories*** (5257), and a selection from ***Blue Eyes*** (5256). Brilliant recording with a "life" that is seldom equalled.

Of the dance items, the best, as usual, from the dance music lover's point of view, are those by the Rhythmic Eight. ***What a Wonderful Wedding That Will Be*** (F.T.) and ***Arms of Love*** (W.), together with ***Shout Hallelujah 'Cause I'm Home*** (F.T.) and ***Don't Be Like That*** (F.T.). These should certainly not be missed. These items are on 5269 and 5270 respectively.

RADIO NOTES AND NEWS OF THE MONTH

A feature in which our Contributor brings to your notice some of the more interesting and important Radio news items.

Conducted by "G. B."

The Brussels Plan

As these words are written, Captain Eckersley is attending a Meeting at Geneva of the International Union to discuss the working of the so-called Brussels Plan, which recently, on January 13th, resulted in the change of wave-length of British and other European stations. It is understood that as a result of this meeting a report will be drawn up for a Convention of Governments to be held in Prague some time in April.

Wobbling Wave-Lengths

The Brussels Plan has certainly not been the success that it was thought it might be. A small improvement was noted to begin with; it was, however, only temporary, but during the last few weeks complaints have been growing as to the numerous cases where stations are not keeping to their wave-lengths, and instances where interference has become even worse than ever.

The trouble seems to be that either stations abroad are careless and will not alter their wave-lengths in accordance with the Plan, or else when they alter the wave-length they do not keep to it.

This has been explained in some cases as being due to unsuitable and antiquated apparatus, and also a lack of discipline among stations abroad. One could understand a certain amount of flitting about before the stations settle down on their new wave-lengths, but the annoyance caused to other stations and the chaos created in many districts is really quite exasperating.

An April Convention

It is to be hoped, however, that the Union will attempt to straighten out the confusion so that when the Convention meets in Prague this month the Brussels Plan may be judged fairly and on its merits.

Listening to the Antarctic

Listeners all over the United States and in many other parts of the world heard late in February, for the first time, a message broadcast from the Antarctic when Pittsburg wireless station relayed a message from Commander Byrd in the Bay of Whales. K D K A has been sending out weekly messages to the Byrd Expedition from the members of the Expedition's families and friends, and also a programme of entertainment.

The message picked up and relayed from Commander Byrd was one of thanks for this service. We wonder if any of our readers by any chance heard it?

New Zeal in New Zealand

It is reported from New Zealand that wireless receiving licences up to December 31st, 1928, amounted to 42,801, an increase of 4,616 for the twelve months. Transmitting licences

(*Continued on page* 464.)

RADIO NOTES AND NEWS OF THE MONTH

—continued from page 462

numbered 169, compared with 136 for 1927. Figures undoubtedly show that the popularity of wireless is increasing. There are four broadcasting stations in New Zealand—in Auckland, Wellington, Christchurch and Dunedin.

Russia's Radio

Since the beginning of 1929 the broadcasting service in Soviet Russia has been placed in the hands of the Commissariat of Posts and Telegraphs, and four times a day listeners may hear Moscow stations broadcast information relative to Soviet events at home and abroad.

Also, these stations have lately begun to broadcast Government speeches, scientific lectures and debates, etc., and a Radio University has now been opened, the lectures of which are only given by radio. It is stated that on October 1st, 1928, there were 326,285 registered radio sets in the U.S.S.R., roughly one and a half times as many as in 1927. In August a new radio station is to be opened in Moscow, with a power of 75 kilowatts.

Nearing Three Millions

According to the B.B.C. estimates, the number of listeners during December, 1928, and January, 1929, increased by about 500,000. The increase for the two months is stated to be 20,000 more than the figures for the same months last year. The total number of licences is now 2,684,941.

Picture Programme Times

The new Fultograph picture transmission hours are now in force, as follow:

Afternoon transmissions, 5 X X—2 o'clock to 2.25 on Tuesdays and Thursdays.

Night transmissions, 2 L O and 5 X X—12 midnight to 12.15 a.m. on Mondays and Fridays.

