THE FLEXIBLE TWO—A NEW BAND-PASS SET

The Wireless World

AND RADIO REVIEW

4D

The Paper for Every Wireless Amateur

Wednesday, December 31st, 1930.

No. 592. Vol. XXVII. No. 27.

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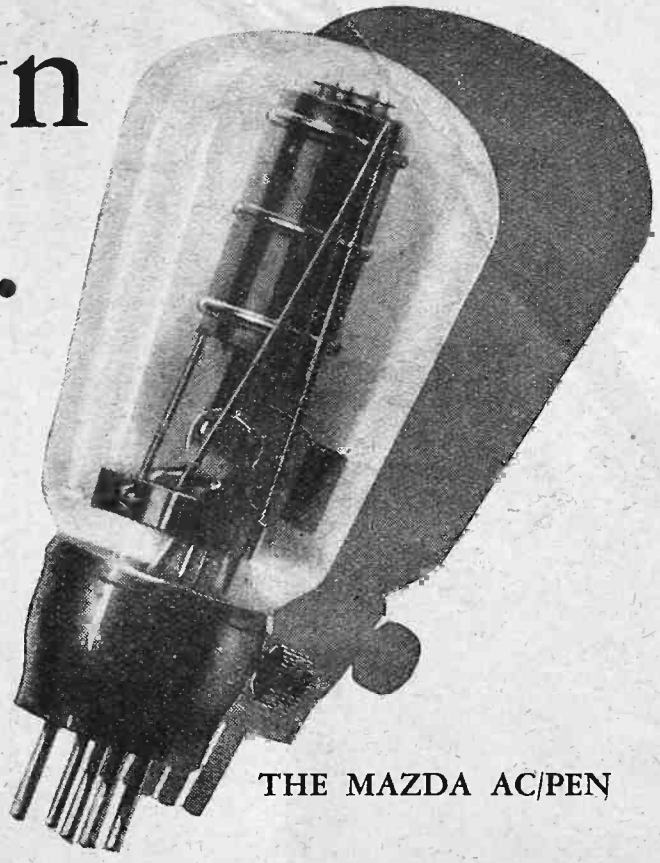

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Broadcast Relay Services.

IN general, every step taken which may help to encourage interest in broadcasting and increase the facilities for listening to programmes, should be supported; but it is always wise to consider any innovation in a critical spirit—however promising it may appear at first sight—and see whether it is really in the public interest.

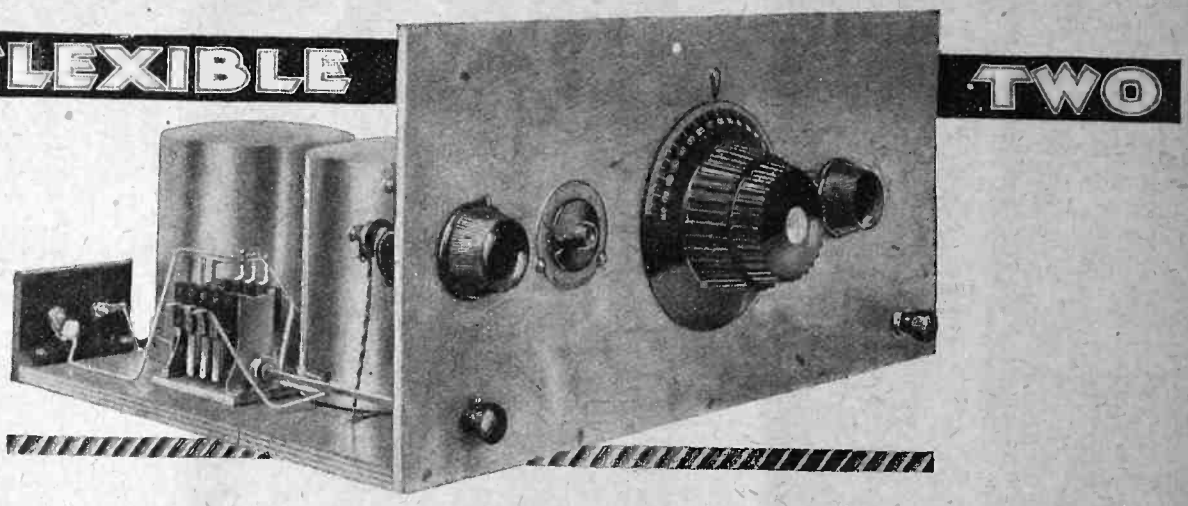
Broadcasting has, during the past year or two, provided the idea of establishing central relay services, the object of which is, first, to receive the broadcast transmissions on a powerful receiver and then to distribute the received signals over wires to individual homes. Those who subscribe to the service can then receive good-quality reproduction without owning an independent receiver. Naturally, no system of this kind could be established without first obtaining a special licence from the Postmaster-General, since the Post Office enjoys a monopoly in communication. The Post Office has, it would appear, given permission fairly freely for these broadcast exchanges to be set up by private individuals in different parts of the country, and subscribers, in turn, pay to the licensee a rental for the hire of apparatus and the lines connecting their homes with the central receiving station.

The effect of the establishment of these exchanges is likely to be far-reaching, and we are inclined to doubt whether the action of the Postmaster-General in sanctioning them is really in the best interests of the public, and whether it is not really a somewhat ill-considered action. To have broadcasting fed into your home so that you have no choice of programme, but only listen to that station which is being supplied from the central receiver, is to restrict, to a very marked degree, the service which broadcasting, under normal conditions of reception, can provide to the listener. It is hardly to be expected that those who subscribe to the one programme reception scheme will also trouble to own a broadcast receiver, so that the manufacturer suffers in loss of sales, and so also does the listener, whose service falls very short of that which he would enjoy if he owned a receiver and paid the ordinary annual licence of the Post Office.

Unless the charge made by the Post Office for a licence to run these exchanges is equivalent to what would have been obtained if the individual subscribers had each paid their 10s. annual licence fees, then the B.B.C. is being deprived of a portion of the revenue to which they would normally be entitled, and, of course, indirectly, the public is the poorer because the expenditure on programmes must, consequently, be curtailed. Nor have we, so far, seen any statement made which gives us any assurance that the sum received by the Post Office for these licences is actually shared by the B.B.C. It may, perhaps, be regarded as a separate item of Post Office revenue, to which the Postmaster-General considers the B.B.C. has no claim. It would be interesting to know the views of the B.B.C.

In This Issue

The FLEXIBLE TWO



An Inexpensive Detector-L.F. Set with Modified Band-pass Tuning.

By H. F. SMITH.

IT has hitherto been necessary to preface the description of a regenerative detector-L.F. set which includes a two-circuit tuner by the statement that it will inevitably be somewhat difficult to operate, due to its four mutually dependent controls—reaction, aerial tuning, secondary tuning, and inter-circuit coupling. But since it has been proved that single-knob tuning of several cascade circuits is thoroughly practicable, this objection no longer applies, as operating difficulties tend to disappear when the two component circuits of the tuner can be adjusted as one unit.

As to whether double-circuit tuning itself is worth while must now surely be beyond doubt or controversy. The practical advantages of the system were forcibly brought home to the writer recently when he had an opportunity of making a direct comparison between a humble detector-L.F. set—with a filter—and a commercial H.F.-detector-pentode mains-fed receiver, which is one of the best of its kind, but has single-tuned circuits. As was to be anticipated, this three-valve set proved itself to have a vastly greater range, but, as regards selectivity—in the sense in which that overworked expression is generally interpreted—the less-ambitious receiver was definitely superior. As the test was made at a few miles' distance from Brookmans Park, the undoubted sensitivity of the H.F. set was almost valueless, except on the long waveband.

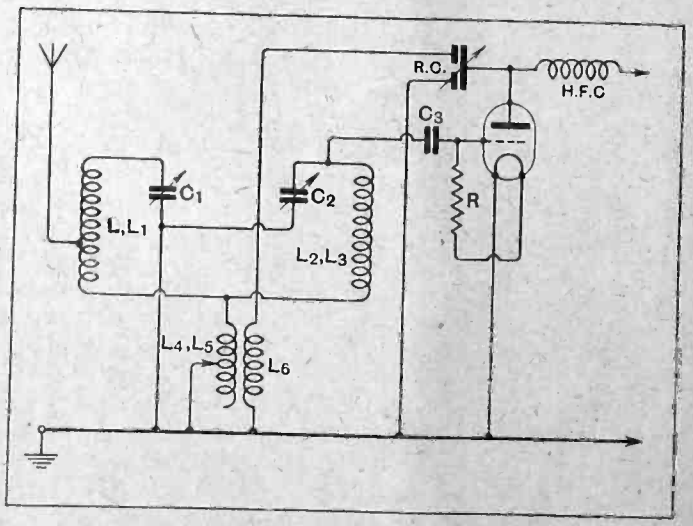


Fig. 1.—Simplified diagram of the tuning circuits and detector. References correspond with those of the complete diagram.

SPECIFICATION.

Regenerative grid detector and a single transformer-coupled L.F. stage.

Double-circuit filter tuning with single-knob control. Variable inter-circuit coupling by means of a small tapped inductance coil.

Tuning coils in individual screening boxes.

Reaction controlled by differential condenser, and applied to the filter coupling coil.

Reception of medium and long broadcast wavebands, with switch change-over.

As the essential difference between a band-pass filter and a two-circuit aerial tuner lies only in the way that these arrangements are operated, the tuning system of the "Flexible Two" may be considered as belonging to either category or as a mixture of the two. The simplified diagram given in Fig. 1 shows that the component circuits are coupled by an inductance which is common to both; this inductance is variable, so that tuning may be broadened to any desired extent, or alternatively, selectivity may be enhanced by reducing coupling even below that value which provides maximum signal strength.

Reaction is always rather a problem when filter circuits are used, but it clearly cannot be ignored in the design of a two-valve general-purpose set without any H.F. amplification. As coupling will naturally be adjusted to the optimum value when maximum sensitivity is needed, and consequently when reaction will be applied it was judged best to feed back energy to the grid *via* the common inductance, thus ensuring that the tuning of both circuits may be affected to an equal extent.

As shown in Fig. 2, the detector and low-frequency amplifying sections of the receiver are entirely

The Flexible Two.— conventional, and do not call for any comment. It may be pointed out that any of the more obvious modifications—power grid rectification, A.C. valves, parallel-fed coupling transformer, etc.—are quite permissible, and that the operation of the tuning system is unlikely to be affected adversely if reasonable care is taken in making any alterations that may be desirable for meeting individual requirements. The necessary coupling-reaction coil assembly may be built up in a number of ways; in this case it is wound in slots cut in a short length of 1in. Becol ribbed former, which is supported by light metal brackets below a 10-point Ferranti selector switch, through which connection may be picked up with any of the various tapping points. Dimensions and connections are shown in Fig. 3, from which it will be seen that the reaction coil L_6 is wound between L_4 and L_5, the medium- and long-wave sections of the coupling coil. L_4 comprises 20 turns of No. 28 D.S.C. wire, tapped at the 6th, 8th, 10th, 13th and 16th turns from the start. L_5, which is a continuation of this winding, has a total of 60 turns of No. 36 D.S.C. wire, tapped at the 15th, 30th and 45th turns. The reaction coil consists of 120 turns of No. 38 D.S.C., and is wound in the same direction as the other two windings; its ends are soldered to tags made by twisting short lengths of wire passed through holes drilled in one of the ribs.

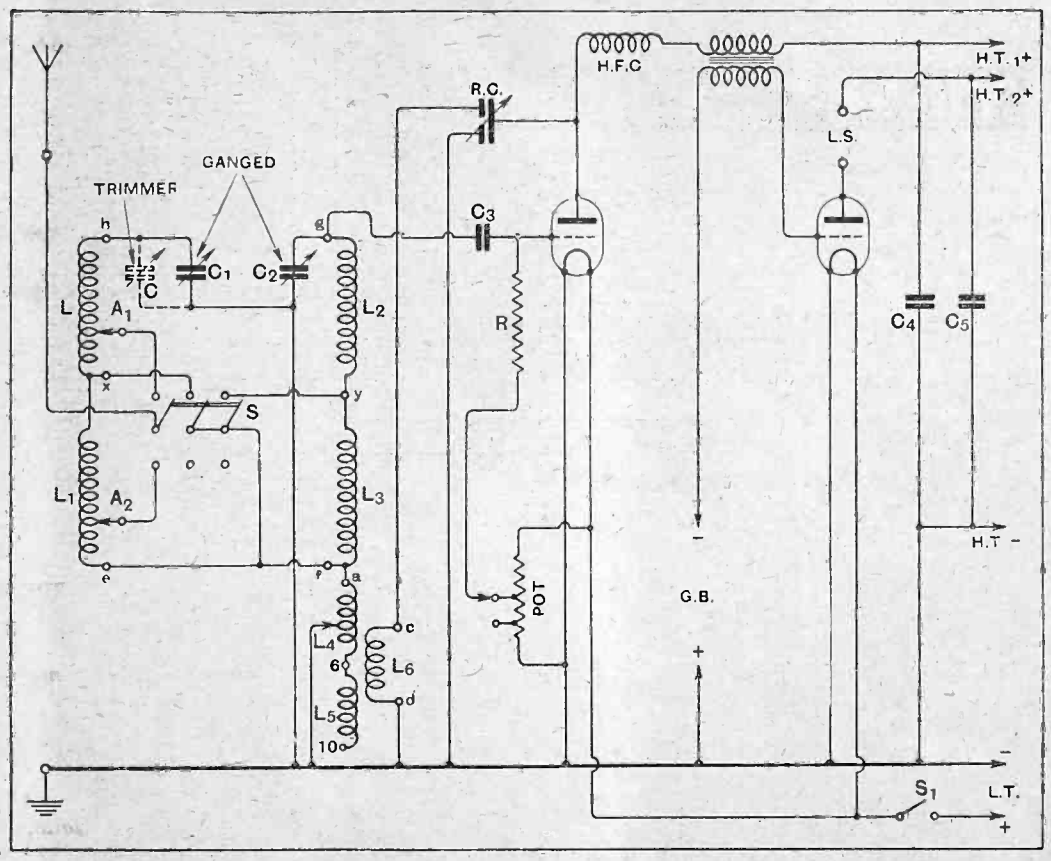


Fig. 2.—Complete circuit diagram: C_t trimming condenser, 25 mmfds.; C_1, C_2, 0.00035 mfd.; C_3, 0.0003 mfd.; C_4, C_5, 2 mfds.; R.C., 0.0003 mfd.; R, 2 megohms.

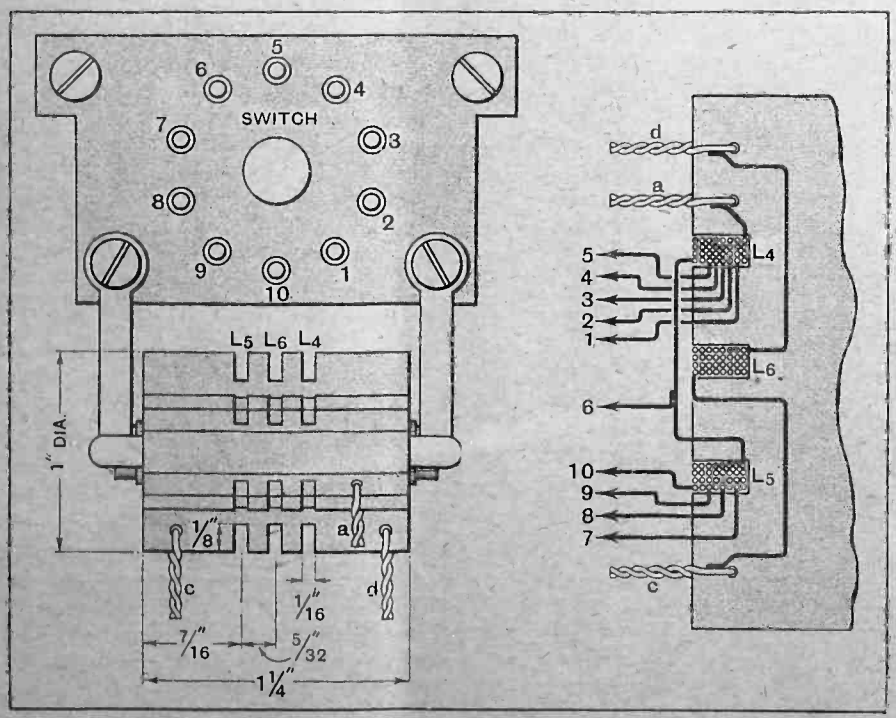


Fig. 3.—Construction and mounting of the coupling and reaction coils. The enlarged sectional diagram shows how the coils are wound; tappings are joined to similarly numbered switch studs, and terminal points bear reference lettering corresponding to the other diagrams.

Connection should be made between coil and switch before the latter is mounted on the panel, and all its back contacts (which are not shown in the diagram) must be joined together and to earth. Instead of a rotary switch it may possibly be preferred to use an arrangement of sockets, grouped in a circle on a small piece of ebonite sheet, with a wander plug for purposes of adjustment.

It will be seen from the accompanying photographs that "potted" tuning coils are used, thus ensuring that coupling may be completely under control. Ribbed ebonite formers, 3in. long and 2¼in. in overall diameter, are used in the construction of these coils, of

LIST OF PARTS.

2 *Variable condensers, logarithmic, 0.00035 mfd. (Ormond; Junior Log).*
1 *Friction Control dial (Ormond).*
1 *Dial indicator (Bulgin).*
1 *Flexible condenser coupler (Ormond).*
1 *Fixed condenser, 0.0003 mfd. (Telsen).*
2 *Condensers, 2 mfds. (Dubilier).*
1 *Trimming condenser, 0.000025 mfd. (J.B.; Midget).*
1 *Differential reaction condenser, 0.0003 mfd. (J.B.).*
1 *L.F. transformer (Ferranti A.F.4).*
1 *H.F. choke (Telsen).*
2 *Valve holders (Telsen).*
1 *Grid leak, 2 megohms (Ediswan).*
1 *Grid leak holder (Bulgin; porcelain).*
1 *Grid potentiometer (Lewcos).*
1 *Switch, single-pole, 10-way (Ferranti).*
1 *Switch, single-pole, on-off (Lotus).*
1 *Switch, 3-pole, change-over (Magnum).*
2 *Coil screens (B. & J.).*
2 *Coil formers, ribbed, 3-in. long, 2¼ in. dia. (Becol).*
1 *Length choke former, 1-in. dia. (Becol; Type 7A).*
4 *Terminals, Aerial, Earth, L.S.+, L.S.− (Burton).*
2 *Terminal mounts (Junit).*
1 *Grid bias battery, 15 volts (Pertrix).*
2 *Wander plugs (Lisenin).*
Wire, screws, sheet aluminium, plywood, etc.

Approximate Cost, £5 : 10 : 0.

In the "List of Parts" included in the descriptions of THE WIRELESS WORLD receivers are detailed the components actually used by the designer, and illustrated in the photographs of the instrument. Where the designer considers it necessary that particular components should be used in preference to others, these components are mentioned in the article itself. In all other cases the constructor can use his discretion as to the choice of components, provided they are of equal quality to those listed and that he takes into consideration in the dimensions and layout of the set any variations in the size of alternative components he may use.

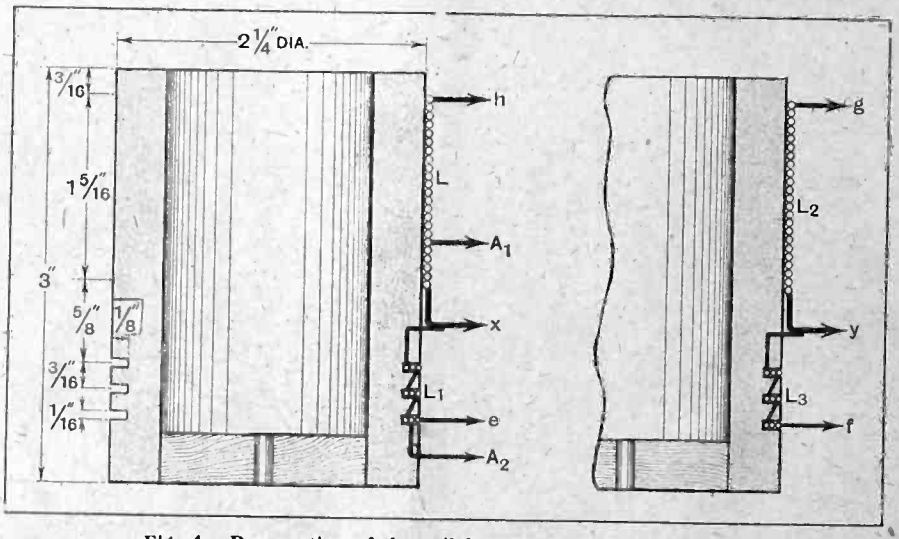


Fig. 4.—Preparation of the coil formers and disposition and connections of the windings

which the dimensions are given in Fig. 4. The separate assemblies, L, L_1 and L_2, L_3 are identical, except that the first-mentioned is tapped for connection of the aerial.

The medium-wave windings, L and L_2, consist of 78 closely wound turns of No. 28 D.S.C. wire; L is tapped at the 18th turn from the end marked *x*. The long-wave coils L_1 and L_3, each comprise three sections of 65 turns of No. 36 D.S.C.; L_1 is tapped at the 45th turn, counting from its low-potential end, for the aerial connection. Plugs of wood are inserted in the formers to act as mountings, and leads from the high-potential ends (marked *h* and *g*) and from the interconnections (*x* and *y*) are brought down inside the tubes and passed out through holes to soldering tags mounted on the lower ends of the ribs in convenient positions for external connections (see practical wiring plan, Fig. 5).

As these connections will be in close proximity to the metal bases of the screening boxes, it is as well to prevent the possibility of accidental short-circuits by interposing a thin disc of insulating material, such as paxolin, between the coils and the trays.