5 G B—11.15 to 11.45 p.m. on Wednesdays and Saturdays.

"St. Joan" to be Broadcast

One of the big Play events of the year will be on April 25th and 26th, when George Bernard Shaw's great play, "St. Joan," will be broadcast from the London studio in two parts; the first part, on April 25th, will take the play as far as the end of the scene before Orleans, and on April 26th the second part will open with the tent scene between the Earl of Warwick and the Bishop of Beauvais.

The Time Factor

The B.B.C. states that it has divided this play on account of its length, and each part will take approximately two hours, but nevertheless it is very regrettable that the continuity of such a play as "St. Joan" should be spoilt because of the time factor This is a play which should undoubtedly be given in its entirety or not at all.

(*Continued on page* 466.)

RADIO NOTES AND NEWS OF THE MONTH

—continued from page 464

Lounges for Listeners

A suggestion has been made for the provision in London of places for listening-in, where, for a small nominal charge, and in conditions similar to those in the more up-to-date cinemas, it would be possible for people to hear radio programmes in comfort.

This idea seems to have aroused quite a lot of interest. Sir Landon Ronald, the famous conductor, has agreed that the best set would be essential for appreciating the musical programmes, and the B.B.C., although not making any promises, seems to have given every sympathy to the idea. Whether it will come to anything, of course, remains to be seen.

* * *

World's Finest Orchestra

It is understood that the first real move will be made shortly towards the formation of the finest Symphony Orchestra in the world. This will be due undoubtedly to the close co-operative work between Sir Thomas Beecham and the B.B.C. These negotiations, the progress of which has been reported in MODERN WIRELESS and "Popular Wireless" step by step, have now reached a satisfactory conclusion, and auditions are now being held with a view to selecting musicians for the orchestra.

The Promenade Concerts

Talking of musicians reminds me that arrangements have now been made between the B.B.C. and Sir Henry Wood for another series of Promenade Concert broadcasts this year. Sir Henry Wood will again be the conductor.

It is understood that the broadcasts of the Promenade Concerts from the Queen's Hall will be more numerous this year, as the B.B.C. realised last season that broadcasting the concerts did not keep people away from the hall itself.

2 L O on the Prairie

Mr. Charles Bowman, a member of the Royal Canadian Commission of Broadcasting, has been touring the Continental radio centres. He was back in London again last week, and said he looked forward to the day when the lonely prairie settler will hear those magic words, "London Calling," and will enjoy an hour or two of the B.B.C.'s entertainment which, in Mr. Bowman's opinion, is the best in Europe.

* * *

"Like Topsy—It Just Growed"

"Our radio system in Canada," Mr. Bowman explained to a newspaper man, "is something like Topsy. It just growed. It is mostly controlled by private enterprise. We have had great help from the B.B.C., and are returning shortly to report to the Dominion Government. We have been impressed by the high standard of your programmes, the excellence of the musical entertainment, and the clearness of transmission."

DRIVING THE DIAPHRAGM

—continued from page 420

such a great variation of the air gap as would be the case at A.

In the case of the balanced unit it is possible to arrange that only the flux due to the winding shall flow through the length of the armature, whilst much of the heavy flux due to the permanent magnets shall take a different path. One such arrangement, resembling that used in the Western Electric "Kone," is illustrated in Fig. 5. Here N and S represent the poles of a permanent magnet, A a specially light armature, and B and C the two halves of the winding.

A Bad Practice

These coils are wound on two hollow bobbins, and the armature is suspended so that it is pivoted in the centre. A current passing round the coils will induce an opposite polarity at the ends of the armature, which will be displaced towards one or the other of the poles N and S, according to the direction of flow of the current. When the armature is mounted on a suitable reed to hold it in position it is obvious that it may be employed for driving a loud-speaker cone.

Lastly, we come to the question of the reed itself. The chief feature of the reed should be elasticity, which necessitates a certain degree of hardness in the material of which it is constructed. As the iron of which the armature is made should be soft, the practice often adopted of fashioning reed and armature from the same material is bad.

The experimenter will find ordinary cane one of the most convenient materials to use, suitable dimensions being: length between supports $1\frac{3}{4}$ in., width $\frac{3}{8}$ in., thickness $\frac{1}{8}$ in. The armature should be very firmly fastened to the centre of the reed, and the reed supported at both ends.

Read Resonances.