One is reluctant to suggest a complication that will generally be of no great value, but it should be pointed out that double-wound aerial input coils, with separate primary windings, confer certain advantages from the point of view of selectivity. Simple tapped coils, as described, are quite adequate for average receiving conditions, but when used in the immediate vicinity of a transmitting station may be responsible for a certain amount of preventable interference, particularly at the lower end of

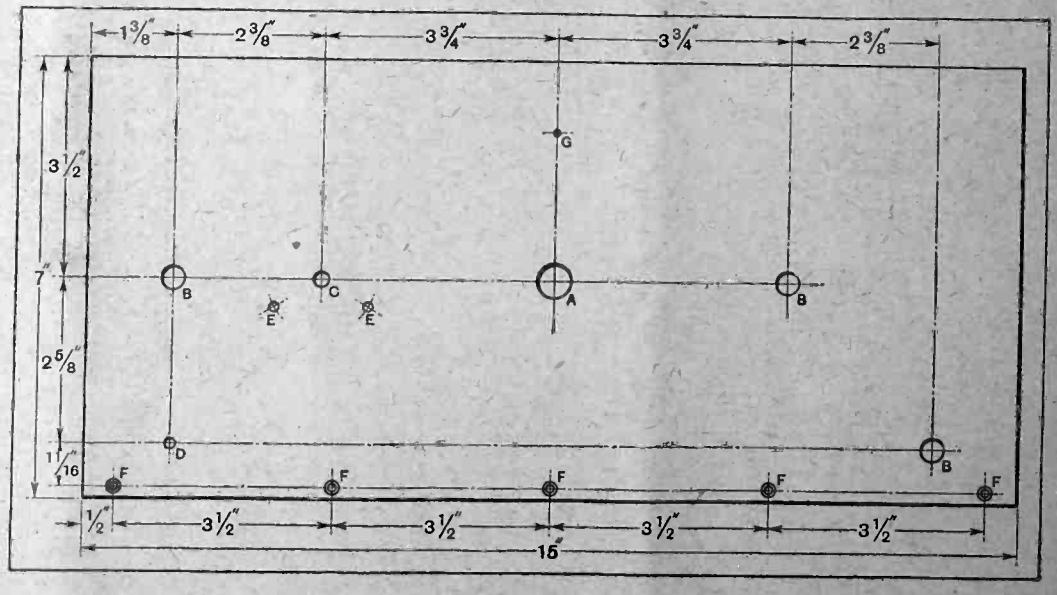


Fig. 5.—Drilling details of the front panel, which is of plywood, 1/4in. thick. A, 9/16in. dia. B, 3/8in. dia.: C, 1/4in. dia.; D, 3/16in. dia.; E, 5/32in. dia.: F, 1/8in. dia., countersunk; G, 3/32in. dia.

The Flexible Two.—

the long-wave tuning scale. This is due to the fact that the filter coupling coil, which is common to both circuits, is also in series with aerial and earth.

Condenser Screen and Mounting Bracket.

By providing separate medium- and long-wave aerial coils, with about 18 and 30 turns, connected in series and with a short-circuiting switch across the long-wave section, this source of trouble is effectively overcome. The alternative plan of earthing the low-potential ends of the tuning coils and inserting the coupling coil between the variable condensers and earth is not satisfactory, as it does not make for stable operation when reaction is used.

A simple vertical screen of heavy-gauge aluminium sheet is placed between the variable condensers to act as an electrostatic shield; it also serves as a support for C_2. There is no need to insulate the fixing bush of this condenser; indeed, in this case it is convenient to pick up connection with the frame and moving vanes through the screen.

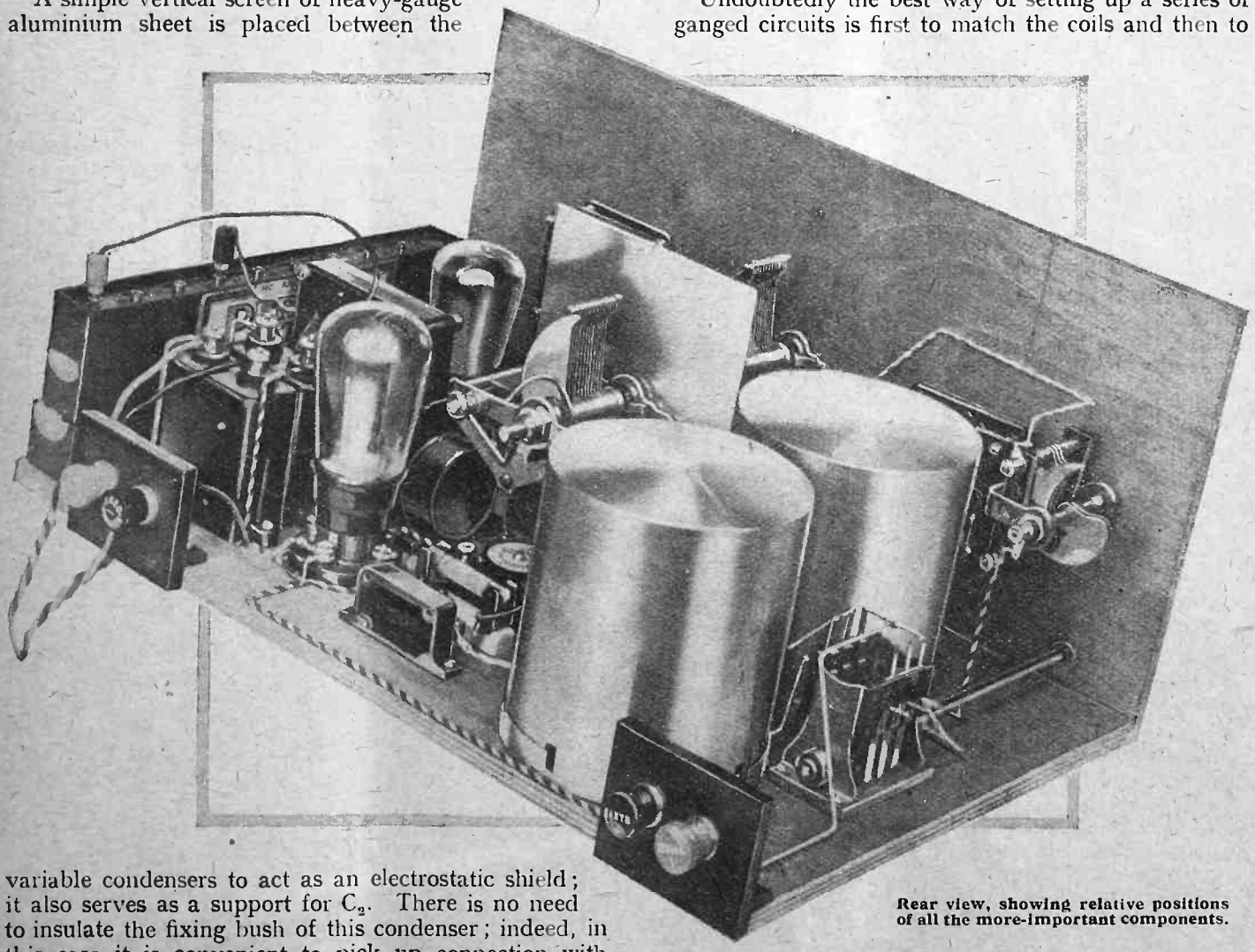
It will be observed that a tapped potentiometer is fitted so that the operating potential of the detector may be adjusted to that value found to give the best compromise between good detection and smoothest reaction control. This fitting must be regarded as a refinement when two-volt valves are used, but, with higher filament voltages, it may be included with advantage.

Before attempting to set up the filter circuits, the constructor would be well advised to assure himself that the detector and L.F. amplifier are working properly. To make this test, the aerial may be joined, through a very small condenser, to the junction between L_2 and C_3. Under these conditions, signals should be receivable, and reaction should work fairly well, provided that a sufficient number of turns are included in the coupling coil.

If everything is found to be in order thus far the aerial connection should be restored to its terminal, and the operation of balancing the circuits may be undertaken. It is assumed that the coils will have been carefully and evenly wound, with an identical number of turns; this is important, as close matching of inductance is desirable.

Undoubtedly the best way of setting up a series of ganged circuits is first to match the coils and then to equalise the stray capacities across each circuit; if the variable condensers are right it is then certain that correct tuning will be maintained when individual rotors are in line. A good deal of information on this subject has recently been published in *The Wireless World*.

In the case of the present receiver matters are so arranged that, with an average aerial, the incidental capacities in the primary and secondary circuits are practically identical, so it is probable that at least



Rear view, showing relative positions of all the more-important components.

The Flexible Two.—something will be heard without the need for making individual adjustments to the rotors, and with the trimming condenser set at zero. Coupling becomes tighter as the number of turns in the common inductance is increased, and it is best to start with the selector switch at about the fourth stud; having obtained some sort of signal (preferably at about the middle of the medium frequency band), coupling should be loosened by rotating the switch knob in an anti-clockwise direction.

Unless the special precautions already mentioned are observed, the normal procedure is to loosen one of the nipping screws securing the condenser coupler, and, with the trimming condenser set at the lowest possible value giving a margin of control, to adjust the rotors independently until maximum signal strength is obtained. If tuning is then found to be imperfect at either end of the scale, an adjustment of the trimmer must be made, but one's aim should be to arrange matters so that this control need not be used to any great extent. These adjustments should always be made with the loosest possible inter-circuit coupling, and preferably without reaction.

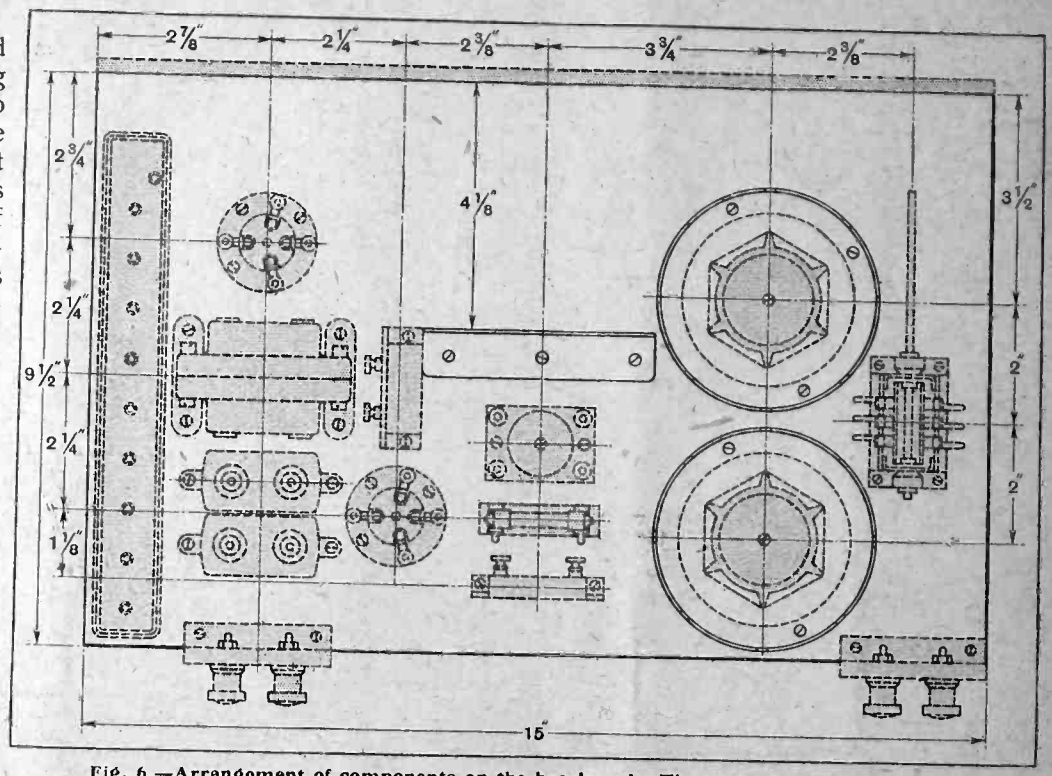
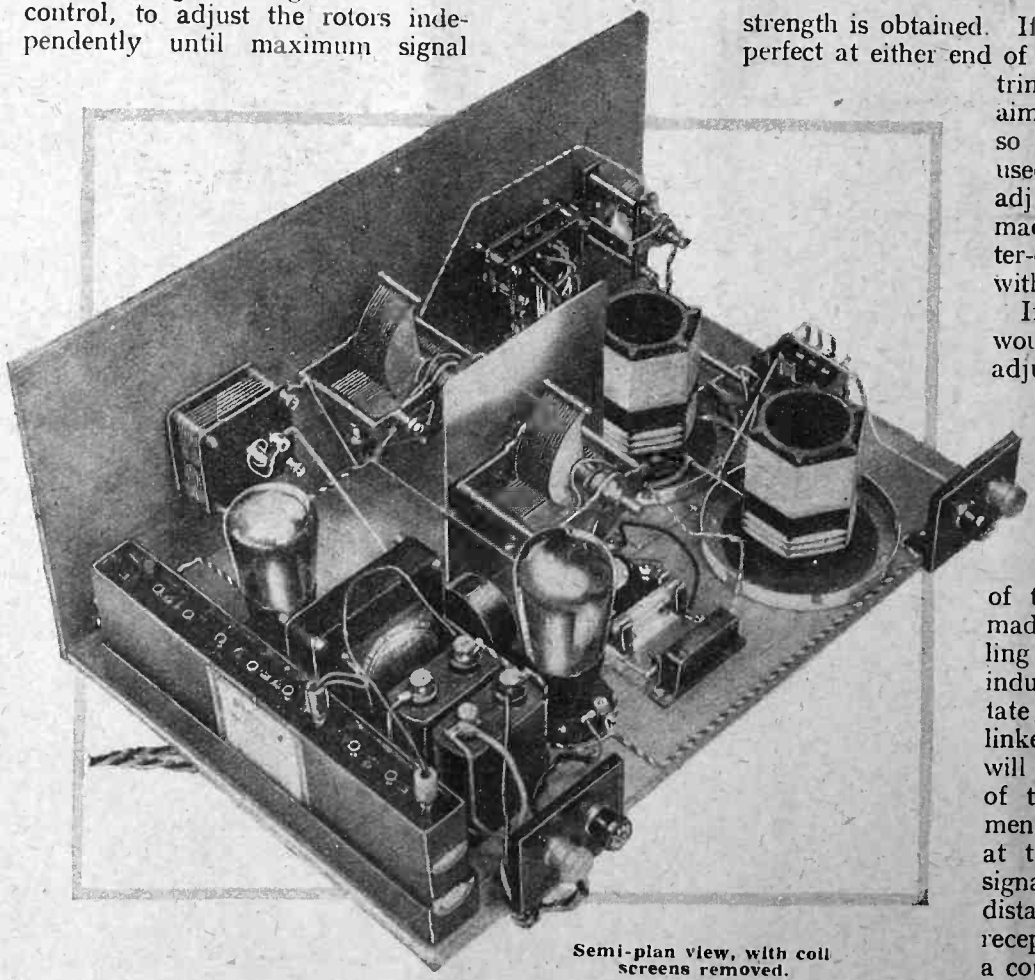


Fig. 6.—Arrangement of components on the baseboard. The vertical screen is 5½in. high and 4in. wide.



Semi-plan view, with coil screens removed.

If the coils have been carefully wound it is likely that the condenser adjustment will hold when passing over to the long waveband; if it does not, a suitable number of turns should be removed from the coil found to have the highest inductance.

When initial adjustments of the tuning system have been made, the effect of varying coupling may be tried. Any change in inductance of the coil will necessitate a slight readjustment of the linked variable condensers, but will not disturb the relative tuning of the two circuits. As already mentioned, this control will be set at the position giving maximum signal strength when searching for distant stations, but for "quality" reception of near-by transmissions, a coupling should be chosen which

The Flexible Two.

provides either broad tuning or actually a double "hump," with maxima about two degrees apart on the condenser scale. The switch indicator dial should be positioned so that it shows clearly when the rotating brush is making proper contact with a single stud; short-circuits between adjacent studs will give rise to misleading results.

Reaction and coupling controls are, as usual, to some extent interdependent, but fortunately there is a compensating effect; the tendency towards self-oscillation becomes greater as the number of coupling turns are increased, but this is partially offset by the fact that, when the adjustment is made, a greater proportion of the aerial load is thrown on the secondary circuit. Reaction may fail when coupling is inordinately loose.

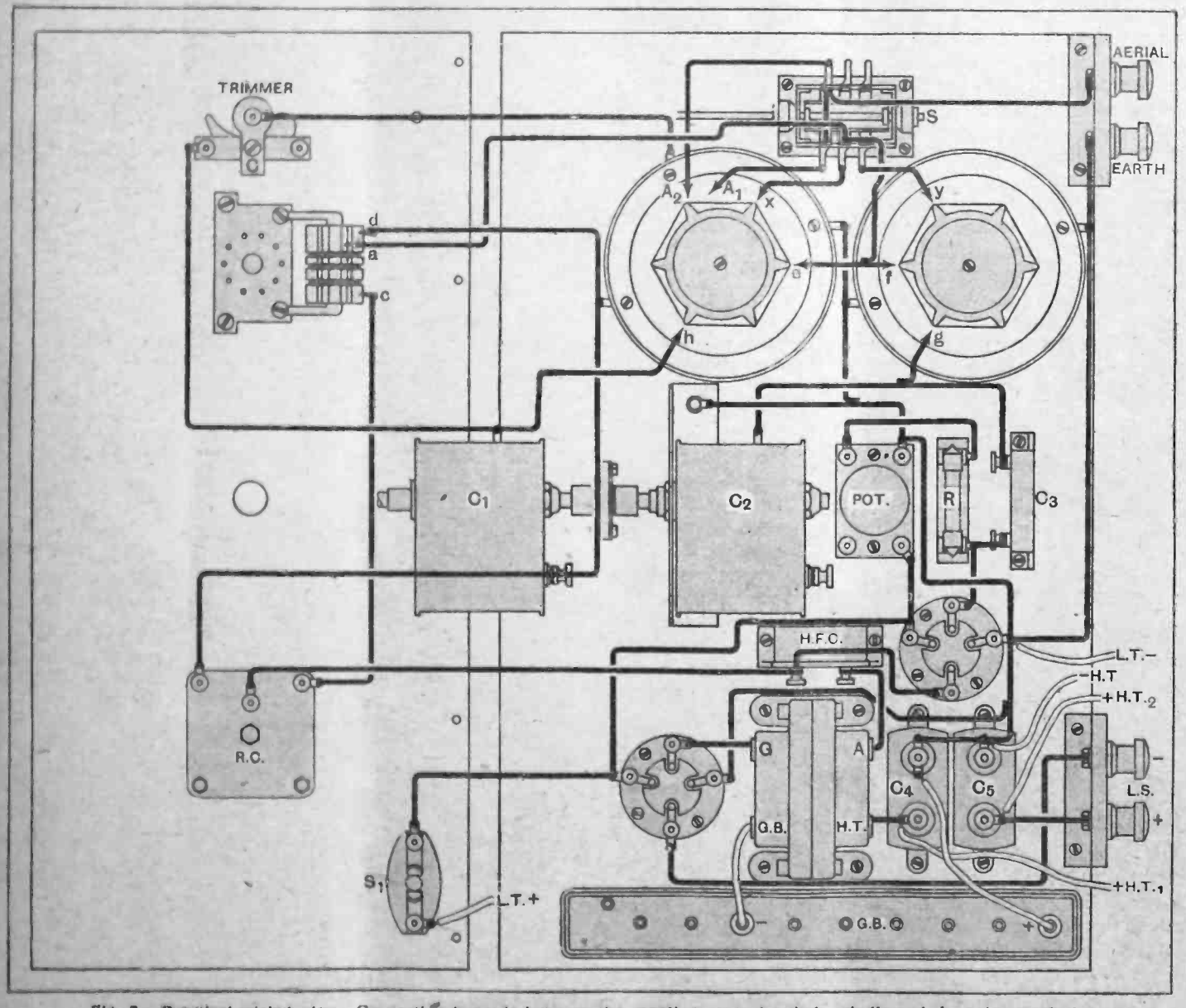


Fig. 7.—Practical wiring plan. Connection is made between the coupling control switch spindle and the point marked *d*. Note that the coil screen bases and the condenser shield are earthed.

To suggest that an input volume control may be a desirable addition will possibly seem like an implied overestimate of the capabilities of a simple detector-L.F. set. But when a really large input is received from the local station, detector overloading will be produced unless some means of reducing signal voltage is provided; the usual expedient of detuning is not permissible, as by doing so the advantages of a filter are partially lost. If a pre-detection control is fitted it should preferably be of the type that does not greatly affect tuning.

A final word regarding the wave-changing switch. As it is undesirable that long connecting leads should be used in the oscillatory circuits, this component is mounted close to the coil screens, and is operated through a length of square-section steel rod (supplied by the makers). The end of this rod is fitted with a small knob.

This receiver is available for inspection at the offices of "The Wireless World," 116, Fleet Street, London, E.C.4.

Unbiased

by "FREE GRID"

Gramoscope or Cinegram?

Truly we live in a remarkable age, in which men of science are constantly demonstrating astounding wonders to us, and yet I doubt whether we ever receive greater shocks than on the memorable occasion over three centuries ago when—as certain American history books tell us—Dr. William Gilbert first demonstrated the potentialities of electricity by rubbing his fountain pen on Queen Elizabeth's silk stockings. All the same, I received quite a shock the other day when I was invited by a scientific friend whose name is well known at the Patent Office to a private demonstration of an apparatus which he described by the none-too-euphonious but highly descriptive name of "Radiogramoscope," although, at my suggestion, he is considering the alternative name of "Radiocinegram."