It is in the reed that we encounter one of the most serious disadvantages of the moving-iron drive. Since the reed has elasticity and the armature weight it follows that the combination will have a natural period of vibration. If this reed resonance is not to mar the reproduction it must be so adjusted as to fall either above or below the extreme limits of the audible range, that is, on one side or the other of the band of frequencies between 30 and about 8,000 cycles.

For the best result it should fall below the 30-cycle limit. With the moving-iron drive such a reed would be so flimsy that it would be quite incapable of holding the armature away from the magnet. For this reason the reed is always arranged to be resonant to a frequency above the audible limit, with the unfortunate result that the lower musical tones are somewhat constricted.

SEVEN USEFUL TIPS

The most common H.T. fault is the use of a battery or mains unit incapable of supplying sufficient current at the required voltage.

* * *

It is much better to underwork an H.T. battery than to overwork it, for if excessive current is drawn the life of the battery is shortened considerably.

* * *

When an H.T. battery runs down not only does the voltage drop, but the internal resistance of the battery goes up.

* * *

The use of an old H.T. battery means that the wrong H.T. voltage is being applied, and a certain amount of resistance due to the old battery has been added to the circuit.

* * *

Generally speaking, the higher the voltage applied to the last (suitably biassed) valve the greater is the chance of distortionless reception.

* * *

As individual valves vary a good deal with regard to their H.T. requirements, it is advisable to readjust the H.T. positive when a new valve has been fitted.

* * *

When adjusting the H.T. or grid-bias plugs of a power stage do not forget that the set should be switched off until the adjustment has been made.

THE NEW B.B.C. BOARD

It was reported in the "Daily Telegraph" recently that half the term of service of the present Board of Governors of the B.B.C. will have elapsed at the end of June, and consequently the new Board will be under consideration by the Government in the course of the next eighteen months.

Although it is not anticipated that the Earl of Clarendon will resign the Chairmanship of the Board, should he do so it is thought that Lord Gainford's name will come up for consideration for the post, and it is very probable that Captain Ian Fraser would, in that case, be appointed Vice-Chairman—the position at present held by Lord Gainford. This carries with it a salary of £1,000 a year.

It is said that, of the Governors, probably Mrs. Snowden is the most active, and her correspondence on many aspects of broadcasting is reported to be very large. Lord Clarendon's interest is now chiefly centred on bringing forward new programme ideas, while some of his criticisms in the House of Lords on broadcasting have thrown a new light on his lordship's interest in the welfare of the B.B.C.

Sir John Reith

Dr. Rendall is reported to be chiefly interested in questions of educational policy in co-operation with Mr. Stobart, the Director of Education. Sir John Reith, the present Director-General, it is reported, is not likely to relinquish his post, but if he should it would undoubtedly be very difficult to fill it with a man capable of in any way approaching the devotion, organising ability and conscientiousness which Sir John has displayed.

THE "M.W." "EASY-CHANGE" CRYSTAL SET

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you must first of all place the cat's-whisker against the face of the crystal, but you will have to find the most sensitive crystal setting by trial when you hear signals.

Find the position on the semi-variable condenser which gives the loudest signals and lock the adjusting spindle in position. If now you wish to receive 5 G B, leave the semi-variable condenser which you have already adjusted, pull out the wave-change switch, and rotate the adjusting screw on the second condenser until you hear the desired signals. If your "local" has a higher wavelength than 5 G B you will have to reverse this procedure.

When you have found the best setting, lock the adjustment and you will now be able to change over from one station to the other by just pulling out or pushing in the switch.

By experimenting with the various aerial tappings and by placing the crystal across different proportions of the fine wire winding you will be able to find an average setting which will give you first-class results on both stations.

Using the Loading Coil

If one station is strong and the other weak, concentrate on the weak station and adjust the tapping adjustment to suit this particular signal, although in so doing you may lose a little strength on the other transmission. To receive Daventry, remove the short-circuiting bar across the loading coil holder and insert a No. 150 coil in the socket, and readjust the first condenser, setting the second for whichever programme you wish to use as your alternative.

Hence, if 5 G B and 5 X X are the two stations you wish to receive, then you must tune-in 5 G B on one of the condensers, and after inserting the coil adjust the other one for 5 X X. When you remove the loading coil always replace the "shorting" bar.

PORTABLE SET PROBLEMS

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of the kind generally connected with mains units.

It is a good plan when designing a portable set to pick highly efficient and high-magnification valves for every stage, so as to see whether there is any general tendency to howl. This does not mean to say that you will choose all such valves in your final assembly, but it is a good plan to try and provoke trouble in this way. It is quite simple to obtain stability in a set by choosing low-efficiency valves. Stability purchased in this way is not worth having.

It is useless to design a portable set on paper alone and then expect it to work perfectly without practical

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PORTABLE SET PROBLEMS

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experimenting. For example, in one portable set I worked out, which had a very great popularity, the set was extremely microphonic and gave great trouble with the microphonic type of howling with the first layout.

Wave-Change Switching

When the valve holders were set back half an inch from the original positions the microphonic troubles ceased. In this case, of course, the reflection of sound waves from cabinet walls undoubtedly had a good deal to do with it. Only those who have had practical experience in designing portable sets can realise what small points have a bearing on overall efficiency.

In the majority of cases, hand- and body-capacity effects are due to the leakage of high-frequency currents to the low-frequency side, making the whole set alive with high-frequency currents. If your portable set howls violently when you touch the loud-speaker terminals there is something wrong, and it should be remedied.

The best cure for trouble of this kind is to place a quarter-megohm grid leak in series with the grid terminal of each low-frequency valve, while the plate of the last valve should have a condenser shunted from it to negative filament as close as possible to the valve holder. The first L.F. coupling should also be shunted by a condenser.

Wave-changing is, of course, easiest effected when there is only one tuned circuit, and Fig. 1 shows a few practical ways. For simplicity the frame aerial has been drawn as a simple coil. Fig. 1A shows how two equal-sized frames can be used in series for the long waves and in parallel for the 200- to 600-metre band by a double-pole double-throw switch.

To give you an idea of size it may be said that the two coils can each be 28 turns of No. 24 D.C.C. wire on a frame of 12-in. size, the turns being wound practically touching. This scheme is quite good where no reaction is needed on the frame. If it is desired to include reaction with this frame a very carefully worked-out design is necessary. Fig. 1B shows a scheme I have myself used quite successfully with two separate frames, one having 14 turns of wire on a frame with 12-in. sides, tapped at the third turn from the bottom, and the other with 56 turns on the same size of frame, tapped at 12 turns from the bottom.

Avoiding Damping

On the long-wave side the short-wave frame is left disconnected, although, of course, the points joined to filament in each case are common. On the short-wave side the long-wave frame is joined in parallel with the short-wave, thus completely avoiding any dead-end effects. No trouble is experienced from the presence of the short-wave frame when using the long-wave, but without such a scheme if we have the long-wave frame near-by when the short-wave is in circuit, the long-wave frame will have a severe damping effect on the short.

By placing the long-wave frame in parallel with the short-wave the total inductance of the short-wave frame is only slightly lowered.

A Third Method

The third method, shown in Fig. 1C, is used for quite a number of commercial sets and consists of inserting a loading coil for the long waves. This scheme is not so efficient as a separate long-wave frame.

Assuming that you have a good loud speaker (and many are obtainable at very reasonable prices), good quality will depend on absence of low-frequency reaction, absence of high-frequency currents in the low-frequency side, good quality inter-valve couplings, lack of battery coupling, and adequate high-frequency magnification to obviate the excessive use of reaction.

Battery coupling can be largely reduced in many cases by placing a resistance of 20,000 ohms in the plate

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PORTABLE SET PROBLEMS

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of the detector valve at the point where the coupling transformer or resistance is normally attached to the high-tension lead.

On the coupling unit side this should be shunted to filament by a 2- or, better still, a 4-mfd. condenser. When a screened-grid valve is used preceding the detector, the anode-feed scheme is also helpful, and as here we are dealing purely with high-frequency currents and do not wish to cut down the voltage to the anode more than we can help, a 3,000-ohm resistance and a ·01-mfd. condenser is useful. In some it will be found that a seemingly microphonic effect is obtained from the screened-grid valve in a long and persistent ringing noise, particularly marked when waves from the loud speaker are able to impinge on the valve, as may happen with certain angles of the lid. I have found this can often be completely cured by reversing the secondary leads of the low-frequency transformer.