Dr. William Gilbert's experiment:

In appearance the machine resembled a modern radio-gramophone, although its fore and aft dimensions seemed rather greater than usual. On opening the lid I was surprised to find that the usual turntable and gramophone pick-up were replaced by two electrically driven cinematograph reels and a photo-electric cell; I at once accused my friend of plagiarising an ultra-modern type of gramophone of which a brief description has already been given in this journal, and which, in my opinion, will eventually oust the ordinary type of gramophone, whatever "discophiles" may say to the contrary. My friend, however, advised me not to make a fool of myself by jumping to conclusions, and bade me be seated in front of the instrument. I did so, and immediately noted that the usual loud speaker front of silk and fretwork had been replaced by some white fabric.

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"Coming Shortly."

My friend adjusted a record consisting of a large reel of cinematograph film, and to my astonishment there burst forth simultaneously from the loud speaker the familiar strains of "We Sail the Ocean Blue" and the opening scene of *H.M.S. Pinafore*. I sat enthralled for a few moments as the familiar sight and sound of Gilbert and Sullivan's opera reached me, but I soon jumped up to unearth the secrets of this remarkable version of "home talkies." It was, of course, nothing more nor less than an all-mains radio receiver, combined with a sound-on-film talkie apparatus, with the exception that instead of the picture being projected across the room on to a screen it was actually thrown on to the front of the instrument by a machine somewhat resembling certain sub-standard cinema projectors which are upon the market; the whole apparatus was, therefore, extremely compact. This fact, of course, accounted for the somewhat large fore and aft dimensions of the instrument which I have already mentioned.

My friend informed me that he had at first encountered a very great difficulty owing to the fact that the loud speaker obviously could not be placed immediately behind the screen as it would then block the projection of the picture. He eventually overcame the trouble in an ingenious manner by using an exponential horn. The projector is mounted on the top of the final straight portion of this horn, and the "eye" of the redressing mirror associated with it protrudes slightly through the back of the horn. This does not in any way upset the quality since, of course, no escape of air takes place, and a small correction is made to counteract the effect of this slight protrusion through the back of the horn.

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Fooling the Public.

I have been studying some of the advertisements in foreign radio journals recently, and I must say that reading the tall stories told in many of them gives one the impression that the people in the country concerned must be very simple-minded folk indeed. In the early days of radio in this country we were not entirely free from this sort of thing, and I dare say that many readers will remember a certain instrument, which, according to its makers, had "a soothing effect on the ether waves," and others will probably remember an H.F. valve which was guaranteed not to burn out even if 20,000 volts were applied to its filament pins; the reason being, of course, that it had no filament, its internals consisting merely of a small by-pass condenser between the grid and plate connections. It thus acted merely as a passenger, and I must confess that in this respect it was no more worthy of condemnation than certain valves which did have normal electrodes. Needless to say, these articles did not manage to trickle in

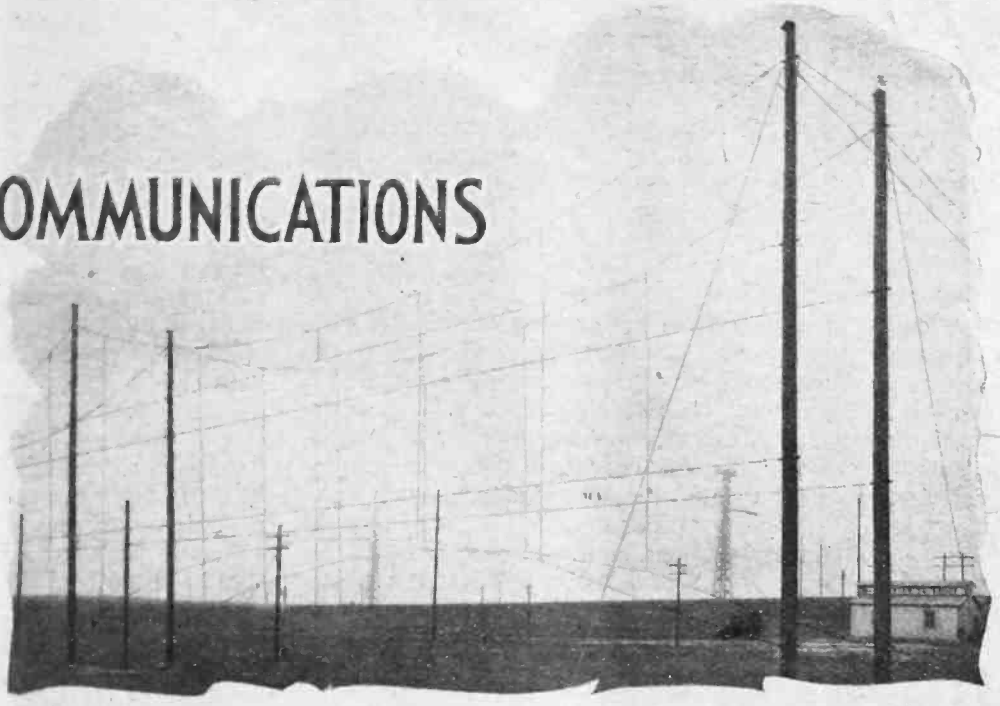
"One leg was longer than the other."

to the advertisement pages of this journal. Even in these enlightened days certain people interested in radio take advantage of the technical ignorance of the average man in the street, and I well remember noticing this year at Olympia that as people left a certain stand they were walking with a decided limp due, I presume, to the fact that one leg was longer than the other.

WIRELESS COMMUNICATIONS

A Record of the Year's Progress

By Lt.-Col. CHETWODE CRAWLEY, M.I.E.E.



Aerial arrays at the Baldock Station.

THE most notable advances of the year in wireless communication must be placed to the credit of wireless telephony.

At the beginning of 1930 there was much discussion both in Parliament and in the Press as to whether the Government should develop wireless telephone services with the Empire through its own stations or through the beam wireless telegraph stations of the Imperial and International Communications Company. Under the previous Government the Imperial telegraph services had been leased to the Company, but the question of how the Government would develop the telephone services had been left open.

In the summer of last year the Company had invited the Government to work the telephone services through the Company's beam stations, and a Cabinet Committee was appointed to advise on the matter. The question at issue was whether these Imperial telephone services should be worked through the beam telegraph stations of the Company or through the Government's transmitting station at Rugby, with its complementary receiving station at Baldock. Questions of a highly technical nature arose, and the Government decided to consult two independent experts of acknowledged repute, Dr. F. E. Smith and Professor G. W. O. Howe. As a result, the Government felt justified in concluding that, without disparaging the possibilities of the Marconi system, at least as efficient services could be provided from Rugby, with certain economic advantages in prospect, and on the 26th of February the Postmaster General announced in the House of Commons that the Government had decided to develop these telephone services from the Rugby-Baldock stations.

Point-to-point Telephony.

The transatlantic wireless telephone service worked from the Rugby station has been in operation since January, 1927, on a wave of 5,000 metres, and an additional channel was opened in June, 1928, using short waves. Later, two more short-wave channels were put into operation, and at the present time arrangements are being made for a second long-wave channel. The receiving apparatus for the original long-wave channel is at Cupar in Scotland, and that for the new one will be there also. This combination of long- and short-wave services has ensured a good commercial transatlantic service throughout the twenty-four hours, and has linked up practically the whole of Europe with the United States, Canada, Mexico, and Cuba.

The charges for this transatlantic service were reduced in July last, and now vary from £2 a minute (minimum of three minutes) between this country and the first U.S.A. and Canadian zones, to £3 between this country and Mexico and parts of Cuba.

On the 30th of April a commercial telephone service was opened on short waves with Australia from the Rugby-Baldock stations, at the same minimum charge of £6 for three minutes' conversation. This service is available for nine hours daily. A direct service with the Argentine has just been opened, and it is expected that direct services with Canada and South Africa will be opened shortly, as well as a service with New Zealand, *via* Australia.

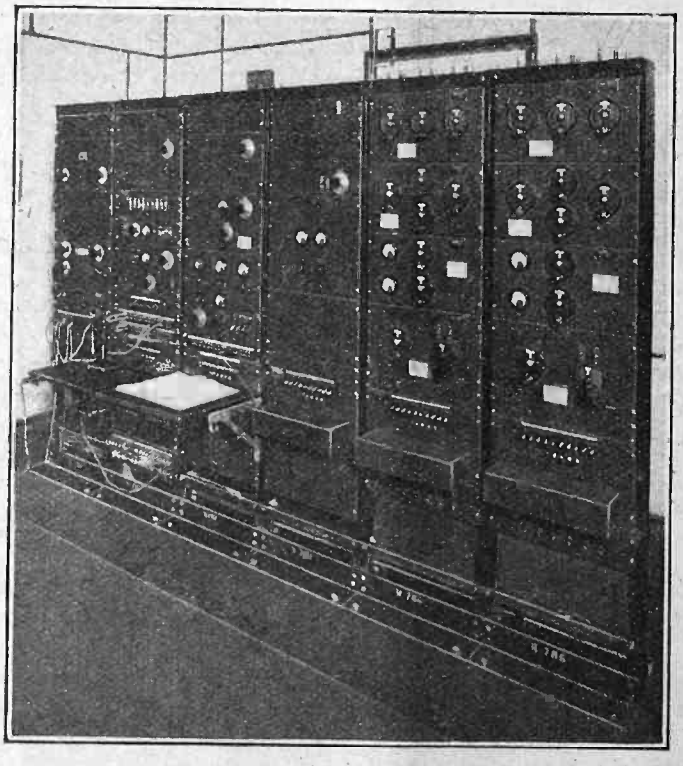
A number of other commercial wireless telephone services have come into operation during the year, all on short waves, which are, of course, much more economical than long waves for working over great distances. The reason why long-wave channels are, however, being retained for the transatlantic service, in addition to short-wave channels, is that they are more reliable, and the additional expense is justified, though it certainly would not be justified for less fully loaded services over greater distances.

Wireless Communications.

Notable amongst other services which have come into operation this year are the services between New York and Buenos Aires, which connect up subscribers in North and Central America with subscribers in the Argentine, Uruguay and Chile, the services between Germany and Spain on the one hand, and Brazil, etc., on the other, and the service between Australia and New Zealand.

Ships' Telephony.

Great strides, too, have been made during the year in developing wireless telephone services with ships. Up to the beginning of the year no ships, with the exception of a few whalers and other fishing craft, made any use of telephony for commercial communication. This was because marine wireless telegraphy had reached a high state of development, whereas wireless telephony, the only other competitor outside visual range, was far less efficient, and more expensive. As soon, however, as short-wave working became a possibility for ships it was obvious that telephony would struggle up to its own, in spite of the inherent technical advantages of telegraphy. It has still a long, and apparently expensive, journey to travel, but early this



A Post Office telephone receiver at the Baldock Station.

year it made a definite start; indeed, it really got off the mark on the 8th of December last year, when a commercial service was opened between New York and the *Leviathan* on her way to Southampton, communication being maintained up to a distance of 2,600 miles. The next step was taken on this side, when the Post Office opened a service with the *Majestic* on her voyage to New York on the 14th of February, and announced that it was ready to extend similar facilities to any other ships on the North Atlantic routes. Several transatlantic liners are now fitted, and passengers in them can converse comfortably with telephone subscribers on either side of the Atlantic. The shore end here is worked by the Post Office from the Rugby-Baldock stations. The charge made is £4 10s. for the first three minutes' conversation, and £1 10s. for each additional minute.

These telephone services with ships present many difficult technical problems, due to two hard facts; first, the space in ships is strictly limited, and, secondly, the ranges over which communication is required are constantly altering. The first fact means that the ship's telegraph and telephone apparatus must always be comparatively close together, which leads to interference difficulties, and, also, that, through lack of space, apparatus must be very compact. The second fact means that the eternal wavelength troubles, due to congestion in the ether, are accentuated. At present, five short wavelengths are being used on this very limited transatlantic service, and it is obvious that one cannot go on at that rate for very long. At the moment, however, the number of passengers who wish to converse (at the price) is small, which is as fortunate technically as it is unfortunate financially. But all these troubles are only growing pains, and what has been done in this first year of commercial services clearly shows that telephony with ships at sea will come into its own much sooner than could have been reasonably expected a few years ago.

A rotating beacon station showing the revolving loop aerial.

During the year, wireless telephony in general has been kept well in the public eye, not only by the world-wide broadcasts of speeches by eminent persons, but also by many interesting demonstrations, such as offices and even aircraft in South America communicating with ships near England, railway magnates in London talking to railway magnates in trains in Canada, aircraft over Los Angeles conversing with business men in Berlin, doctors in Madrid diagnosing heart troubles in Buenos Aires, banquets all over the world listening to the same speeches, and even ships in the Mediterranean switching on lights in Australia.

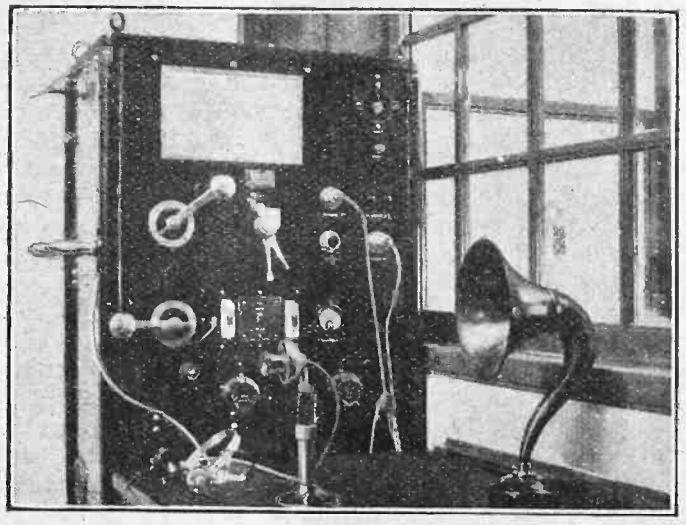
All such experiments, useful and interesting as they are, can hardly be included, however, in a short résumé of commercial progress, though, indeed, one

Wireless Communications.—of the most interesting, which took place last month, may be fitly added to the list, as it really was a commercial communication, viz., a subscriber in Melbourne speaking to a subscriber in Los Angeles. The route, the longest over which commercial telephone communication has been effected, was from Melbourne to Sydney by land line, Sydney to England, and England to the U.S.A. by wireless, and New York to Los Angeles by land line.

Point-to-point Telegraphy.

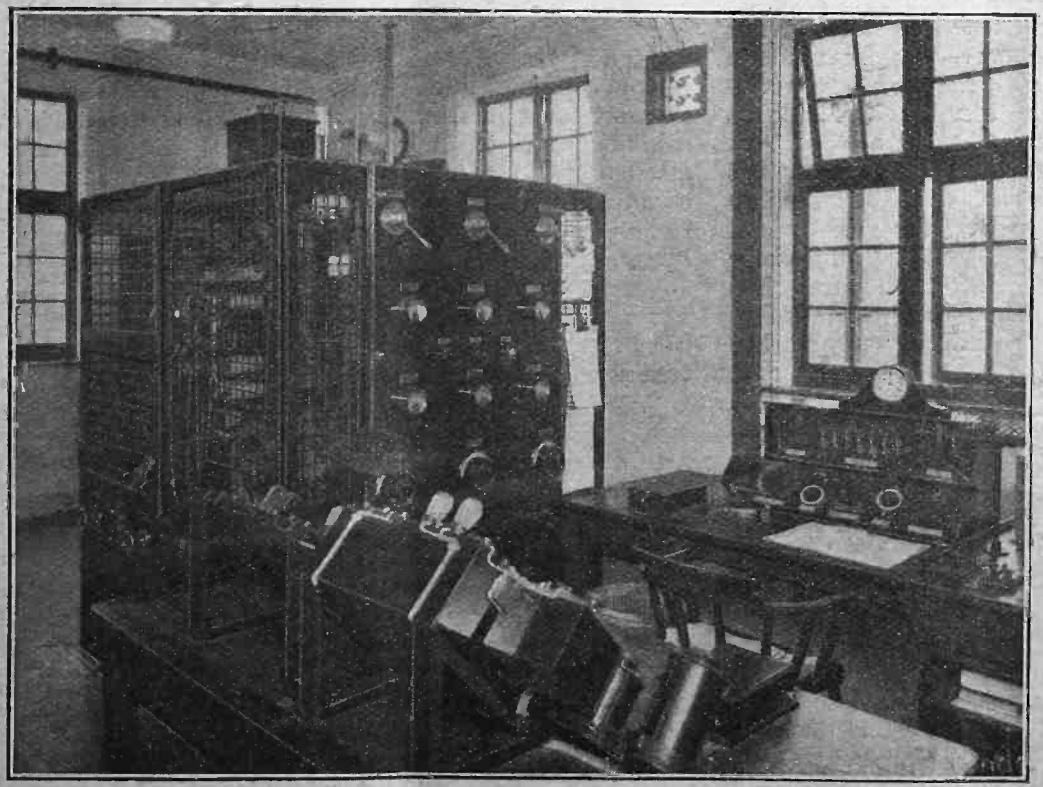
So much for telephony in 1930. We must now turn our attention to telegraphy, and here we find that progress, though sure, has been less spectacular, and even disappointing from the commercial point of view. The disappointment is not due to any slackening in technical achievement, but to that "world depression" with which we are all so painfully familiar, as well as to those magnetic storms of which the chairman of the Wireless Section of the Institution of Electrical Engineers has recently told us. It appears that these storms were peculiarly severe in 1930, and account for a falling off in the number of hours of recordability on short-wave circuits. But the main trouble with commercial wireless telegraphy during the last year has undoubtedly arisen from the "world depression," which showed up less in telephony, apart from the transatlantic circuit, as there were no comparative results for previous years.

The number of long-wave telegraph circuits showed little, if any, increase during the year, but it is understood that the Imperial and International Communications Company contemplates having an additional long-wave circuit for its transatlantic telegraph service. Some new medium-wave circuits were opened, but the real increase was in short-wave circuits, many of which came into operation all over the world.



A wireless telephone set at the Post Office station at the Humber, used for communicating with fishing craft, etc.

The practical experience gained with these short-wave commercial services during the last few years gave many data which have formed the basis of experimental investigation during the year, and fading, the great bugbear of short-wave working, naturally came in for the lion's share. At the receiving end use has been made of separate or spaced aerials, and modulation of the transmitter's output has been proved effective in certain cases, while many varieties of beam aerials have been used with success. Short-wave working is still largely in the experimental stage, but meanwhile it has been plugging away satisfactorily for commercial communication ever since the Marconi Company successfully staked its reputation on the erection of our Imperial beam telegraph stations.



The transmitting instruments, the main receiver and the directional receiver at the new Post Office coast station at North Foreland.

For several years now it has been the practice to concentrate transmitters at one place, receivers at another place, and operation at the central offices in a city, but during this last year there has been a tendency to erect transmitters and receivers on the same

Wireless Communications.

site wherever possible. This has not, of course, become general practice, but it is a notable move towards economy in running costs, the most expensive item in wireless communication.

Picture-Telegraphy.

Facsimile transmission has made great strides experimentally during the year, though it has hardly made a start yet from the commercial point of view.

The Marconi Company has indeed worked a commercial transatlantic service on long waves for some years, and pictures have been sent on short waves experimentally over its beam telegraph circuits. Many experiments too, have been carried out with ships, and it is hoped that before long it will be found possible to start commercial services. The fact is that for long and medium waves the technical difficulties are not great, but for short waves these difficulties have proved serious, and the year has slipped by without the hoped-for opening of commercial services. Next year the story may be different.

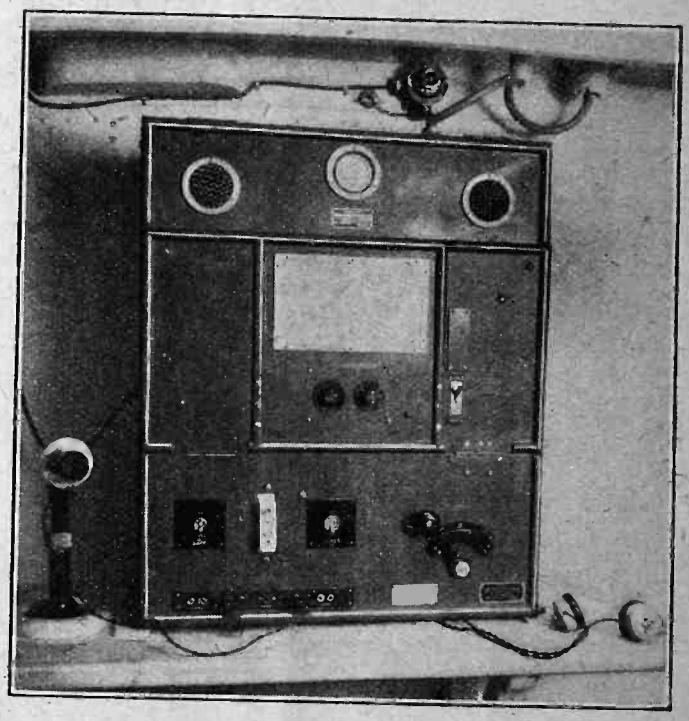
There can be no doubt that there is a great commercial future for this form of wireless communication, and its rather tardy début has been disappointing to many who recognise the possibilities.

Ships' Services.

As regards ships' communications, apart from telephony, the most important advances have been made in short-wave services. Some three hundred ships are now fitted with short-wave installations, as compared with half that number a year ago, and the commercial traffic on short waves is increasing steadily, though this increase is, to some extent, at the expense of the long-wave traffic. Still, much of it is new traffic, and this will increase rapidly when short-wave working becomes more stabilised, and has reached the stage where world-wide communication with ships can be considered as normal practice.

Directional apparatus for navigational purposes has also been improved during the year, and will come into even more general use when the Safety of Life at Sea Convention is brought into force internationally next summer. Already more than one-fifth of the total number of ships fitted with wireless have directional apparatus installed, a very marked advance on the meagre number of a few years ago.