CHOOSING VALVES FOR PICK-UPS

From a Correspondent

CHOOSING suitable valves for pick-up work is not a difficult task, providing one bears one or two important things in mind. The first of these is that, assuming that you are going to use the set also for radio reception, you will be using the detector as the first low-frequency valve when the pick-up is in operation, and therefore this valve must be capable of handling the volume applied to it from the pick-up without distortion.

Less Volume Obtained

Furthermore, as you have no chance of H.F. amplification or reaction when the pick-up is in use the low-frequency side of your set must be capable of giving sufficient magnification to enable you to get sufficient volume on the loud speaker without distortion.

An ordinary radio set somehow seems to give an amount of volume on radio which is never equalled by a pick-up outfit consisting of the same valves coupled in the same way. In other words, if you take an ordinary radio set, say, of the four-valve variety, using a H.F., detector, and two L.F. stages, then couple a pick-up to the set, using the detector as the first L.F., it is usually found that the set is capable of giving stronger signals when used on radio than it is when used on the pick-up, unless loud records are being employed.

So, when running a radio receiver for use with a pick-up as well as radio, one must have the valves specially chosen, control the radio volume, and bring up the pick-up volume as required, by carefully selected L.F. valves.

A Practical Example

For instance, the writer knows of a set consisting of four valves; the first being an ordinary neutralised H.F. valve, followed by a resistance-coupled detector using a H.F. valve, followed by a moderately low-mag. L.F. valve, and then an output valve of the P.625A type.

On radio this set gave quite good strength on a large speaker, and in most cases on the local and on 5 G B it would certainly have to be detuned quite considerably in order that distortion due to overloading in one or other of the stages should not occur.

When a pick-up was tried, however, the strength was not nearly enough, and an R.C. first stage (detector) valve was tried. This was quite useless as a pick-up first L.F. stage, for the pick-up overloaded it on anything but a soft record.

A volume control across the pick-up, of course, did the trick of keeping the volume down to prevent overloading of the R.C. valve, but when such was the case the total output strength was nowhere near sufficient for really good reproduction, and was certainly nothing like as strong as that obtained by radio.

It was therefore decided to change the R.C. valve back to the H.F.

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CHOOSING VALVES FOR PICK-UPS

—continued from page 472

valve, and thereby be able to use the maximum input from the pick-up, and then to tackle the L.F. valves. This was done, and the volume went up considerably, but still it was less than that obtainable by radio on the same receiver, and the H.F. valve was not getting all it could carry from the pick-up.

Changing the Super-Power Valve

The lack of strength was partly due to the output valve, which, although excellent in every way and having a large grid swing, and capable of passing a large volume and giving great signal strength when supplied with a *big* input, was nevertheless not of high enough magnification factor to give adequate volume with the much weaker input passed to it from the pick-up when the gramophone was being employed.

Consequently it was changed for a P.625, which had twice the magnification factor, although the impedance was somewhat higher. This immediately worked a great change and pick-up strength came up to much better volume. Of course, the requisite alteration in grid bias had to be made, but no alteration was made in the H.T., which was still kept at 150 volts.

Had the P.625 been given its full voltage of 250 volts, then, of course, still greater signal strength would have resulted, but in a comparative test that would have been hardly fair, and so the same H.T. voltage was used throughout, the grid bias only being altered.

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CHOOSING VALVES FOR PICK-UPS

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When turned on to radio, however, the set now overloaded horribly at "full tune," the last valve distorting, and the set had to be detuned in order that pure signals could be obtained. When these pure signals were obtained, however, it was noticed that the signal strength was just as great as when the P.625A valve was in position. In other words, it was now possible to use the set on radio with the ordinary H.F. valve in the detector position, and a higher magnification valve in the last stage.

The Output Valve

It might have been thought that the magnification could have been brought up by using a higher magnification intermediate valve in the first L.F. stage of the radio set; this was tried, and a slightly higher magnification valve was found advantageous. But on increasing this magnification factor by using a steeper slope valve the pick-up caused overloading of this valve, and the one previously used was resorted to in the end, as this did the trick quite well without overloading.