Many wireless beacon stations have been erected throughout the world during the year. A few of these are of the revolving pattern, from which ships can obtain bearings on an ordinary non-directional receiver, and it is in this class of beacons especially that, with the aid of such devices as the Adcock aerial, great technical advances are confidently expected.



The Marconi Company's telephone transmitter in the new Dover lifeboat.

A good deal of work has been done in wireless telephone communication with trains, especially on the Continent and in Canada, and commercial services are available on certain long-distance trains, but most train installations, like those of the L.N.E.R., just inaugurated, have been fitted in connection with the reception of broadcast programmes, which is a matter outside the scope of this article. So, too, are the advances made in television, which will one day advance to the entertainment stage, from which it will be warmly welcomed, to the more prosaic stage of commercial communication.

TRANSMITTERS' NOTES.

R.S.G.B. Tests and Competitions.

The December issue of the "T. and R. Bulletin," which is well known as the Official Journal of the Incorporated Radio Society of Great Britain and the British Empire Radio Union, gives particulars of several tests and competitions planned for the early part of 1931.

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28-megacycle Tests.

On January 4th, 11th, 18th, and 25th the annual tests on the 10-metre waveband will be open to all members of the R.S.G.B. in the British Islands. Space does not permit of full particulars being given in these columns, but these may be obtained from Mr. R. W. Leader (G5VL), Porth, St. Columb Minor, Cornwall, who is organising these tests, and to whom reports should be sent. Competitors are asked specially to concentrate upon reflector systems, whether designed for directional work or not, and to compare the results with those obtained previously without the use of any reflecting system. Only stations distant more than 100 miles should be included in reports.

G5VL asks those who write to him on the subject of these tests to enclose a stamped and addressed envelope.

The 5-metre Waveband.

The four Sundays in February are set aside for the annual tests on 56 megacycles, which it is hoped will produce interesting results.

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Interference on the 7 mC. Band.

Amateurs working on the 7 mC. waveband are experiencing some trouble from commercial stations encroaching on this strictly preserved territory. One correspondent writes that he has heard RPK (Moscow) on 7,190 kC. with an I.C.W. note that is audible on either side of his frequency, and has also heard EAK on about 7,130 kC.

CURRENT TOPICS

Events of the Week in Brief Review.

1931.

The Wireless World takes the opportunity on the last day of 1930 to wish readers in all parts of the world a Happy and Prosperous New Year.

L. OF N. AND SHORT WAVES.

"Day," "night," and "twilight" wavelengths are to be used by the short-wave station to be built for the League of Nations by the Société Française Radio-électrique. During daylight the wavelength will be 15 metres, at night 35 metres, and at dusk periods 18 metres.

FRENCH BROADCASTING CHAOS.

The story of the French barber who displayed the sign: "To-morrow I will shave gratuitously" is recalled by the present situation in French broadcasting, writes our Paris correspondent. The late Postmaster-General, M. Mallarmé, seemed on the point of securing legislation to control broadcasting when the Cabinet collapsed. The new party in power is not likely to pursue the same policy, so broadcasting remains in its chaotic condition as ever!

RADIO AND BACCHUS.

The sobering influence exerted by broadcast receivers in public houses was referred to at a recent meeting of the Leeds Watch Committee. "The Chief Constable informs us," said Alderman N. G. Morrison (chairman), "that where such installations exist the conduct of the patrons has been good, and this he attributes to these installations, which appear to induce quietude."

400 KW. FROM PITTSBURGH?

Transmissions on a power of 400 kilowatts will shortly be carried out by W8XAR, auxiliary of KDKA, Pittsburgh, if the Federal Radio Commission grants the necessary permit. It is intended at first only to transmit on high power between the hours of 6 and 11 a.m. (G.M.T.) on a wavelength of 306 metres. If facilities are granted, W8XAR will be the highest-powered broadcasting station in the world.

IRELAND'S HIGH-POWER STATION.

We understand that the Irish Free State Government has finally decided to erect the new high-power broadcasting station at Athlone, and that it is hoped to have the station working before the end of 1931. Athlone possesses a good trunk telephone connection with Dublin, where the studios will be situated. The actual site of the station has not yet been divulged, but it is believed that Government land in the neighbourhood of the town will be selected. The apparatus will be constructed at the Chelmsford works of the Marconi Company.

Listeners in Britain whose sets are unselective will be interested to know that the transmitter, although rated at 60 kilowatts, will contain provision for an increase of power to 120 kilowatts! The wavelength will be 413 metres.

A RADIO RELIC.

A lonely hut marring the landscape near Babylon, Long Island, New York, has just been identified as the first commercial wireless station built by Marconi in the United States. According to the best information, says "The R.C.A. News," Marconi erected the station in the late autumn of 1900, or the early winter of 1901. This was before he amazed the world by flashing the letter "S" across the Atlantic. The shed, which resembles a large dog-kennel, might be mistaken for a tool-house or chicken coop. Its existence was accidentally discovered by Captain H. J. Round, who, while on a recent visit to Major E. H. Armstrong at Bayport, Long Island, expressed curiosity as to what had happened to the original station at Babylon, at which he had been third assistant technical officer. The two engineers motored to the site, and Captain Round immediately recognised the shed, on which were a number of old insulators.

This interesting relic has been handed over to the Radio Corporation of America for preservation.

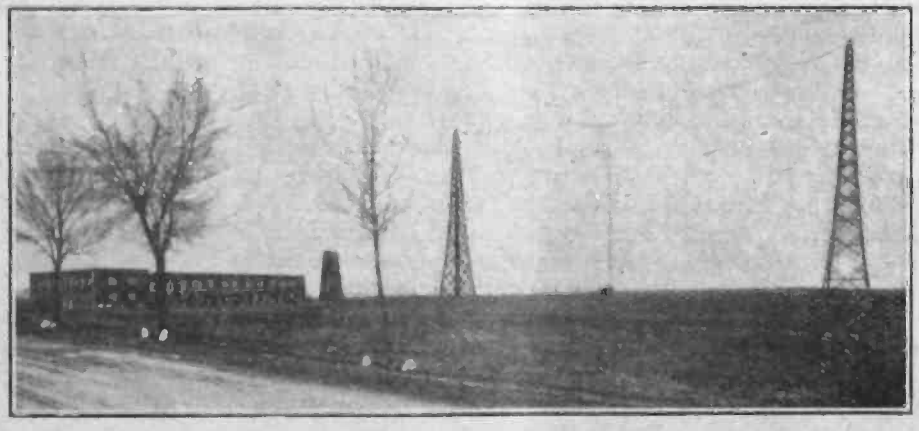
RECORD AIRWAY WIRELESS CHAIN.

The most comprehensive airway wireless system ever evolved will, it is stated, be in operation with the opening by Imperial Airways during 1931 of the 8,000 miles' air line between England and South Africa.

During the whole of the eleven days spent on the journey between London and Cape Town passengers will be in wireless touch with ground stations. Long- and short-wave communication will be employed, and messages will be both by telegraph and telephone. Wireless bearings will be available to pilots throughout the flight over seas, rivers, forests and jungles.

It is expected that a transmission range of 300 miles will be attained. During flight power will be derived from a dynamo driven by a small air-screw.

Though the bulk of the wireless work will be conducted on the normal 900-metre wavelength, some interesting test transmissions will be carried out on 30-40 metres.

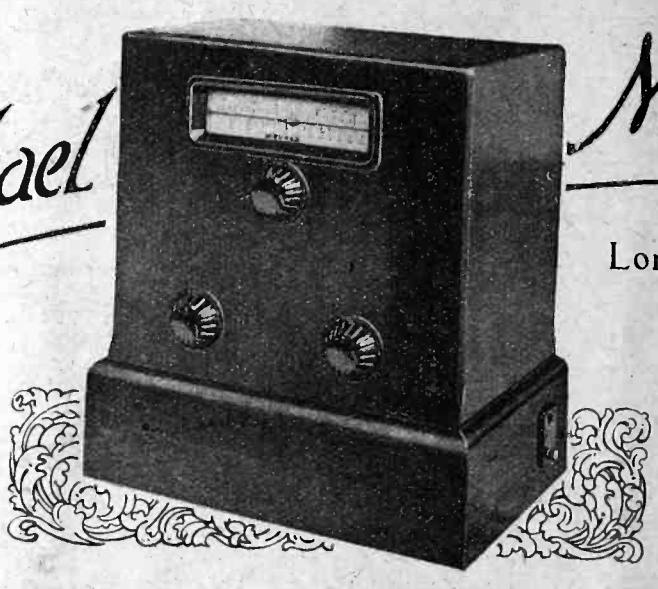


HEILSBERG. A comprehensive view of a typical German high-power station, of which there will be nine in the proposed new broadcasting scheme. The long, low transmitter house resembles the station building at Brookmans Park. The water-cooling tower and low-voltage feeder wires can be clearly seen.

NEW YEAR GREETINGS BY RADIO.

The Postmaster-General announces that facilities are available for the transmission of New Year greetings through Rugby Radio, Portishead Radio, and other Post Office wireless stations to ships at sea. Messages can be sent *via* Rugby Radio (charge 1s. 6d. a word) to ships on all seas, or *via* Portishead Radio or other stations (charge 11d. a word) to ships up to five days' voyage from ports in the British Isles.

The McMichael Mains Three



Long-range Receiver with One Dial Control.

THAT the possession of a reputation for excellence carries with it special cares and responsibilities none will admit more readily than the successful wireless manufacturer. To retain public confidence he must steer a middle course between dangerous conservatism and risky experiment. Such a course has been steadily pursued by the firm of McMichael, who, in producing the "Mains Three" receiver, have once again proved their ability to hold and augment a reputation established many years ago. Designed with the simplest possible controls, the set is bound to appeal to the general listening public. The single tuning dial, which moves a pointer across an illuminated scale calibrated in wavelengths is fascinating to handle and is likely to set a new fashion. In the case of, say, twelve of the most powerful European stations, together with those in this country, it is only necessary to move the pointer to the desired wavelength, when, on depressing the mains switch, the selected transmission will be heard. By judicious use of reaction (the right-hand control seen in the title illustration) and the selectivity-cum-volume control (on the left) many more stations can be logged.

The set which is housed in a well-finished walnut cabinet is built as a chassis, and can be easily withdrawn. From the illustration on the opposite page the ingenious drive mechanism for the horizontal tuning scale is seen. The centre knob on the front of the cabinet controls the twin-gang condensers by a reduction gear, and on the rear end of the rotor spindle is a large pulley controlling a cord with pointer attached. Small jockey pulleys act as guides and maintain the right tension. Screening has been carried out with the greatest care—there being separate and total enclosure of both tuning condensers and inductances. The aerial and tuned anode coils, wound on 1½in. formers, are contained in a copper box below the variable condensers, and the single screen-grid valve is surrounded by a removable aluminium hutch. The eliminator is built as a separate metal-shielded unit in the base of the chassis and feeds the valves through five connectors neatly grouped together on small polished ebonite terminal strips. Servicing has been simplified by arranging that the wiring of the receiver and mains unit is readily accessible.

Probably one of the most ingenious pre-H.F. volume controls yet devised is included in the aerial circuit. The left-hand dial on the front of the cabinet actuates the wave band and pick-up switches (arranged below the H.F. and detector valve holders) by means of a long spindle. This terminates in a crank attached to a connecting rod and piston clearly visible in the illustration. The piston and cylinder into which it works form two elements of the volume control condenser. Extreme rotation clockwise gives the maximum transference of aerial energy (and hence greatest volume) on the medium wave-band, whilst rotation in the other direction gives increasing volume on the long waves. A position mid-way between the two puts the pick-up in circuit. The many functions of this dial are clearly marked, and its handling becomes a matter of simplicity in a very short time.

Interesting Volume Control.

Inside the cylinder containing the large piston connected to the aerial is a second and smaller piston which forms the third electrode of the differential condenser which is earthed (see circuit diagram). The relative dimensions and movements of the component parts of this assembly are such that control of volume, and, incidentally, selectivity, is not accompanied by any appreciable change in the aerial capacity thrown on to the first tuned circuit, with the result that ganging is not upset; furthermore, the special construction makes a very low minimum capacity possible. In this way the volume of the local station may be reduced practically to zero. In some receivers with a conventional series aerial condenser as a volume control adequate reduction of signal strength is impossible.

On the main terminal panel which is still exposed when the back of the cabinet is screwed home, there are sockets for loud speaker and pick-up jacks and nickelled terminals for aerial and earth wires; also, there is provision for the use of the electric lighting or power mains as an aerial for local-station reception. To prevent shock due to accidental contact with live terminals, it is arranged that the removal of the back of the cabinet breaks the main circuit.

In general, the circuit is orthodox, but there are a number of small refinements which merit description. Tuned anode coupling between the screen-grid valve and the leaky-grid detector is employed, but as it is necessary to maintain the common rotor spindle of the ganged condensers C_1, C_2 at earth potential, the anode

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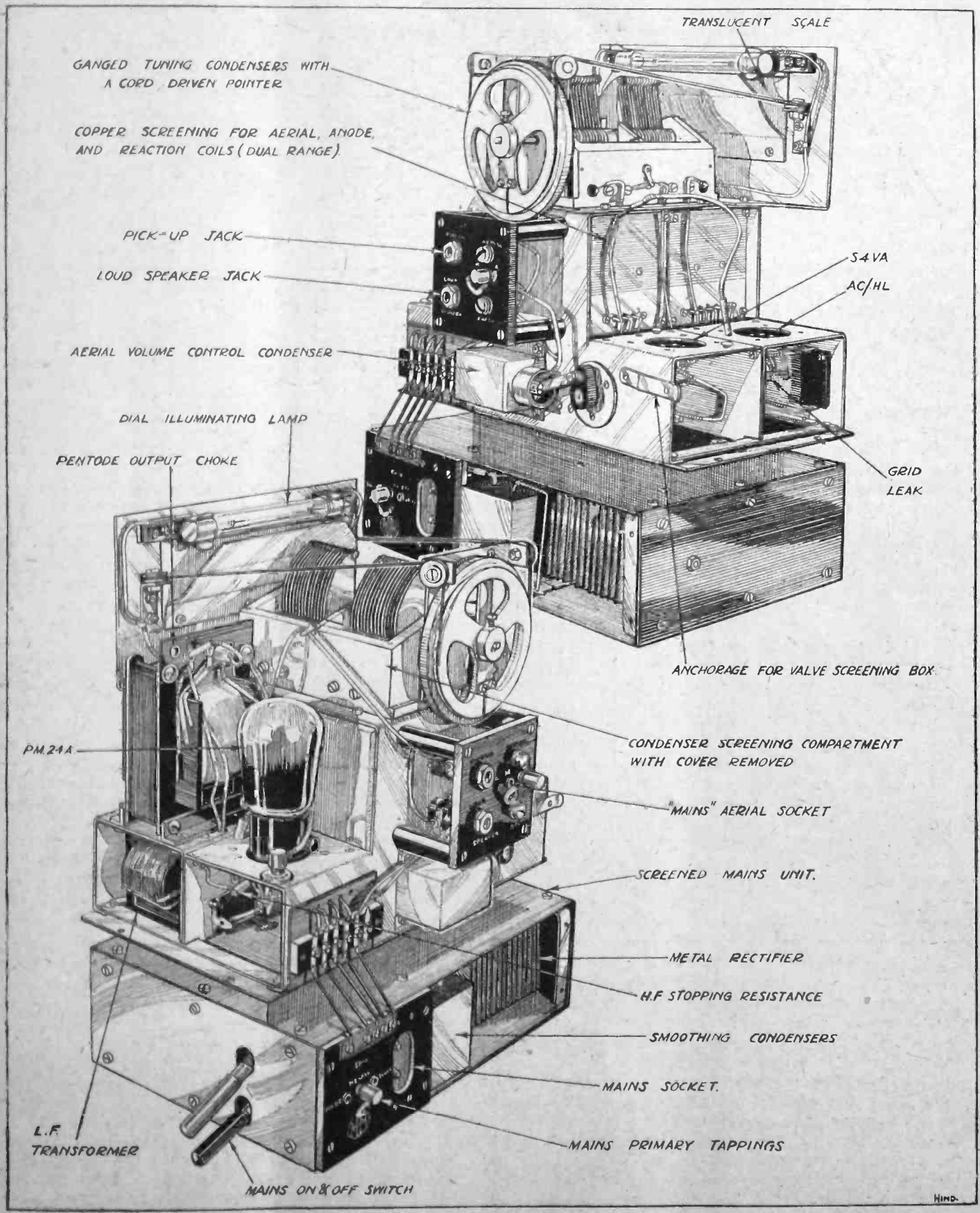


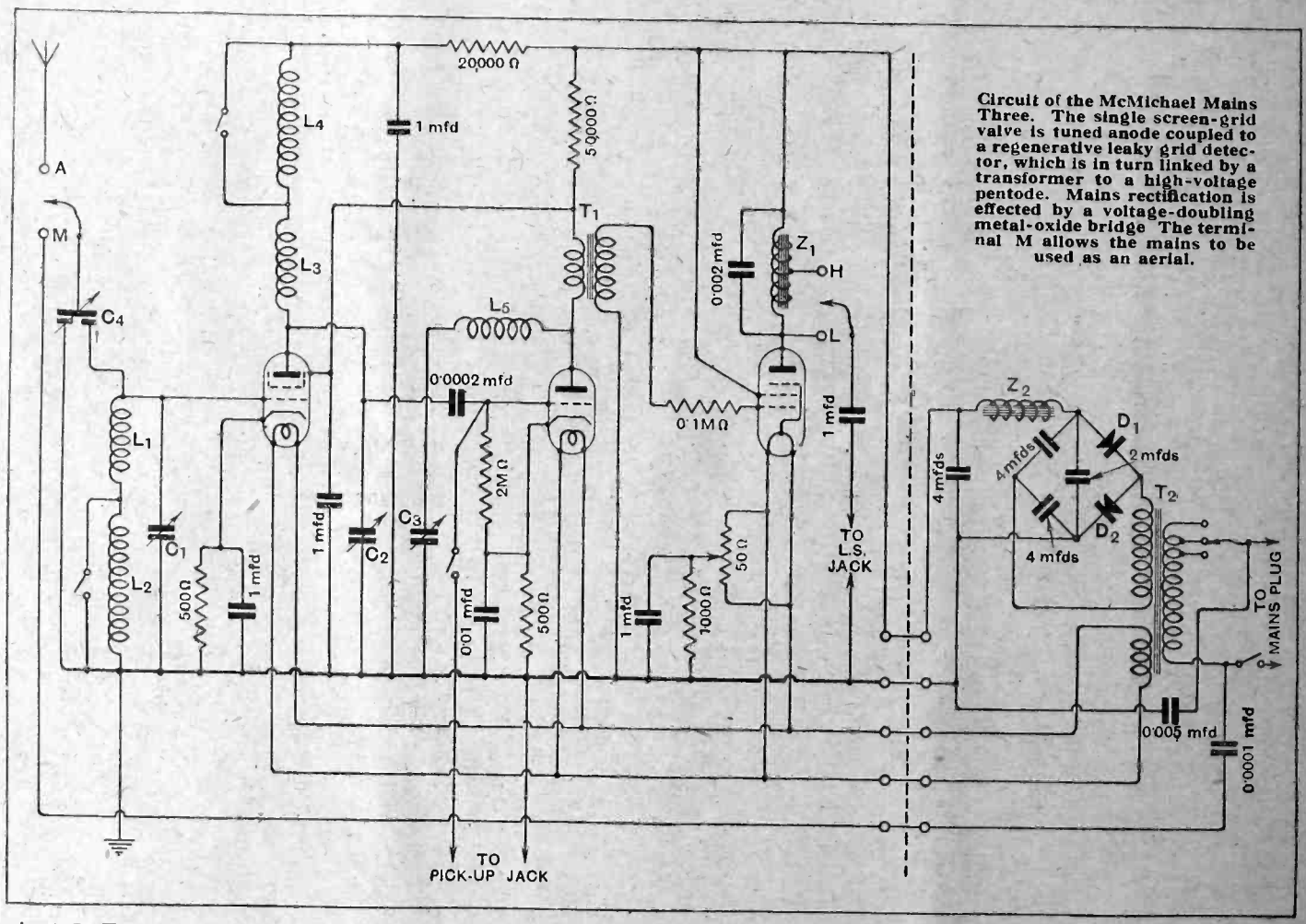
McMICHAEL MAINS THREE.—Constructional details of the chassis. Features of outstanding interest include the "piston" type volume control and the cord-driven pointer tuning device.

The McMichael Mains Three.—

condenser is connected as shown in the diagram and not directly across the coil. The three valves used are the Mullard S4VA (screen-grid), the Mazda AC/HL (detector), and the PM24A high-voltage pentode; their anode circuits are well decoupled, and the screening-grid of the H.F. valve, which at first sight appears to be fed through a 50,000 ohm series resistance, really derives its current from a potential divider—one arm of which is the detector valve. No H.F. choke is to be found in the plate circuit of the detector; presumably the primary of the intervalve transformer deflects sufficient H.F. energy, as the behaviour of the reaction condenser C_3 is perfectly satisfactory. An H.F. stopper of 100,000 ohms is included in the pentode control grid circuit, and the anode circuit of this valve contains a centre-tapped choke and impedance-limiting device or compensator which prevents the accentuation of high notes when certain types of moving-iron speaker are used. One side of the mains is connected to earth through a 0.005 mfd. condenser, thus minimising 50 cycles modulation by shunting away local H.F. energy.

When tested about seventeen miles south of London after dark, the set gave a very good account of itself, no fewer than fourteen stations on the medium band being received at good loud-speaker strength without interference. On the long waves, Hilversum, Kalundborg, Warsaw, Eiffel Tower, Daventry, Königswusterhausen, Radio Paris, Lahti and Huizen were received satisfactorily, with the exception of Königswusterhausen, where there was slight interference from Daventry. Moscow could be heard with reaction pressed to the limit. The minimum local station spread was about 40 kc. at 356 metres.

An undistorted A.C. output of a little over one watt, which is more than sufficient for domestic needs, is available from the output stage. The quality of reproduction is excellent, and fully vindicates the claim so often made in this journal that the high-voltage pentode when compensated can give an account of itself that is not excelled by any triode. There is a very slight residual hum, but this is not heard during a programme. The ganging holds well over both the wave bands, and is not affected by the volume or reaction controls. Great care has been taken by the makers to match the coils and condensers together with stray capacities before assembling the set, and trimmers have not been found necessary. The wavelength calibration was never more than 2 metres out on the medium band. At twenty guineas the "Mains Three" is very good value for money. The makers' address is: L. McMichael, Ltd., Hastings House, Norfolk Street, Strand, London, W.C.



Circuit of the McMichael Mains Three. The single screen-grid valve is tuned anode coupled to a regenerative leaky grid detector, which is in turn linked by a transformer to a high-voltage pentode. Mains rectification is effected by a voltage-doubling metal-oxide bridge The terminal M allows the mains to be used as an aerial.

A NEW DETECTOR VALVE

The Marconi and Osram H2 Valve Tested.

THE valve which is the subject of the present review is known as the H2, and is intended as a high-magnification amplifier, or as a detector valve, and is especially suitable, owing to its comparatively low consumption in the anode and filament circuits, for sets in which dry batteries are used as the source of supply.

The rated characteristics of the valve are as follows:

Filament voltage ..	2.0 volts.
Filament current ..	0.10 ampere.
Anode voltage (max.)	150 volts.
*Amplification factor ..	35
*A.C. resistance	35,000 ohms.
*Mutual conductance or slope..	1.0 milliamp. per volt.

*At anode volts 100, grid volts 0.

On checking the mutual conductance of the valve tested, taking the same standard conditions as were used in the official test, it was found that the valve had an even higher slope than claimed by the makers; the figure found was 1.14 mA/volt. The possession of so high a slope as this entitles the valve to rank as one of the most efficient two-volt valves available.

A full set of grid-volts/anode-current curves are shown in Fig. 1, together with a grid-current curve for $E_a = 80$. It will be noted that grid-current starts at $E_g = +0.15$ volt, so that it is necessary to supply a small negative grid-bias when the valve is used as amplifier. The steepness of the grid-current curve suggests that the H2 will make an unusually sensitive and distortionless grid rectifier; for this purpose it is suggested that the anode voltage be as high as convenient, and that a grid leak of about 2 megohms be used in conjunction with a grid condenser of the order of 0.0001 mfd.

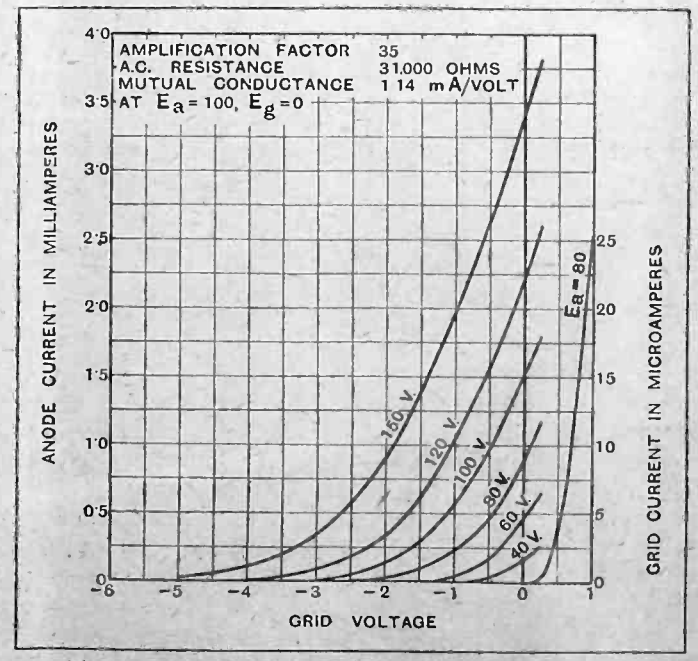


Fig. 1.—Marconi and Osram H2 valve. Grid volts/anode current curves and grid volts/grid current curve.

Owing to its comparatively low A.C. resistance, the valve will provide good amplification with but small loss of high notes when used with a resistance in its plate circuit. Either as grid detector or as first L.F. amplifier, a resistance of 150,000 ohms is suggested as suitable coupling to the next valve, though as an anode-bend rectifier a higher resistance would increase the sensitivity.

Fig. 2 gives a set of anode-volts/anode-current curves, from which the behaviour of the valve as an amplifier can be determined in detail. Each curve refers to a different value of negative grid-bias, as the figure shows. From these curves it is possible to read off the A.C. resistance of the valve, as expressed by the slope of the curve, for any conditions of working; in addition, by drawing in certain other lines that cut through the curves, the anode current drawn by the valve with any desired value of resistance in its plate circuit can be found.

In the figure a series of lines are drawn across the curves; all these lines are parallel, and all represent an anode resistance of 150,000 ohms, external to the valve. That this is so can be seen from the fact that the line passing through 1 milliamp. on the anode-current scale also passes through 150 volts on the voltage scale, and by recalling that 150 volts are needed to drive a current of 1 milliamp. through 150,000 ohms. Lines representing an anode resistance of

A New Detector Valve.—

200,000 ohms, in the same way, would all be parallel to a line joining 200 volts to 1 milliamp.

If the battery voltage is 150, for example, and the anode resistance 150,000 ohms, the anode-current taken by the valve at any selected grid-bias is given by the point at which the line AB cuts the appropriate curve. With one volt grid-bias, the current taken by the H2 would thus be 0.4 milliamp., rising to 0.56 milliamp. with zero grid-bias. The same points also give the D.C. voltage assumed by the anode of the valve itself; it is 90 volts or 66 volts for the two cases named. The points where the curves cut the other lines shown give corresponding information for other battery voltages, using the same value of anode resistance.

The utility of these curves is not by any means exhausted when these data as to static working conditions have been found. Suppose the valve is working at the point O; that is to say, the battery voltage is 150, the grid-bias 1 volt, and the anode resistance is 150,000 ohms. If a signal be applied to the grid, the momentary grid-voltage will be swung up and down about the fixed point O; if the peak value of the signal voltage is exactly one volt, the voltage on the grid will swing between the points P and Q. Inspection of these points shows that the voltage at the anode of the valve will swing in sympathy between the values 66 and 112 volts; a total swing of 46 volts, making a peak voltage of 23 volts (on either side of the steady value of 90 volts). The amplification provided by the valve, which gives out 23 volts of signals for every one volt applied to its grid, will thus be twenty-three times. Further, since the distance OQ is more than nine-elevenths of the distance OP, the distortion introduced by the valve in handling a signal of this magnitude will be less than 5 per cent. (the generally accepted limit), so that the H2 may safely be used at the operating voltages named to feed any output valve that does not require a grid-bias greater than 23 volts with an anode voltage of 150.

When used as a detector, the H2 will naturally not be capable of providing so large an output of signals before overloading begins, for the valve then has to deal with quite large high-frequency voltages to obtain even a small output of rectified signals. As a set-off against this, however, there is the fact that with the small amount of positive bias used when the valve is operating as a grid detector, the A.C. resistance is low enough to permit the use of a transformer, provided this has a primary of very high inductance, without loss of bass notes. The comparatively small current drawn by the valve will not saturate the core of an iron-cored transformer, though some of those using special alloys would have their performance seriously upset if called upon to carry 3 milliamps. through their primary.

If the valve is to be used as a detector, it will necessarily be connected in parallel with a tuned circuit. This being the case, it seemed desirable to enquire whether the base of the valve introduced appreciable high-frequency losses. On putting the matter to the test, it was found that at 250 metres the damping effect of the unlighted valve was equal to that of a non-inductive resistance of 1½ megohms.

Although a loss exists it is small and may be neglected in all but the most exacting conditions. A valve of similar type, but made (by the same makers) some two or more years ago, was found to introduce about five times the losses of the H2; we are glad to be able to make the inference that the matter of base-losses is having the makers' attention.

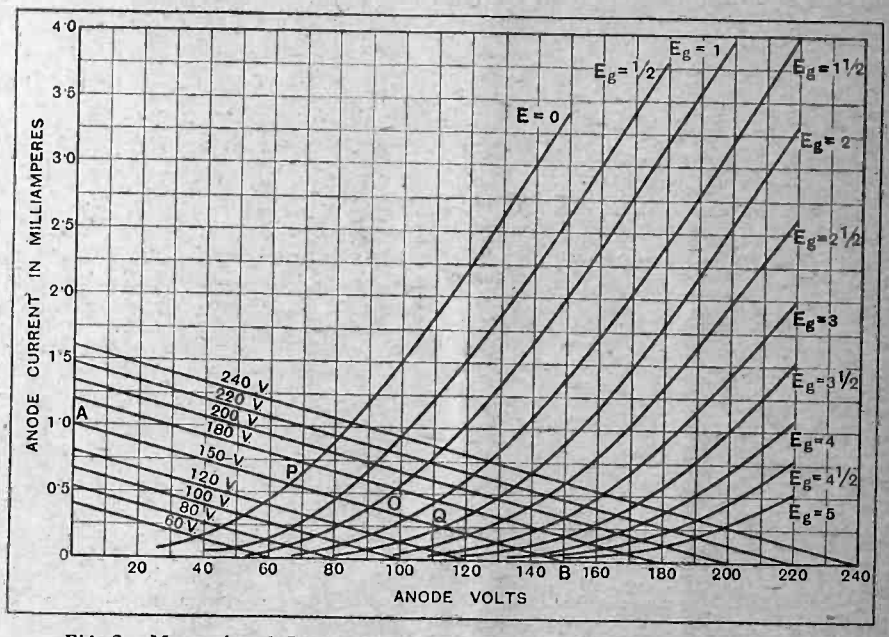


Fig. 2.—Marconi and Osram H2 valve. Anode volts/anode-current curves, with load lines for 150,000 ohms.

PARLOPHONE SOUND-TEST RECORDS.

Two Recent Additions.

IN addition to the three original test records which were reviewed in the issue of this journal for August 21st, 1929, two new records have been recently released, the numbers being P9797 and P9798. Each of these records contains eight sine-wave constant frequencies distributed at octave intervals throughout the useful musical range as follows:—

Record No. P9797: 32, 64, 128, 256, 512, 1,024, 2,048, 4,096 cycles.

Record No. P9798: 50, 100, 200, 400, 800, 1,600, 3,200, 6,400 cycles.

The duration of each frequency is approximately 40 seconds, and a plain groove is cut in the space between each frequency band to locate the needle point at the end of each section.

As in the case of the previous records, the recording has been carried out by the Heinrich Hertz Institute at Berlin. The price of the new records, which are obtainable only from the Parlophone Co., Ltd., 81, City Road, London, E.C.4, is 15s. each.

Broadcast Brevities

By Our Special Correspondent.

A Broadcast Satire.

If recent broadcast plays have contained more than a touch of morbidity, the balance should be redressed on January 16th when Du Garde Peach's new play, "The Path of Glory," specially written for the microphone, will be broadcast on the National wavelength.

I hear that the play is an entertaining satire on war. In the imaginary conflict both sides are striving to lose, since it is recognised that it is the defeated nation that comes off best as regards taxation and the general aftermath of the campaign.

The play will be repeated on the Regional wavelength on January 17th.

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Radio Drama on the Continent.

Radio drama in Britain absorbs a comparatively small amount of the programme time, but on the Continent it is different. The Bureau Internationale de Radiofusion has just issued some interesting figures in regard to European radio drama during the past year or two. Since February, 1930, the number of plays broadcast in the countries covered by the Union has exceeded 600; the total since March, 1929, is approximately 1,500.

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A New Art.

About one-third of the number were written specially for broadcasting, and the critics declare that many of them can really be classed as examples of a new art.

Germany takes the radio play very seriously, and her output easily exceeds the modest British total of four per month.

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A Tribute From Canada.

On the subject of radio drama a "bouquet" for the B.B.C. has just been received from Canada.

It comes from Mr. E. A. Weir, Director of Radio for the Canadian National Railways, who has now returned to the Dominion after a personal survey of broadcasting in Europe.

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Where Britain Leads.

"It may be hard for some to conceive of New York being second to Europe in anything," writes Mr. Weir. "Nevertheless in the production of radio drama and in education broadcasting America is undoubtedly in second place.

"Production methods for radio dramas in Great Britain are definitely ahead of those in America."

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Return of Mr. Vernon Bartlett.

Mr. Vernon Bartlett, who has been on a lecture-tour of America, returns to the microphone at Savoy Hill in the New Year, with a new series of "The Way of the World." The first of his reviews will be broadcast on January 8th.

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Those Piano Transmissions.

It is generally conceded that the microphone has no more difficult instrument to deal with than the common or garden pianoforte. Both in wireless and in gramophone reproduction it is the piano which comes crashing in to spoil an otherwise beautiful illusion of re-creation.

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A Sparring Match.

Unfortunately for Savoy Hill, however, it is demonstrated daily by the B.B.C. engineers that almost perfect reproduction of the pianoforte is not impossible. This fact at once removes any excuse for the sometimes atrocious quality of the piano transmissions during the weekly talks on music. If the piano can be conquered once it can be conquered again, but the engineers and the piano seem to be engaged on a sparring match which has lasted ever since 1922.

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The Knock-out.

If the engineers appear to be winning during the early part of the evening, the piano shows its perversity later on in (strangely enough) a music talk. A few blasting blows and where are the engineers?

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An Official Listener.

Where are they, indeed? Are they listening?

I addressed a few questions to a B.B.C. official. He assured me that every word and every note emanating from the transmitting aerial is listened to by a responsible official of the B.B.C. In fact, a log is kept.

A Case in Point.

I put this log to the test. On a recent Tuesday, I pointed out, my home set gave excellent reproduction of the pianoforte part in a performance of the Gershom Parkington Quintet on the National transmitter. The set was then switched off until later in the evening when Mr. Victor Hely-Hutchinson's music talk was listened to on the same wavelength. No adjustment had been made to the set, yet the pianoforte reproduction was distressing.

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What the Log Revealed.

The log book was consulted and it was found that, whereas the Quintet performed that evening in No. 4 studio, the music talk was given in No. 3. Beyond this no explanation was offered for the disparity of the two transmissions, and I can only imagine (*a*) that No. 3 possesses a poor microphone or (*b*) that the room is architecturally unsuitable.

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A Possibility?

It would be a happy triumph if the engineers completed their conquest of the piano by the time the B.B.C. moves into "Broadcasting House."

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The Truth About Modern Music.

Modern music is perhaps easily assimilated by a world reared on Bach and Beethoven; but the B.B.C. is to do something towards "explaining" the newer school to listeners in a series entitled "New Friends in Music," starting next February.

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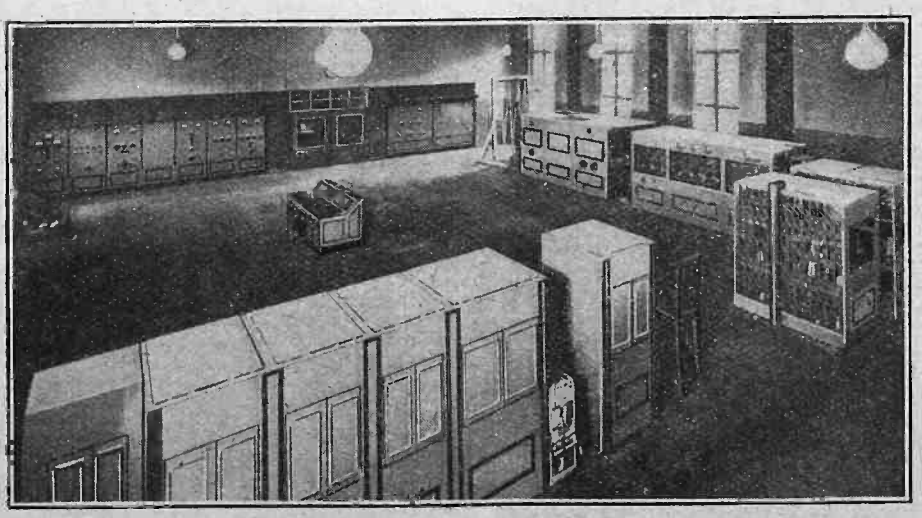
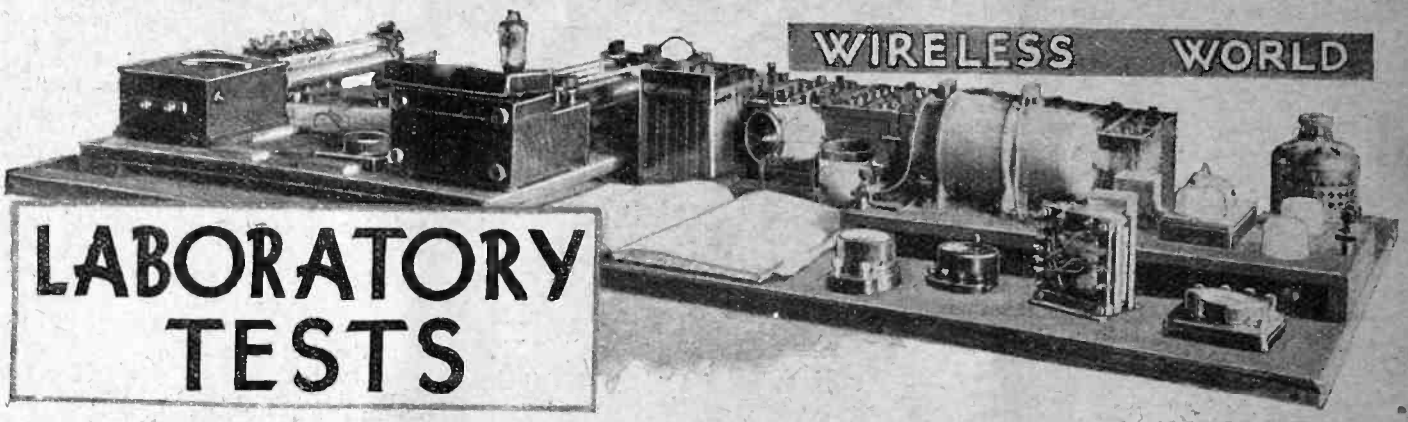
Filling the Niche.

So the niche over the main entrance to "Broadcasting House" is to be filled with a group representing Ariel and Prospero in the famous scene in "The Tempest." The sculptor, Mr. Eric Gill, has a reputation for daring originality, and the new B.B.C. building should allow ample scope for exercising the gift



A GERMAN HIGH-POWER STATION.—There are interesting points of resemblance between the transmitting hall at Heilsberg, seen in the picture, and that of the B.B.C. station at Brookmans Park. Heilsberg, the second station of Germany's new high-power scheme, opened transmission on December 10th with a wavelength of 276 metres and a power of 75 kilowatts.



LABORATORY TESTS

A Review of Manufacturers' Recent Products.

TANNOY A.C. MAINS UNIT. Model C.P.2.

This unit combines an H.T. eliminator and an L.T. trickle charger in a metal container, the overall size of which is $9\frac{1}{2} \times 5\frac{1}{8} \times 3\frac{3}{4}$in. high. It will fit, therefore, in the space provided for the H.T. battery in the majority of portable sets. Its usefulness is not restricted to this one function, and it can be used as an external unit to supply H.T. to a cabinet-type receiver. Westinghouse rectifiers are fitted, a voltage doubling full-wave unit is employed for the H.T. supply, and a bridge-connected unit for the L.T. trickle charger, the latter giving 0.5 amp. max.

Three H.T. tappings are provided, two being variable and one fixed. The variable output voltages can be adjusted, in one case from 0 to 95 volts, and in the other from 0 to 120 volts, the maximum in each case depending on the load.

The fixed output was found to give 192 volts at 2 mA., 177 volts at 5 mA., 153 volts at 10 mA., 130 volts at 15 mA., and 105 volts at 20 mA. A small reduction occurs when a few milliamps are drawn from each of the variable tappings, the voltages from which are derived from potentiometers.

A practical test showed the unit to be entirely satisfactory provided the usual precautions have been taken in the set to counteract the detrimental effects of common resistance in the H.T. supply.

Tannoy A.C. mains H.T. eliminator and L.T. trickle charger.

The makers are Tannoy Products, 1-7, Dalton Street, West Norwood, London, S.E.27, and the price is £5 10s.

FERRANTI CELL TESTER. TYPE C.T.2.

This instrument has been developed especially for cadmium tests of accumulators. This test enables the faulty element in a cell to be determined when voltage measurement and acid tests fail to definitely locate the trouble. In large batteries it is cheaper to replace the faulty element than to scrap the cell.

Ferranti cel.-testing meter designed especially for cadmium tests.

The cell under test should be charging or discharging at normal rate; on open circuit true reading will not be obtained. The cadmium electrode, which is encased in a perforated ebonite sleeve, clips on to the fixed pointed prod on the meter, and when lowered into the electrolyte enables true readings to be taken of the voltage between the acid and the positive, and acid and negative, plates.

The meter has a centre zero and two ranges: 3-0-3 and 0.3-0-0.3 volts, a switch bringing the desired range in operation. A fully charged cell shows, between cadmium and positive, 2.35 to 2.5 volts, and between cadmium and negative 0.1 to 0.2 volt, but on the opposite side of the zero, the difference being the true terminal voltage. This difference should correspond with the voltage given by the cell makers for a fully charged cell.

The meter can be used also as an ordinary centre-zero voltmeter.