No doubt just as big signal strength could have been obtained if we had increased the magnification factor of this valve and still kept to the old P.625A, but the handling of the set would have been difficult, due to the likelihood of overloading of this intermediate valve. It was therefore found best to keep the valve with its impedance of somewhere about 10,000 ohms and a magnification factor of 10, and to make up on the last stage.

Careful Consideration Necessary

Of course, all this was done by trial and error, and it is very often necessary to do it this way if one wants absolutely the utmost from a receiver. For average work it is not necessary to work so finely as was done in this case, but when choosing valves for a new set which is to be used as a Radio-Gram receiver, and which has to deal therefore with both radio and pick-up impulses, it is advisable to think carefully about the valves and to decide for oneself—by trial if possible—or, if not, by careful consideration of the makers' characteristics, which valves are likely to serve the dual purpose best.

THE ROMANCE OF EMPIRE RADIO

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the harmonics of 200-metre transmitters, either intentionally or otherwise. Early in 1923, however, the amateur world was buzzing with waves 100 metres long which were now permitted to amateurs in the United States, and it became clear that even shorter waves might be commercially used for long-distance communication, though, so far as our knowledge went, they were subject to almost complete fading at certain times of day and season.

Early in 1923 the great wireless companies began to investigate the matter. The Radio Corporation of America erected short-wave plant in Maine, and the Marconi Company arranged experiments based on the Cornish station of the company.

Birth of the Beam

The first commercial message on short waves was sent from Maine to Buenos Aires in September, 1923, but such messages were still subject to pronounced fading. The first British commercial messages organised by the Post Office, following their experiments of 1924, suffered from similar irregularities.

However, about this time the British Government ordered from the Marconi Company, on the recommendation of the Wireless Telegraphy Commission, a number of short-wave reflector stations—now called "beam" stations—for direct communication with the Dominions during certain hours of each day.

The Dominions followed suit, and thus the whole Empire scheme underwent, in less than a year, a considerable change. From our present point of view the interest of the story lies in the fact that on this occasion the change was brought about by a discovery, and not by a patented invention.

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THE ROMANCE OF EMPIRE RADIO

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In studying the history of the inventions concerned in a great venture, such as the Empire wireless network, we find that a few inventions become universally indispensable; others rank as mere alternatives to one another, giving almost equal performance; whilst still others, after a show of early promise, sink into oblivion.

We see that the inventor has often little choice or even foresight in respect of the future of his invention; that sometimes he does not know wherein his invention is meritorious or, indeed, which part of his invention to patent.

If there is any general rule, it is that the early inventions have the best chance of immortality and indispensability, and that those coming later tend to concern themselves with improvements in sections of the subject, or in details of the apparatus. Sometimes, however, a later invention earns the greater financial reward, for an improvement in detail may prove to be very profitable if it results in displacing something more costly to install or operate.

TALKING OF ANNOUNCERS

—*continued from page* 378

winning personality in our announcers. In a word—leadership.

I may be a little prejudiced, but I cannot help feeling that there is just a trifle too much "culture" about our present-day announcers. A hint too much of "superiority." That indefinable atmosphere which one invariably detects amongst platform speakers for the League of Nations. A suggestion that they are really beings from another planet, condemned for a while to share our poor mortal husk.

Never, for example, can I picture Mr. Suchanone, of 2 L O, as travelling fourteen in a carriage to Margate on a sticky Bank Holiday and making a cockle-lunch on the sands—if you take my meaning. Never am I likely to meet Mr. Asterisk, of Daventry, speeding to Blackpool at Lancashire Wakes' time upon his motor-bike, with "peach-perch" complete with "peach" behind him.

Instead, I am made very conscious that Mr. Suchanone lunches only at the Marlborough Club, and that Mr. Asterisk takes his holiday with the ducal house-party at Bagwigge Hall, shooting grouse over His Grace's moor. And to me, gazing upon the forest of aerials that bespread the network of mean streets and horrible slums south and north-east of the Thames—not to mention the awful "backs" of Leeds, Sheffield and the like—this seemingly studied aloofness on the part of our announcers from the simple humanities of life strikes as something more than a pity.