The makers are Messrs. Ferranti, Ltd., Hollinwood, Lancashire, and the price is 66s. 6d. The cadmium element is a separate item, and costs 5s. 6d.

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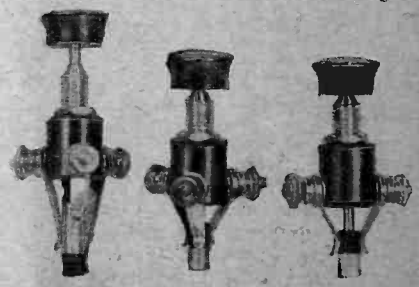
"RED DIAMOND" SWITCHES.

The Jewel Pen Co., Ltd., 21-22, Great Sutton Street, London, E.C.1, have recently introduced three new types of push-pull switches. In each case the operating spindle and bush are insulated from the contact springs and collar so that the switches can be used on metal panels.

Type RD44, which is priced at 2s., is a single-pole double-throw switch designed specially for gramophone pick-up connections. Here the isolated spindle is a distinct advantage, as it is essential to keep the capacity of the grid lead down, when the switch is called upon to deal with a change in grid bias.



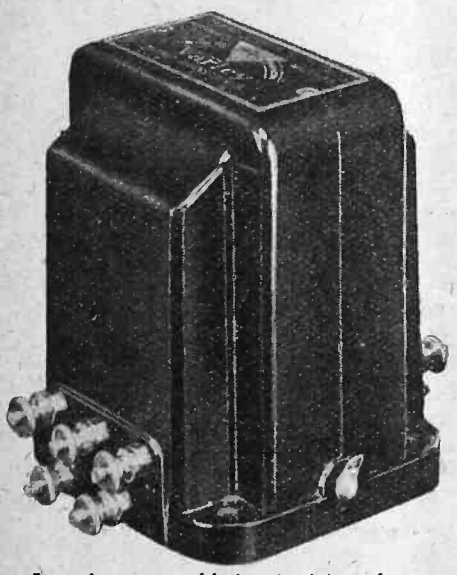
"Red Diamond" push-pull switches with insulated spindles. (Left to right) Types RD44, RD47 and RD49.

Types RD47 and RD49 are specially designed respectively for the 1931 Ferranti "Battery Two" and "Screened Grid Three" kit sets. The RD47 is a three-contact switch for making and breaking the H.T. and L.T. circuits, and the RD49 a two-pole filament switch.

In all three types the action is positive and the contact springs are firm.

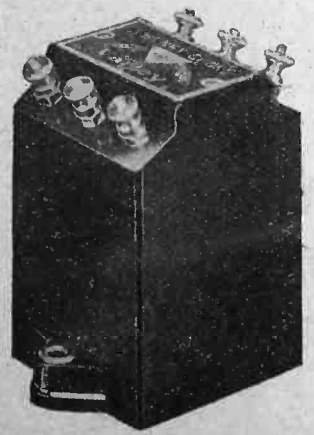
TWO NEW VARLEY COMPONENTS.

To facilitate the correct matching of the loud speaker and the output valves, Varley, 103, Kingsway, have introduced an output transformer which gives the choice of six ratios, namely 8 : 1, 10 : 1, 12 : 1, 15 : 1, 20 : 1, and 25 : 1. The D.C. resistance of the primary winding is 162 ohms, and its inductance 6.5 henrys when carrying 25 mA. of D.C. The primary is designed to carry 50 mA. of D.C. The overall dimensions of the components are 3½in. × 4in. × 3⅞in., and the weight is 2 lb. 12 oz. The price is £1 2s. 6d.



Impedance-matching output transformer by Varley.

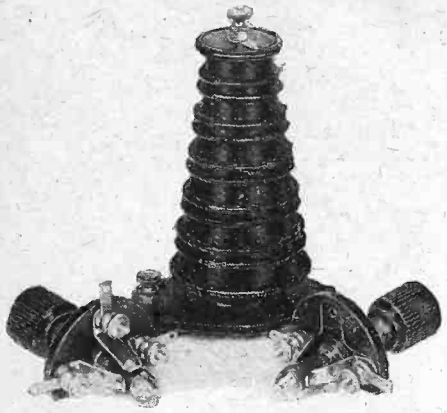
A 3-henry L.F. choke with tappings giving 0.5, 1.0, 1.5, 2.0 and 3.0 henrys is another new addition to the Varley range. Its D.C. resistance was found to be 47 ohms. This component can be used, in conjunction with a large variable condenser and a resistance, in a tone control circuit in parallel with the anode impedance of one of the L.F. stages. Normally, it will not be required to



Varley 3-henry tapped L.F. choke.

carry the D.C. component of the anode current, consequently its dimensions are small, the overall size being 2⅞in. × 1½in. × 2⅞in., and the price is 8s. 6d.

NEW TUNEWELL PRODUCTS.



Tunewell H.F. choke, in which the sections are wound in alternate wide and narrow slots, and examples of new type push-pull switches. These components are made by Messrs. Turner and Co., Station Road, Old Southgate, London, N.11; the H.F. choke is priced at 6s. 6d., and the two- and three-point switches cost 1s. and 1s. 3d. respectively.

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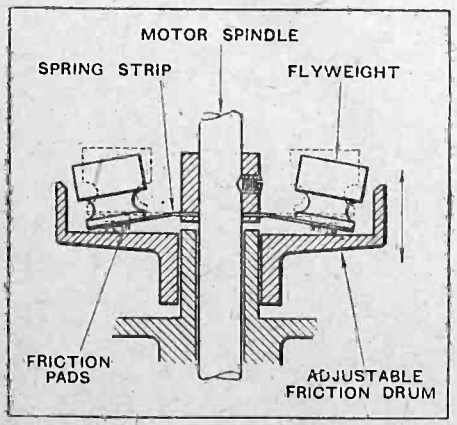
DIEHL "ARISTOCRAT" GRAMOPHONE MOTOR.

Designed exclusively for A.C. supply mains, this motor is of the induction type and is backed by the Singer Sewing Machine Co., of America. It is interesting to note that for some years this company has fitted induction motors of this type to its products with the object of



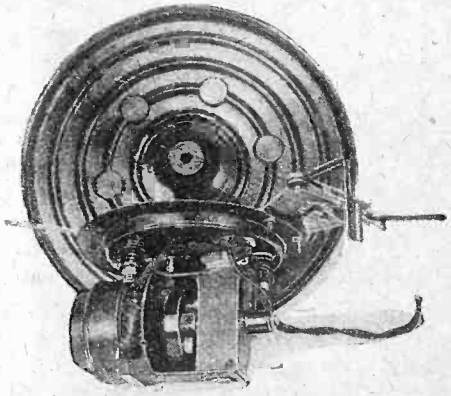
Sectional diagram showing principle of the Diehl governor mechanism.

eliminating interference with wireless receivers in the vicinity.

The motor is mounted horizontally and drives the vertical turntable spindle through a worm gear of conventional design. The governor, however, is unconventional from British standards and consists of two brass fly-weights mounted in a single spring strip at right angles to the motor spindle.

The motor plate is circular and the work of fitting to a cabinet is thereby considerably simplified. A three-point attachment is employed between the motor and its base plate, and each point is provided with coil springs and felt washers to absorb vibration. The turntable is moulded and its inertia is low so that the motor quickly attains its working speed. The centre hole is provided with cork bushes and the weight of the turntable is supported on a single-plate cork clutch. Thus protection is afforded to the worm gears, while sufficient friction is provided to drive the record against the resistance of the needle.

Tests were made on 230 volts A.C., and the current taken on load was 107 milliamps. A continuous run of two hours failed to show any signs of overheating,



Diehl "Aristocrat" induction motor and moulded turntable.

and at the end of this time a slight "grumble" in the governor mechanism, which was noticed at first, had disappeared, the friction pads having by this time been thoroughly bedded down.

The starting torque is good and the motor reaches its normal running speed in just over one complete revolution of the turntable. In the steady state the torque is satisfactory, and the speed is unaffected by large amplitudes in the record.

Messrs. Claude Lyons, Ltd., 40, Buckingham Gate, London, S.W.1, are the distributors in this country, and the price complete is four guineas.

A quick make-and-break switch incorporated in an automatic stop is a standard item of the equipment.

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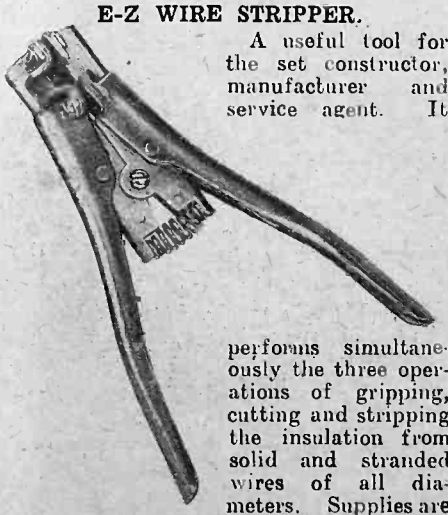
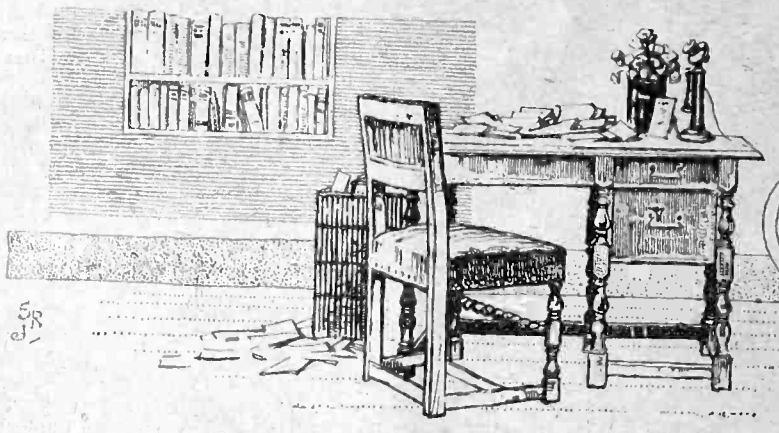
E-Z WIRE STRIPPER.



A useful tool for the set constructor, manufacturer and service agent. It performs simultaneously the three operations of gripping, cutting and stripping the insulation from solid and stranded wires of all diameters. Supplies are obtainable from J. B. Hyde and Co., Ltd. Broadheath, near Manchester, and the price is 15s. 6d.



The Week's Postbag

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

PENTODE v. TRIODE.

Sir,—In the article "Pentode *v.* Triode" (November 26th, 1930), reference is made to the sensitivity of a power valve in milliwatts per volt. This is somewhat in error, for sensitivity is actually measured in milliwatts per (volt)^2; the unit is thus independent of the actual grid input voltage, and one can fairly compare values of different power on the same basis. A unit in terms of milliwatts per volt is actually a mixture of sensitivity and output power, and therefore two valves which give the same output for a given particular input might have very different "sensitivity" merely because one happened to be rated at a higher power than the other.

Although the milliwatt per (volt)^2 unit is seldom referred to in print it is much used by designers in comparing valves, particularly pentodes with triodes. The only uncertainty lies in the unit of voltage. The tendency is to use the peak value in amplifier calculations, as this is more connected with other matters, such as bias, than the R.M.S. value; yet it seems to me to be inadvisable to adopt peak values unless specifically mentioned, as considerable confusion is liable to be caused when using the figures in connection with other electrical quantities.

London, S.E.3. M. G. SCROGGIE, B.Sc., A.M.I.E.E.,
Chief Engineer, Burndept Wireless (1928), Ltd.

LOUD SPEAKER EFFICIENCY.

Sir,—My attention is drawn to Mr. Barclay's article in your issue of December 3rd and to his statement that the efficiency of a loud speaker is less than 2 per cent.

I should be very glad to know how he arrives at this view. In the "acoustic tube" type of speaker developed by Dr. F. W. Lanchester and my firm it is possible to say with considerable accuracy what the output of energy in sound-waves is, and, as the same argument applies to the cone speaker and the sensitivity of the two is similar, I feel that it is possible to give the efficiency in set terms.

If Mr. Barclay were referring to the ratio of sound energy emitted to the dissipation of the valve, then I would not take much exception to his statement beyond saying that 4 per cent. was nearer the mark. But the instrument itself has an efficiency more nearly 33 per cent. R. H. PEARSALL,

Birmingham. Lanchester's Laboratories, Ltd.

Sir,—In reply to Mr. Pearsall, I cannot do better than refer him to the issue of *The Wireless World* for July 6th, 1927, which contains an article by Dr. McLachlan entitled "Loud Speaker Inefficiency—Sources of Energy Loss which Reduce Efficiency to 1 per cent."

Doubtless since the date of that article this figure has been somewhat improved, and I believe that in putting it on the average at 2 per cent. to-day I am not unduly wide of the mark. Indeed, if Mr. Pearsall will turn to an article on "Loud Speaker Performance" by E. J. Barnes, A.M.I.E.E., in *Experimental Wireless* of June, 1930, he will find the figure ascertained experimentally for the "absolute efficiency" of a cone of 7in. diameter in a flat baffle 3ft. square with moving-coil drive. The conclusion may be quoted. "It was found that somewhat under half of one per cent. of the input was radiated as sound over the hemisphere facing the cone."

The discussion of loud speaker "efficiency" is gravely hampered by the lack of precise definition. It is, I think, somewhat misleading to speak of efficiency without any reference to the frequency-intensity characteristic. It is generally recognised that it is impossible to arrive at any set figure which will convey an idea of relative merit as between different loud speakers. In this connection, it is somewhat difficult to understand the figure of 33 per cent. which Mr. Pearsall puts forward for the efficiency of the product of his firm. One would like to have a precise definition of what constitutes the efficiency of "the instrument itself," which reaches this highly attractive figure.

Arcadia, Bieldside, N.B. W. A. BARCLAY.

SERVICE.

Sir,—Your recent editorial on servicing, and letters called forth from readers on the same subject, have been of outstanding interest, not only to retailers, but to the average reader. The all-important matter of servicing calls for a really high standard of technical knowledge and experience, and while some traders themselves have thoroughly gone into the technical side of the radio art there yet remain a great majority who have not considered this a worth-while matter. Too often they rely on the practical experience of their employees to carry them through the difficult part of after-sales work, and this is regrettable if for no other reason than good service makes good sales. As a branch service manager of a very large radio manufacturing firm, I could give innumerable cases of adequate service bringing a very rich reward indeed, while, on the other hand, indifference to customers' wishes has brought the eternal grouse of poor sales.

My contention is that where a trader is thoroughly interested in the sale of radio products, servicing becomes second nature to him, and, if the trader himself has no time to study this subject, he will invariably pick out a thoroughly competent engineer to look after this side of his business.

In your editorial of October 22nd you indicated that "Those who join the ranks of the service man on the merits of technical knowledge and training alone should also have some recognised certificate of competence to give confidence to the public." This very important matter was in the minds of a number of radio engineers who, during recent months, have inaugurated a scientific body known as "The British Radio Institution." It is the aim of this society to standardise technical and practical knowledge of all subjects appertaining to the radio art—and this by examination and examination only. It is hoped by this method to embrace those workers ashore and afloat who have made wireless their profession, both in applied radio and its kindred subjects of power speaker equipment and talkies. Our examination covers this extensive field of knowledge, and it will be the aim of the B.R.I. to so maintain a standard of knowledge that whenever a radio engineer indicates associateship with the

B.B.I. his qualifications in the radio art will be unquestionable. This institution, therefore, very closely meets with the scheme put forward by you two months ago, whereby traders and radio engineers will have a basis of qualification, and in view of this sympathy of ideals, Mr. Editor, may I ask you to bring the activities of the British Radio Institution to the notice of your many readers through the medium of your correspondence columns?

D. H. IRVING,
Bristol. Secretary, British Radio Institution.

GRAMOPHONE MOTORS.

Sir,—Following a recent note on the Garrard Induction Motor for gramophones, your readers may be interested to know that, although primarily designed for 40-60 cycle supply, it can be made to work satisfactorily on higher frequencies.

I obtained one of these motors, and wished to use it temporarily on 90 ~ 200 v. (pending the alteration of my supply to 50 ~ next year). The windings are in two parts, which can be connected in series for 200-250 v., or in parallel for 100-130 v. The windings were connected in parallel (marked "100-130 v., 40-60 ~ ") and supplied with 50 ~ 120 v., and the current taken was noted. (There was some difficulty in finding an ammeter with a low enough range, but finally a 0-250 mA. hot-wire meter was borrowed; it read 0.175 amp., which is probably inaccurate, but we may assume that the same point on the scale indicates the same current at 90 ~ and at 50 ~.) The 100-volt winding was then supplied through a series resistance from 200 v. 90 ~ and it was found that if the series resistance was about 350 ohms the current was the same as in the first case (0.175 amp. nominal). (It is interesting to note that in each experiment the rotation was stopped by holding the turn-table; the increase of current was too small to read.)

It is found that a 100-volt 32 c.p. carbon filament lamp is exactly right used as a series resistance, with the 100-volt windings on 200 v. 90 ~. The motor was run continuously for two hours in this way; the windings were only slightly warm, and the (unwound) rotor was cool enough to bear the hand on with comfort. It does not slow up, with this arrangement, on heavy passages in the record. Used with a Marconiphone pick-up and a powerful amplifier (AC/HL, AC/P, two LS6As in push-pull, all resistance-coupled except power stage), bad A.C. hum was noted, even before switching on the motor. This was chiefly due to the potentiometer volume control mounted near the pick-up; screening with a tobacco tin, and using lead-covered wire (connected to screen and earthed on covering), made a great improvement, especially when the current to motor was taken in lead-covered and earthed wire. The last traces of hum were completely removed when the body of the motor itself was earthed (by one of the holding-down screws).

Anyone having a higher frequency supply than 60 ~ may be interested to know of the possibilities of using an induction-type motor; in general, it may be expected to be more satisfactory than a "Universal" type, since the latter employ brushes and a commutator, which are generally troublesome to keep in order, even with machines of several horse-power, and more so with such very small sizes as are required to drive a gramophone.

Cambridge. C. R. COSENS.

NEWCASTLE TRANSMISSIONS.

Sir,—I write to you on the subject of the B.B.C. transmission from Newcastle in the hope that you may see fit to deal with the subject editorially, and, also, that the publicity which *The Wireless World* provides will secure at an early date some improvement in the conditions under which local broadcast licensees receive the B.B.C. programmes. There are perhaps two aspects of the matter, namely, quality and choice of programme.

As regards quality, I should first say that my own receiver is situated some two miles from the transmitter, and is, though of course not perfect, I think, of adequate goodness to enable one to form a proper judgment. It consists of a band-pass filter feeding an H.F. stage which is coupled by a straightforward transformer to a detector. There is then a resistance-capacity stage of L.F. followed by push-pull output incorporating LS5A valves with 445 volts at the anodes. A moving-coil speaker is used, and there is a milliammeter in each anode feed. All stages are decoupled, and there is practically no trace of hum, even at full power. There are nine valves in all, five in the receiver proper, two half-wave rectifiers for the output stage, one full wave for the earlier stages, and another for the speaker field.

Now, it is noticed that, while there are times when reproduction is as good as the receiver is capable of providing, there are more times when the background noises so mutilate the transmission as to make listening almost impossible. Part of this is due, I understand, to land-line noises and part to the radio link which is employed at those periods of the day when the Post Office do not supply the B.B.C. with land-lines. Not only does the local listener have his programmes interfered with by noises, but not infrequently does the transmission get cut off entirely. (On the evening of December 8th, for instance, there was a cut-off for several seconds at 7.56 p.m. and again at 8.25 p.m.)

Now I admit that probably the only argument a local listener has is the poor one that he pays the same fee as his co-listeners near London, who have a local station which is capable of transmitting programmes which do not suffer from the defects I have mentioned, but I still think that the conditions here are such as to warrant considerable improvement. They were far better, for instance, when Newcastle had its exclusive wavelength and could radiate its own programmes.

I turn now to the question of choice of programme. There is no alternative station available, for Newcastle radiates for the most part the National programme, which is about the only other programme that can be reached by the average receiver, i.e., from Daventry 5XX. Even when the new twin station at Moorside Edge starts its operations, Newcastle will in all probability be no better off, for it will be outside the guaranteed service area. (See B.B.C. Year Book, 1931, p. 268), and even the retention of the Newcastle transmitter will presumably mean the duplication of one or other of the programmes.

I, therefore, suggest that Newcastle be given again an exclusive wavelength. It could take over the frequency of 1,013 kc., about 295 metres, at present—according to *World Radio*—not allotted, and which would give the standard separation of 9 kilocycles from the nearest allotted wavelength. If this were done, and Newcastle allowed to produce its own programmes, considerable improvement would be effected, and the many thousands of listeners in the densely populated area of Newcastle and the large district with which it is surrounded would be able to receive programmes which were not adulterated with the unpleasant rumblings, etc., to which they for some time have been obliged to submit, if they wanted to listen at all.

I have little or nothing to say as regards the programmes themselves. The task of preparing programmes day after day for so many stations is an immense feat in itself, and it is clearly impossible to provide every listener every day with everything he wants most. I would, however, suggest, as others have done before, that more variety, or at least alternatives, be given on Sundays. Those whose tastes lean towards pious meditation or ecclesiastical music till 9 p.m. on a Sunday evening surely would not deny their equally sincere brethren music of a lighter character. By all means let us have education (in addition to entertainment), but why coercion?

I would further say that it seems that the time has arrived when the timing of evening programmes generally might be altered. The evening programme might begin at 7 p.m. instead of 7.45, when probably the majority of listeners are eating. The time-table might run then as follows:—7-8; 8.15-9.15; 9.30-11.30, with the intervals either silent or for news. At present the programme from 3.45 is like a patchwork quilt:—3.45-4.45; 4.45-5.15; 5.15-6; 6-6.15, etc.

QUALITAS.
Jesmond, Newcastle-on-Tyne.

RE *BROADCASTING GRAMOPHONE RECORDS.*

Sir,—As one who is interested in all remarks under the above heading, I consider that the arguments for and against about balance out. I do, however, consider that your correspondents have entirely overlooked the most important argument against gramophone broadcasts, namely, the apparent lack on the part of the B.B.C. of appreciation of the necessity of keeping constant turntable speed. Surely the chronic speed variation of the machine used by the London Regional at lunch time on December 10th was apparent to the most uninitiated ear. Really

good recording was absolutely wasted, whilst the entertainment value of the programme was negatived.

Forest Gate, E.7. L. S. DEIGHTON.

Sir,—My attention has been drawn to a letter written by Mr. Chestney in your issue of December 10th, dealing with the psychological effect on the radio listener of the broadcasting of gramophone records. I do not believe that a judicious increase in the number of records broadcast by the B.B.C. would lose them a single licence-holder besides Mr. Chestney himself.

The very considerable correspondence which I get from listeners leads me to suppose that in the present state of programme-building such as the B.B.C. can afford, more rather than less broadcasting of records is desired, even when no illusion is intended. Where, however, the fact that records are being used is not emphasised, or has even been camouflaged, the improved efficiency of the performance would probably induce even Mr. Chestney to keep his licence going, and if or when the B.B.C. begins to make its own recording of complete programmes, we may hope for a palinode from him.

London, W.1. CHRISTOPHER STONE.
The Gramophone.

REACTION AND THE BAND-PASS FILTER.

Sir,—May I suggest to Mr. Cocking that his approximate formula (2) on page 642 for the voltage magnification of a capacitatively coupled filter at peak frequency would be rendered more accurate as well as simplified were it written:

$$\frac{e}{E} = \frac{1}{2R\omega C}$$

This result is obtained by differentiating the standard formula for $\frac{e}{E}$ with respect to $\left(\omega L - \frac{1}{\omega C}\right)$, on the assumption that $\frac{1}{\omega C_m}$ is constant over the peak width of the tuning band.

N.B. W. A. BARCLAY.

PHILIPS RECTIFIERS.

Interesting Range of High-vacuum and Gas-filled Types.

THE full range of rectifying valves made by Philips Lamps, Ltd., Philips House, 145, Charing Cross Road, London, W.C.2, includes over 100 different types which may be divided broadly into three classes, namely, high-voltage rectifiers suitable for use in wireless transmitters, gas-filled rectifiers for charging high- and low-tension accumulators, and high-vacuum types intended for use in H.T. battery eliminators. Those comprising the last-mentioned class are designed to operate at filament voltages for which suitable transformers are readily available.

The majority of these valves are fitted with 4-volt filaments and consume from 0.6 amp. to 2 amps., according to type. In the following list we give briefly the essential information with regard to those valves particularly suited for use in A.C. receivers and H.T. battery eliminators.

PHILIPS H.T. HIGH-VACUUM RECTIFIERS.

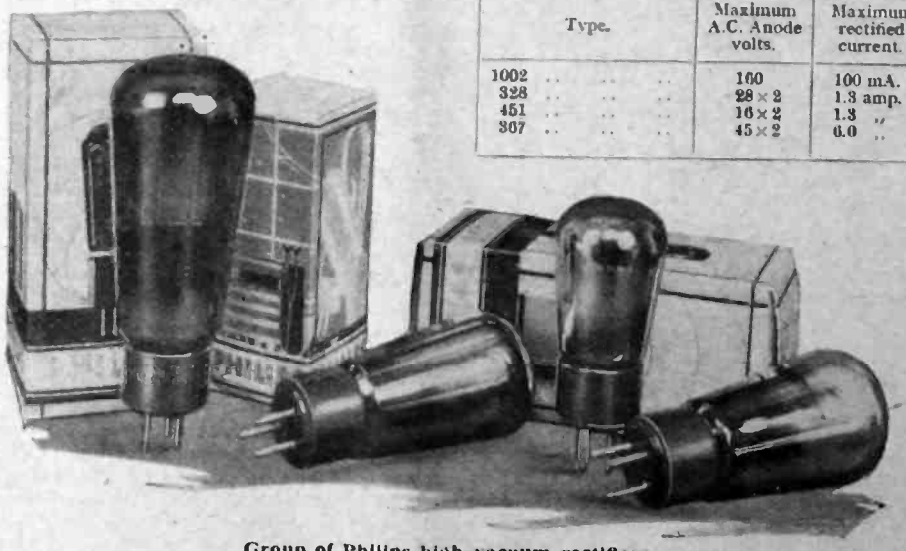
Type.	Maximum A.C. Anode volts.	Maximum rectified current.	Half- or Full-wave.	Filament voltage.	Filament current.	Price.
373	220	40 mA.	Half-wave	4.0	1.0	15/-
505	400	60 ,,	,,	4.0	1.0	15/-
1562	750	110 ,,	,,	7.5	1.25	30/-
1801	220×2	30 ,,	Full-wave	4.0	0.6	15/-
1821	250×2	60 ,,	,,	4.0	1.0	17/6
506K	300×2	75 ,,	,,	4.0	1.0	20/-
506	375×2	60 ,,	,,	4.0	1.0	20/-
1560	300×2	125 ,,	,,	5.0	2.0	22/6
1561	500×2	120 ,,	,,	4.0	2.0	22/6

Another group which has a special application in the radio sphere is the gas-filled types developed for charging high- and low-tension batteries. Philips gas-filled thermionic rectifiers are fitted with a barium-oxide coated filament, which confers the advantages of low filament consumption and low filament temperature. Consequently a small bulb can be used, rendering the rectifier easily accommodated in a restricted space.

The most interesting valves in this class will be found in the following table:—

PHILIPS GAS-FILLED RECTIFIERS FOR H.T. AND L.T. CHARGES.

Type.	Maximum A.C. Anode volts.	Maximum rectified current.	Half- or Full-wave.	Filament voltage.	Filament current.	Price.
1002	160	100 mA.	Half-wave	1.8	2.8	15/-
328	28×2	1.3 amp.	Full-wave	1.8	2.0	12/6
451	16×2	1.3 ,,	,,	1.3	2.8	12/6
307	45×2	0.6 ,,	,,	1.8	8.0	25/-



Group of Philips high-vacuum rectifiers.

A very useful appendage to these gas-filled rectifiers is the Philips regulator lamp, the function of which is to maintain the current at a constant level even though the voltage varies within quite wide limits. The charging current depends upon the difference between the voltage of the battery and that of rectified voltage delivered by the valve. With a 2-volt cell, for example, this difference will be relatively large as compared with the case when a 6-volt battery is connected to an L.T. charger, and in the former case a current-regulating resistance must be used.

The resistance of these regulating lamps depends upon the temperature of the wire, the resistance increasing as the temperature rises. Thus, within certain limits the current through the device remains at a constant value. These regulating lamps can be obtained to suit the majority of gas-filled rectifiers listed. The correct lamp for the 328 rectifier is type No. 328, with a limiting factor of 1.3 amp. and with the 1002 rectifier lamp No. 1003 should be used, which maintains the current between 60 and 90 mA. for any battery voltage from 40 to 120.

READERS' PROBLEMS

Replies to Readers' Questions of General Interest.

Technical enquiries addressed to our Information Department are used as the basis of the replies which we publish in these pages, a selection being made from amongst those questions which are of general interest.

Safety Fuses.

Due to the fact that the H.T. battery failed suddenly, I have just fitted a flashlamp fuse between the negative H.T. and L.T. terminals of my "Band Pass Three" receiver. It is now noticed that the lamp glows quite brightly when the high-tension battery is connected; does this indicate that there is still a short-circuit, and, if so, which is the most likely place to find it?

If your flashlamp bulb is of the low-consumption variety, it is quite possible that its filament will be heated to incandescence by the flow of charging current to the by-pass condensers which are included in this receiver. If the flash is of momentary duration, you can rest assured that all is probably in order, and that the original short-circuit, if indeed it ever existed, must have cleared itself.

On the other hand, if the lamp glows continuously there must clearly be a fault, which may possibly be attributed to a defective by-pass condenser. If these components are proved to be beyond suspicion, your attention should be transferred to the H.F. transformer, as there may be a short-circuit between its primary and secondary windings.

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Bias Resistance Values.

With reference to the Valve Data supplement included with "The Wireless World" for November 26, will you please tell me if it is in order to use the anode currents given there as a basis for calculating the values of automatic bias resistance?

Yes, the information given with regard to average anode current may certainly be used when making these calculations, as it is correct with regard to normal specimens used under amplifying conditions. In dealing with abnormal valves, or with valves used in an abnormal manner, the only way of ensuring extreme accuracy is to make an actual measurement.

It may be pointed out that many automatic bias circuits are to a great extent self-regulating, and in consequence it is seldom vitally necessary to choose exactly the right value of resistance.

Obsolete Valves as Power Rectifiers.

I have a large number of obsolete bright-emitter valves which I should like to use in place of my double-wave rectifying valve, which has just failed. Will you please show me how to make the necessary alterations to the eliminator (the circuit diagram of which I am sending you), and also say if these old valves should be capable of supplying 25 milliamps. at about 160 volts?

We assume that you wish to use two of the bright-emitter valves as full-wave rectifiers. This plan should be fairly satisfactory, and the alterations to your eliminator—of which the rectifying section is reproduced in Fig. 1 (*a*)—should be made on the lines suggested in diagram (*b*). You will observe that plate and grid terminals of each valve are connected together. The filament-heating winding of your transformer should be capable of delivering between 4 and 5 volts at about 1.5 amp.

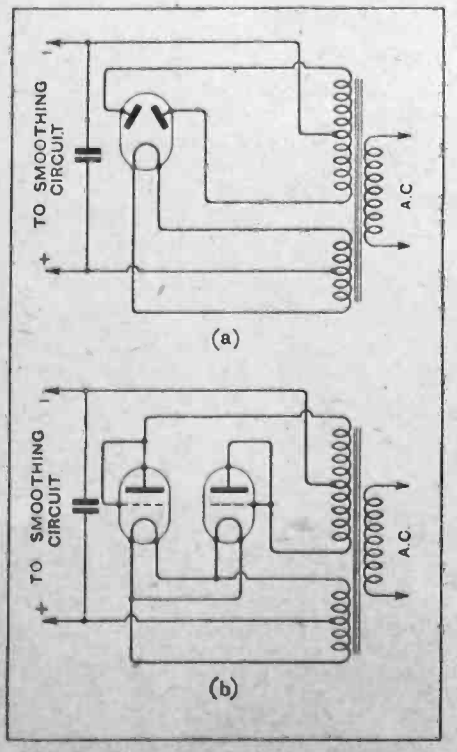

Fig. 1.—Diagram (a) shows the conventional circuit arrangement for a full-wave valve rectifier; two triodes, with plates and grids joined together, may be substituted in the manner shown in diagram (b).

Provided that the H.T. secondary of your transformer gives an A.C. voltage in the order of 250 R.M.S., there should be no difficulty in obtaining the output you require, but it must be realised that regulation will not be so good as when a proper rectifier is used.

o o o o

"Half a Loaf . . ."

Do you consider that an input band-pass filter may be satisfactorily operated if its circuits are tuned by separate variable condensers? Although my own condensers are fitted with spindle extensions, they are not of the type that is generally recommended nowadays for ganging purposes.

We would strongly dissuade you from attempting to tune your filter circuits by means of independent condensers. Experience shows that it is extremely difficult to operate a set of this type if coupling is sufficiently close to give proper band-pass or double-humped tuning. Even if your present condensers are so unsuitable that single-dial control can only be maintained perfectly over a few degrees, it would be better to link them together mechanically—with, of course, some provision for compensation—rather than operate them separately.

o o o o

A.C. Valves as Detectors.

I am about to fit indirectly heated A.C. valves in my two-valve det.-L.F. receiver. As it will no longer be possible to obtain positive bias for the detector by connecting the grid leak to L.T. positive, would it be worth while to fit a bias cell?

The average A.C. valve of the type likely to be used as a rectifier has such characteristics that it is quite unnecessary to provide bias for a grid detector, as grid current in these valves usually starts to flow before the grid is made positive with respect to the cathode.

"Power Pentode Two" Tuning Arrangements.

I am about to rebuild my "Power Pentode Two" in a larger cabinet, and at the same time should like to fit a band-pass filter. If this is practicable, will you please give me a circuit diagram showing the necessary alterations, and also say where I can find a published description of suitable coils? It is intended to use a differential condenser as an input volume control device.

As the "Power Pentode Two" normally covers only the medium broadcast band, we take it that long-wave reception is not desired, and the circuit diagram given in Fig. 2 is prepared on this assumption.

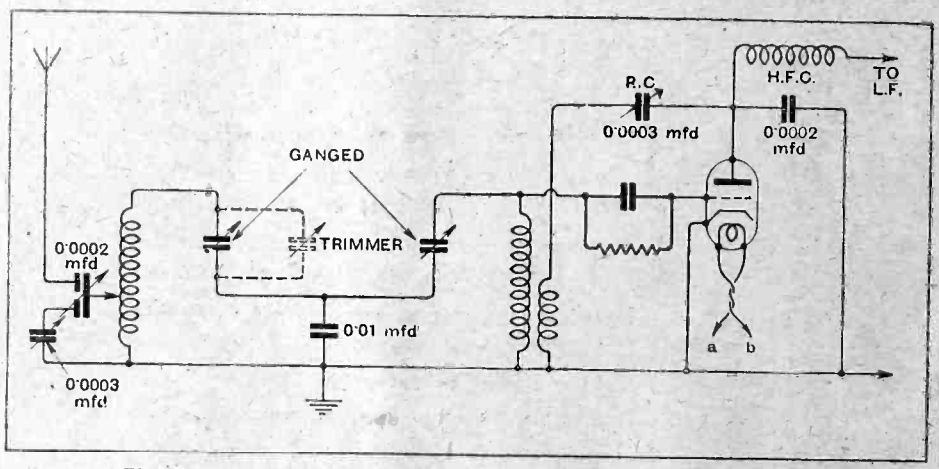

Fig. 2.—Aerial input circuit of the "Power Pentode Two," modified for band-pass tuning.

Regarding the coils and condensers for the filter circuit, you may be guided by the description of the components used in the "Band Pass Unit" described in our issue for August 27th, 1930.

A differential condenser will be suitable as an input volume control device, but we recommend you to use, in conjunction with it, a semi-variable balancing condenser, so that tuning need not be unduly affected. This condenser is shown in our diagram.

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Doubtful Economy.

To save space, I have been thinking of using tuned-anode couplings for the two H.F. stages of a projected self-contained battery-operated receiver with screen-grid valves. I am aware that the prevention of interaction becomes more difficult when this form of H.F. coupling is used, but am quite prepared to fit decoupling devices for each circuit. Will you please give me a word of advice?

In spite of the fact that several very successful portable sets employ the tuned-anode system, we think that you would probably save yourself much experimental work by using either the tuned grid or transformer method of H.F. coupling.

Although you may be prepared to take the fullest possible precautions, it must not be forgotten that the inclusion of decoupling resistances of high value will bring about a commensurate loss of H.T. voltage, which can seldom be spared in a battery-fed receiver of the self-contained type.

o o o o

The Cathode Connection.

The power transformer of my eliminator is fitted with a spare centre-tapped secondary winding giving a rated output of 6 volts, and intended for heating the filament of the last L.F. valve of a receiver. It is my intention to take advantage of this source of supply, and to fit a P.625 in place of my present 2-volt output valve. To what point should the centre tapping be connected?

The centre tapping of this filament winding must be regarded as the cathode connection of the output valve. Unless some form of automatic bias is used, the tap will be joined directly to the common H.T.-L.T. negative bus-bar.

o o o o

Filament Current Meter.

An ammeter is permanently connected in series with the filament circuit of my D.C. mains receiver; it normally shows a reading of 0.25 amp. I am puzzled by the fact that, when self-oscillation is produced by operation of the reaction control, a momentary "flicker" of the meter needle is produced, and its steady reading is slightly changed. As oscillatory currents should be confined to plate and grid circuits, I am at a loss to see how the filament circuit can be affected. Will you please explain this effect?

In a receiver fed entirely from D.C. mains, it is quite usual that the filament current meter should be connected in such a way that it indicates any change in anode current—such as the change produced when a valve passes from the non-oscillating to the oscillating condition.

If it is desired that the meter should register filament current only, and be unaffected by changes in anode current, it should be transferred to between the mains input and the positive filament terminal of the output valve.

Artificial Loading.

I have an L.T. transformer, rated at 4 volts, 4 amp., and propose to use it temporarily for feeding the heaters of two A.C. valves, consuming a total of only 2 amps. Under these conditions, I believe that the voltage output of the transformer is likely to exceed its rating, with the consequence that the valves may be slightly overrun. In any case, it will be necessary to connect a potentiometer across this winding; would it not be possible to prevent any rise in voltage by using a potentiometer of exceptionally low value, thus imposing an artificial load?

Although the rise in voltage across the secondary of a well-regulated transformer should not be excessive when operating under the conditions you describe, no harm would be done by using a low-resistance potentiometer. A value of 2 ohms would be correct, and you should take care to see that it will carry a current of 2 amperes without undue heating.

o o o o

Unscreened Condensers.

In the construction of a "2-H.F." receiver to be operated with a frame aerial, it is intended to use separate screens for each of the H.F. inter-valve coupling coils; will it be necessary to provide screening for the tuning condensers as well?

If high-stage gains are aimed at, it will be wise to screen the condensers, as otherwise instability may be caused by interaction between them (or their exposed wiring) and the frame. Experience shows that total enclosure in a screening metal container is a desirable condition.

FOREIGN BROADCAST GUIDE.

ALGIERS

(Algeria, North Africa).

Geographical position: 36° 45′ N. 3° 11′ E.
Approximate air line from London: 1,042 miles.

Wavelength: 363.4 m. Frequency: 825.3 kc. Power: 13 kW.

Time: Greenwich Mean Time.*

Standard Daily Transmissions.

12.30 G.M.T., gramophone records; 18.00, oriental concert (Fri.); 19.00, news bulletin, concert; 21.00, oriental concert (Tues); 22.30, dance music or relay of cabaret.

Male announcer. Call: *Ici Radio P.T.T. Alger du Gouvernement Général.*

Announcements are sometimes made in both French and Arabic.

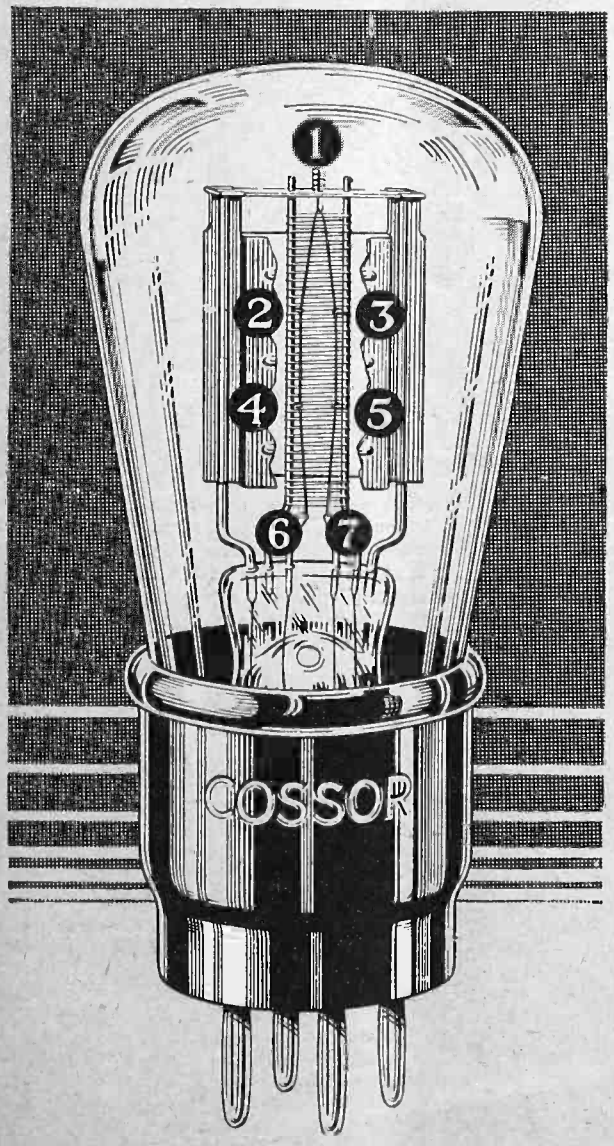
Occasional Interval signals: Gong.

Closes down with *La Marseillaise* and usual good-night greetings in French.

*** Algeria does not adopt Summer Time when the change-over is made in France.**

Seven point suspension *definitely prevents* microphonic noises

—*by eliminating filament vibration*



Microphonic noises in a Receiving Set are usually traceable to the Detector Valve. Nine times out of ten the cause is filament vibration. Look at the illustration alongside. This shows the internal construction of the new Cossor Detector Valve. See how the filament is held—not only top and bottom—but also by four insulated hooks spaced at intervals throughout its length. The purpose of these hooks is to damp out any tendency for filament vibration. Therefore by using this "steep slope" Cossor Detector Valve in your Receiver the possibility of microphonic noises is definitely eliminated and you are assured of greater volume with absolute tonal purity.

We have just issued a novel, circular Station Chart which gives identification details of nearly 50 stations and space is provided for entering your own dial readings. Price 2d. each they are obtainable from any Wireless Shop. In case of difficulty write us, enclose 2d. stamp and head your letter "Station Chart W.W."

Cossor 210 DET., 2 volts, .1 amp. Impedance 13,000. Amplification Factor 15. Mutual Conductance 1.15 m.a./v. Normal working Anode Voltage 90-150. *Price* **8/6**

THE NEW COSSOR DETECTOR VALVE

DEFINITELY FREE FROM MICROPHONIC NOISES

A. C. Cossor Ltd., Highbury Grove, London, N.5, V 7131

 Advertisements for "The Wireless World" are only accepted from firms we believe to be thoroughly reliable.