Straight-Jacketed Announcers

Surely it should not be difficult to hit the golden mean between the Homeric laughter of yesterday and the aristocratic precision of to-day. We all wish to hear our noble language beautifully spoken. But Shakespeare could write speeches for Oberon and Bottom with the turn of a page. Caliban and Ariel jostle each other within a couple of lines.

The B.B.C. is, I think, far too much afraid of criticism. Thus it plays far too much for safety. It straight-jackets its announcers. Hearts (or human nature), as W. S. Gilbert reminds us, beat with equal fervour in Belgrave Square and "the lowly air of Seven Dials." And I should like, as I say, to have the announcers given their heads occasionally to set those hearts a-beating, to move the humanity in us.

In the meantime, here are some of our old friends back again as Directors of Ceremonies. May we take that as a happy augury for the revival of the Spirit of Youth? Or have they (horrible thought!) emerged from retirement with beards and whiskers?

Heaven forfend so grievous a calamity in these dark days when we need all the cheer obtainable!

WIRELESS IN OTHER LANDS

South Africa

Since the installation of the beam service between Great Britain and South Africa over 300,000 messages were sent from South Africa last year, which represents an increase of about 100,000 upon the previous year.

S.O.S.

In order to ensure that no S.O.S. shall be missed, the United States Naval stations which broadcast weather and other information for the use of the Fleet have now arranged to cease transmission for a period of three minutes twice in every hour, and to switch over to listen for the S.O.S. on the "distress" wave-length used by shipping.

Radio Toulouse

Some severe difference of opinion has arisen between Radio Toulouse and the French Postal Authorities in connection with the operatic performances which have been given for some time from the Capitole Theatre. Instead of using a landline, a radio link is used and the performances are relayed from the Capitole Theatre to a special receiver which is situated on the Plateau de Balma, the wave-length used being 93 metres.

Plan de Bruxelles

The Plan de Bruxelles, of which such high hopes were entertained, is not working out according to programme, and Mr. A. R. Burrows, the Secretary General, has apparently received a great many criticisms of the Plan and suggestions for its amendment. There is a great deal of interference on the Continent, and although the interference problem is not nearly so serious in Great Britain it is by no means non-existent here. Since the change-over it is pretty definite that heterodyning has actually increased.

An American Invention

A new instrument for determining the height of an aeroplane above the ground was demonstrated recently at the New York Aviation Show. This instrument depends upon the principle of sending out waves and making observations upon the reflected waves. Using acoustic waves it is possible to determine the height by observing the time between the sending out of the sound and the returning of the echo, and this method has been largely used by ships for "acoustic depth-sounding." Of course, the velocity of sound in water is different from the velocity in air, and allowances have to be made accordingly.

The altimeter (as the new American device is called) may also be employed using radio waves by a special and ingenious system of triangulation.

Portugal

At present there is only one broadcasting station working in Portugal, and this is a private station operating under the call-sign of "Postus Amador POEEA, Lisbon, Portugal." The wave-length is about 310 metres.

Beam Transmission at Hartford

A new high-power station at Hartford, Connecticut, U.S.A., has adopted the beam transmission owing to the increasing ether congestion in the States. Another interesting feature of the plant at this station is that the full 100 per cent modulation is to be employed in order to make the greatest use of the 50 kilowatts of power available.

Automatic Telegraphy

A device has now been perfected which will send out S.O.S. signals automatically once it has been started. The machine is not unlike a small portable typewriter in appearance, and in addition to the S.O.S. it will also send, by wireless telegraphy, transmissions of latitude and longitude, call-signs and certain other signals, and can be operated by any one unacquainted with the code.

A Record

The R.A.F. wireless station at Cairo has sent a message to Croydon Aerodrome stating that telephone conversations sent out by an aeroplane, which was carrying out tests with a Marconi short-wave experimental transmitter, while flying over England, were distinctly heard in Cairo. This would appear to be a record in long-distance transmission from an aeroplane in flight.

Java to Buenos Aires

With commercial service by telephone between America and Europe and between Holland and Java, all records for 'phone communication have been recently broken. On October 16th, Bandoeng, Java, spoke with Buenos Aires (Argentina), via Kootwijk (Holland), and Berlin (Germany). The rather circuitous route of the message covered about 16,000 miles.

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