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Each paragraph is charged separately and name and address must be counted.

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ADVERTISEMENTS for these columns are accepted up to **FIRST POST** on **THURSDAY MORNING** (previous to date of issue) at the Head Offices of "The Wireless World," Dorset House, Tudor Street, London, E.C.4, or on **WEDNESDAY MORNING** at the Branch Offices, 19, Hertford Street, Coventry ; Guildhall Buildings, Navigation Street, Birmingham ; 260, Deansgate, Manchester ; 101, St. Vincent Street, Glasgow, C.2.

Advertisements that arrive too late for a particular issue will automatically be inserted in the following issue unless accompanied by instructions to the contrary. All advertisements in this section must be strictly prepaid.

The proprietors retain the right to refuse or withdraw advertisements at their discretion.

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All letters relating to advertisements should quote the number which is printed at the end of each advertisement, and the date of the issue in which it appeared.

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

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For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. When this is desired, the sum of 6d. to defray the cost of registration and to cover postage on replies must be added to the advertisement charge, which must include the words Box 000, c/o "The Wireless World." Only the number will appear in the advertisement. All replies should be addressed No. 000, c/o "The Wireless World," Dorset House, Tudor Street, London, E.C.4. *Readers who reply to Box No. advertisements are warned against sending remittance through the post except in registered envelopes ; in all such cases the use of the Deposit System is recommended, and the envelope should be clearly marked "Deposit Department."*

DEPOSIT SYSTEM.

Readers who hesitate to send money to unknown persons may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt.

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. For all transactions up to £10, a deposit fee of 1/- is charged ; on transactions over £10 and under £50, the fee is 2/6 ; over £50, 5/-. All deposit matters are dealt with at Dorset House, Tudor Street, London, E.C.4, and cheques and money orders should be made payable to Iliffe & Sons Limited.

SPECIAL NOTE.—Readers who reply to advertisements and receive no answer to their enquiries are requested to regard the silence as an indication that the goods advertised have already been disposed of. Advertisers often receive so many enquiries that it is quite impossible to reply to each one by post.

RECEIVERS FOR SALE.

SCOTT SESSIONS and Co., Great Britain's Radio Doctors. — Read advertisement under Miscellaneous.

HIRE a McMichael Portable Set, by day or week, from Alexander Black Wireless Doctor and Consultant, 55, Ebury St., S.W.1. Sloane 1655. [0328

STRAIGHT Five Portable, makers' 12 months' guarantee; 8 guineas, complete.—Mosby, 507, London Rd., Sheffield. [1169

"WIRELESS World" Four, Foreign Listener's Four, or any other "Wireless World" circuit built to specification with listed components by experienced staff, work and results guaranteed.—Matlock Radio Manufacturers, Matlock House, Woodberry Grove, Finchley N.12. 'Phone: Finchley 2837. [2634

Receivers for Sale.—Contd.

APPLEBY'S, where radio part exchange began.

THE Service is as Follows : We can supply practically all the leading lines of radio apparatus on the market at current list prices; if so desired we can accept in part exchange the reputable makes of the following apparatus : Receivers (domestic and portable), radio-gramophones, loud-speakers (cone and moving coil), cone unit and chassis battery eliminators and mains equipment components, battery chargers, remote control equipment, pick-ups and carrier arms, electric gramophone motors, H.F., L.F., and power chokes, condensers (variable, reaction, by-pass and smoothing), measuring instruments (high grade), L.F. transformers, slow motion dials (high grade), modern miscellaneous components; valves and tuning coils cannot be accepted in part exchange except by special arrangement.

IN View of the Difficulty of Making Fair and Definitely Offers for Material that we have not inspected, it is requested that apparatus tendered for part exchange be kindly forwarded to us for valuation; no business can be proceeded with in connection with part exchange until material tendered has been examined; in this connection there need be no fear; material is sent to us from all over the world; not a single item of customers' property has ever been lost or mislaid; rejected offers from Xmas last amount to only 3.

IN Order to Furnish a Guide, the part exchange allowance may be gauged as approximately 50% of the list price of the article or articles tendered; for some articles the allowance will be more, and for others somewhat less; the allowance is entirely determined by the demand for individual articles, considering also their condition and production age; amateur constructed receivers cannot be accepted in part exchange as receivers, their value lying wholly in the components contained in them; only modern apparatus in good condition is accepted in part exchange; material cannot be purchased by us for cash.

TERMS of Part Exchange Business : A minimum of 50% of the value of an order, plus carriage charge where due, is payable in cash, unless the value is below £1, when a minimum of 10/- is payable; should the part exchange allowance exceed 50% of the total value of new requirements, the difference will be credited against future orders; material may be deposited against a credit note, which may be utilised at a later date; the maximum amount allowed to stand to the credit of any one individual is £200.

APPLEBY'S, Chapel St., St. Marylebone, London (opposite Edgware Rd., Metropolitan Station, or 4 minutes from Marble Arch, Oxford St.). Tel. : Paddington 8828 (3 lines). [0340

IGRANIC Superhet., large open type, with high frequency stage, about 250 metres to 4,000, very fine condition; to clear at £5.—Michael Lavin, Old House, Sonning, Reading. [2597

VOLTMETER-WESTON Standard Portable Model, unused, A.C. and D.C., range 0-600v. (guaranteed to 0.25%).—Offers to Box 8470, c/o *The Wireless World*. [2623

MARCONIPHONE Straight Eight Receiver, with valves, mahogany case, high and short wave coils, £12; also eliminator, £5.—Goldie, Park Av., Mansfield. [2626

IGRANIC Semi Portable Supersonic Het., with folding frame aerial, 7 Mullard valves, including Pentode, perfect order, £14; Sifam 2 S.G., D. and P., including valves, frame aerial, Box pattern, and 2 coils for outdoor aerial, £8; both these sets a bargain and full working order; reason given for selling.—Blair Hotel, Minehead, Som. [2633

YOUR Old Receiver or Components Taken in Part Exchange for New; write to us before purchasing elsewhere and obtain expert advice from wireless engineer of 25 years' professional wireless experience; send a list of components or the components themselves, and we will quote you by return post; thousands of satisfied clients.—Scientific Development Co., 57, Guildhall St., Preston. [0226

CHARGERS AND ELIMINATORS.

PHILIPSON'S Safety H.T. Supply Units are Famous for Reliability and Silent Working.

OUR New Prices Again Make Them Famous for Value; for D.C. mains model D.C.4 gives 120v. at 15 m.a., 27/6; D.C.5, 150v. at 25 m.a., 1 fixed, 2 var. tappings, 35/-; for A.C. mains model A.C.7, 120v. at 20 m.a., £3; A.C.5, 150v. at 30 m.a., 1 fixed, 2 var. tappings, £3/17/6; A.C.6, for 25 cycle mains, £5.

PHILIPSON'S Safety HT. Supply Units are Guaranteed for 12 months; write for our booklet, "Radio Power."

PHILIPSON and Co., Ltd., Radio Engineers, Astley Bridge, Bolton. 'Phone : 2038. 'Grams : Safety, Bolton. Est. over 50 years. [0318

PHILIPS High Tension Unit, 100 volts A.C., type 372, 3 tappings, 1 variable, purchased March last, cost £6/10, guaranteed absolute new condition and perfect working order; £2/17/6.—Allen, Crabbes Cottage, Aldeburgh, Suffolk. [2386

Chargers and Eliminators.—Contd.

H.T. Eliminator Kit, incorporating Westinghouse H.T.5 rectifier, kits consist of transformer, choke, Westinghouse rectifier; required condensers, resistance, safety plugs and sockets, and baseboard; output 20 milliamps at 120 volts, 47/6, post free; metal case for same, 3/9 extra.

ELIMINATOR Kits, transformers, choke, condensers, valve, valve holder, resistance, terminals; 36/-; post free.—Fel-Ectric Radio, Garden St., Sheffield. [2049

VORTEXION Transformers and Chokes, wound to specification; best quality components only supplied.

VORTEXION No. 4 Bobbins, 1in.×1½in., 1/3, post 2d.; 1in.×1in., 1/-, post 2d.; cast aluminium end plates, 2/3 per pair, post 2d.; No. 4 laminations for 1½in. bobbins, 6/2, post 9d.; for 1in. bobbins, 4/2, post 6d.

VORTEXION, 72, Merton Rd., Wimbledon, S.W.19. Tel.: Wimbledon 2814. [0439

TANTALUM for A.C. Rectifiers; blue prints for inexpensive H.T. and L.T. chargers.—Blackwell's Metallurgical Works, Ltd., Garston, Liverpool. [1209

RADIELLE Eliminator, input 200-240 volts, output 150-400 volts, 100 milliamps and two variable tappings, cost 13 guineas, perfect; what offers?—Rogers, 21, New Rd., Brentwood, Essex. [2628

SAVAGE'S Specialise in Wireless Power from the Mains; reliable apparatus at reasonable prices.

SAVAGE'S Transformer Laminations and Bakelite Bobbins; intending home constructors should write for list.

SAVAGE'S Reliable Smoothing Condensers, 1,500 volts D.C. test, 1 mfd. 2/-, 2 mfd. 3/-, 4 mfd. 5/3; 500 volts D.C. test, 1mfd. 1/6, 2 mfd. 2/3; 4 mfd. 3/9.

SAVAGE'S Power Chokes for the Power Pentode Two, smoothing L.C.36G. 18/-; output L.C.36P.G., 19/6; many other types available, write for list.

SAVAGE'S Mains Transformers for the New Westinghouse Units; please write for list.

SAVAGE'S New Foreign Listeners' Four Equipment.—Transformer, N.F.L.4, 33/-; smoothing choke. C32G, 20/-; output choke C32/0, 20/-.

SAVAGE'S "Wireless World" Four Equipment, mains transformer, W.W.4, 34/-; smoothing and bias chokes, type W.W.4C, 16/- each; centre tapped output choke, L.C.36P.G., 19/6.

SAVAGE'S Mains Transformer, B.T.4, 500-0-500 volts 120 m.amps., 7½ volts 3 amps., 6 volts 3 amps., 4 volts 2 amps., 4 volts 1 amp., 4 volts 1 amp., all centre tapped, specially developed to facilitate automatic bias in all stages; 57/6.

SAVAGE'S Mains Transformer, V.T.37, 250-0-250 volts, 60 m.amps., 4 volts 1 amp., 4 volts 1 amp., 4 volts 1 amp., 4 volts 2 amps., all centre tapped, a useful instrument for modern receivers with automatic bias in every stage; 35/-.

SAVAGE'S Main Transformers and Power Chokes are carefully constructed from first class materials with an exceptionally generous margin of safety; they are fully guaranteed and may be purchased with confidence.

SAVAGE'S Have Moved to Larger Premises; please note new address: 292, Bishopsgate, London, E.C.2. Telephone: Bishopsgate 4297. [2629

SOUND SALES.—Genuine British Stalloy Stampings.

NO. 30 for "Wireless World" choke, 1½in. core, 4/6, post free; 1in. core, 3/6, post free.

NO. 4 Stalloy Stampings, 1½in. core, 6/-, post free; 1in. core, 4/2.

CLAMPS and Bolts for Above, 1/6 and 2/-.

"WIRELESS World" Constant Inductance Chokes; 15/-; repairs a speciality; see our speaker advertisement.

SPECIAL Filament Transformer, 200-240 volts, tapped primary, 4 volts, 4 amps., centre tapped output, metal shrouded, shockproof terminal; 15/-.

WE Guarantee All Transformers Undergo a 4-hour Test on Overload; for insulation, correct voltage and freedom from buzzing, the safety factor is ample for all requirements.

SOUND SALES, Tremlett Grove, Highgate. 'Phone; Archway 3871. [2492

COILS, TRANSFORMERS, ETC.

TRANSFORMERS and Chokes for Battery Eliminators.—Chester Bros., 495, Cambridge Rd., London, E.2. [9706

DYNAMOS, ETC.

E.M.1 Motor Generator Set, 230v., 50 cycles, single phase, direct coupled to 2 generators, output of one 400v., 200 m.a., output of other 8v. 7 amps., unused; cost £31, what offers?—Apply Armstrong, 55, Brown St., Manchester. [2591

BERCLIF Coils, the finest made, for all receivers; get our list (post free) before buying, trade supplied.—Simmonds Bros., 38, Rathbone Lane, Smethwick. [2620

Loud-Speakers.—Contd.

BAKER'S SELHURST RADIO 36-page Booklet, "Sound Advice is Yours for the Asking"; write now for new edition; see displayed advertisement on page 11. [0231

BEAUTIFULLY Polished Oak Firescreen Loud-speakers. Osmond unit, excellent tone; 35/-.—Lunt, 41, Heatherdale Rd., Mossley Hill, Liverpool. [2627

SOUND SALES Specialise in Moving Coil Speaker Repairs.

SOUND SALES Supply Replacement Mains Transformers from 15/-

SOUND SALES Convert D.C. and Battery-excited Speakers to A.C.

SOUND SALES.—Amazing Christmas offer : Magnavox Little Giant moving coil speakers, complete, in oak, mahogany, or walnut finish cabinet, also special gold or fancy cabinet, guaranteed free from box resonance, 6-volt and 220v. D.C. models; £3/3; c.o.d. if required.

SOUND SALES, Tremlett Grove, Highgate. 'Phone : Archway 3871. [2365

REALISTIC SPEAKERS, wood diaphragm, ingenious construction, unrivalled results, true to its name; chassis, 27/6, fit any unit; complete speakers, £3/10 to £25; write for particulars, demonstrations daily.—Realistic Speakers, 72, Penton St., London, N.1. [2308

CABINETS.

ARTCRAFT Cabinets, illustrated list free; radiograms, from 79/6; unbeatable value.—Artcraft Works, Grant Rd., Croydon. Established 1925. 'Phone : 1981. [1814

DIGBY'S Cabinets.—Table models in solid oak and mahogany; from 11/6 to 71/-.

DIGBY'S Cabinets, fitted with Radion or Resiston ebonite if required.

DIGBY'S Cabinets.—Pedestal model, with separate battery components; from 56/- to £12.

DIGBY'S Cabinets Made to Customer's Own Designs.

DIGBY'S Cabinets.—Write for new 16-page art catalogue.—F. Digby, 9, The Oval, Hackney Rd., E.2. 'Phone : Bishopsgate 6458. [0128

KAY'S Cabinets.—Exclusive practical models in radio and radiogram cabinets, 50% cheaper than elsewhere, used and recommended by the most distinguished and discriminating radio experts; a range of 60 designs to select from; illustrated price lists free.—H. Kay, Wireless Cabinet Manufacturer, Mount Pleasant Rd., London, N.17. 'Phone : Walthamstow 1626. [1789

GRAMOPHONES, PICK-UPS, ETC.

B.T.H. Electric Gramophone Motor, type Y1, form B, volts 100-250, cycles D.C., 25-60 A.C., unused; what offers?—Armstrong, 55, Brown St., Manchester. [2590

VALVES.

AMPLIFIER Valve.—If you require power you cannot do better than one of these (or matched in pairs if required)

FILAMENT Volts 6, plate volts 400 (maximum), grid bias 84 volts (approx.), impedance 800 ohms, amplification factor 3.8, mutual conductance 4.35 m.a./volts; price now reduced to £5; see article "The Wireless World," 24th July, 1929, then send to North London Valve Co., Ltd., 22½, Cazenove Rd., Stoke Newington, London, N.16. [0341

COMPONENTS, ETC., FOR SALE.

BELLING-LEE Panel Fittings are designed to give an expert finish to any home-constructed set; catalogue post free.—Belling and Lee, Ltd., Queensway Works, Ponders End, Middlesex. [0018

COMPONENTS Lent on Hire.—Details from Alexander Black, Wireless Doctor, 55, Ebury St., S.W.1. Sloane 1655. [0329

CYLANITE Panel Covering, 30-1,000th in. thick, high insulation value, now obtainable in white, bronze, mahogany (large and small grain); 3/- per sq. ft.; send stamp for samples; trade enquiries invited.—Marsh and Wright, 5, Royal Arcade, Weymouth. [2387

"WIRELESS WORLD" Four, complete as specified, with valves and coils, £24; gramophone equipment and loud-speaker, £14/10 extra; other sets supplied to order; send particulars.—Smith, 3, Park Parade, Harlesden, N.W.10. [2574

NEW Type Valve, screen and base, fit any valve holder, ventilated for A.C. valves and bushed, 2/6; extension rod for valve, 6d.; earthing cable, 3d.; complete set, 3/-; coil screens, 2/9; choke screens, 2/6; as specified in "Wireless World" circuits.—The Loud Speaker Co., Ltd., Palmer Works, Palmer St., Westminster, S.W.1. [1801

Components, Etc., For Sale.—Contd.

WESTON 506 0-300 m.a., 19/-; Weston 506 0-20 amp., 19/-; Weston 506 0-10 volt., 19/-; new, in original boxes; 70-volt .n.p. motor, 1,500 r.p.m., new, £4; 400-volt 200 m.a. generator, 1,500 r.p.m., new, £5/10; 12-volt 10 amp. generator, new, £5/10; heavy duty L.T. choke for 12v. 8 amps., made by Rich and Bundy, £2; can be seen oy appointment.—L. Vincent, 51, Holmstall Av., Edgware. [2624

FERRANTI Meter and Bulgin Valve Tester for Sale, stamp reply.—Wm. Clarke, 49, Campbell Terrace, Hanley. [2630

PART Exchange.—See our advertisement under Receivers for Sale.—Scientific Development Co., 57, Guildhall St., Preston. [0228

MISCELLANEOUS.

ALEXANDER BLACK,

THE Original Wireless Doctor, will call (London and Home Counties) and cure your set.

CONSULTATIONS by Appointment without Obligation; sets installed, maintained and brought up to date; components and McMichael portable sets on hire; purity reproduction specialists.

55 Ebury St., Victoria, S.W.1. Sloane 1655. [0277

EASY Payments.—We supply, by easy payments, components, accessories, and sets, any make; 10% down, balance spread over 11 months.—Send list of requirements to London Radio Supply Co., 11, Oat Lane, London, E.C.2. [0337

WIRELESS Notes.—A monthly service of information for all those who want the very best in wireless or gramophone reproduction; frank criticism of receivers and components; immediate postal help and advice in all difficulties; something new and unique; you must have it if you want to know the truth.—Full particulars free from Ernest H. Robinson, Langmead, Pirbright, Woking, Surrey. [1979

SCOTT SESSIONS and Co., Great Britain's Radio doctors, officially appointed as wireless repairers by Radio Society of Great Britain and Wireless League; old set of every type repaired, rebuilt, modernised; send set for immediate quotation.

SCOTT SESSIONS and Co.—New sets constructed with your or our components, guaranteed finest workmanship; we specialise in "The Wireless World" circuits; remember we have satisfied customers throughout the British Isles and in three Continents; if you so desire, we will design and construct high grade apparatus to suit your especial circumstances for quality, range and selectivity.—Tel.: Tudor 5326. Muswell Hill, London, N.10. [0262

"ENGINEERING Opportunities."—In this unique book Prof. A. M. Low tells of the opportunities engineers of all descriptions are missing. Our book gives latest information on B.Sc., A.M.I.C.E., A.M.I.Mech.E., A.M.I.E.E., A.M.I.A.E., G.P.O., Matric., C. and G., and all exams. We alone guarantee "NO PASS—NO FEE." Up-to-date Home Study Courses in all branches of Civil, Mech., Elec., Motor, Aero, Wireless, and Talkie Engineering. Don't neglect this offer. Write for free copy now (state branch, post or exam.).—British Institute of Engineering Technology, 87, Shakespeare House, 29, Oxford Street, London. [2502

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PATENTS and Trade Marks, British and foreign.—Gee and Co. (H. T. P. Gee, Member R.S.G.B. and A.M.I.R.E.), 51-52, Chancery Lane, London, W.C.2. 'Phone: Holborn 1525. [0001

REPAIRS.

SCOTT SESSIONS and Co., Great Britain's radio doctors; read advertisement under Miscellaneous column. [0263

LOUD-SPEAKERS, headphones, cone units, any type, rewound, remagnetised and overhauled; 3/6 post free; repairs guaranteed; 24 hours' service; terms to trade.—Walters, 1, Dunn's Terrace, Lower Compton, Plymouth. [2622

YOUR Transformer Repaired or Rewound Promptly; 3/6, post free; repairs guaranteed 12 months.—James, 190, Bitterne Rd., Southampton. [2636

EXCHANGE.

WE Will Accept Your Surplus Apparatus (making you a high allowance) in part payment for any new apparatus; your enquiry will be dealt with promptly.—Bostock and Stonnill, 1, Westbourne Terrace, S.E.23. [2608

WANTED, 500,000 potentiometer, 3 type F Formo Densers. 150,000 ohms, 10,000 ohms resistances. B1 and B2 chokes. 4 mfd. 1,000v. and 2.2 mfd. 1,000v., cheap; cash or exchange.—Jones, 33, Council St., Llandudno. [2635

WANTED.

THREE or Four Stage Gramophone Amplifier for 230-volt A.C. Mains Operation; state particulars and lowest price.—Nixon and Cobbett, Wakefield Rd., Horbury. [2632

WANTED, O.M.M.4, under £8; 66R, and cone chassis, under 35/-; 15, Oldham's L.H.T.L. units, under 70/-.—C. Goldsworthy, 185, Mitcham Lane, S.W.16. [2625

SITUATIONS VACANT.

TESTERS and Charge Hands Wanted Immediately, must be thoroughly conversant with screened grid work; write or call.—The Plessey Co., Ltd., Vicarage Lane, Ilford. [2603

SITUATIONS WANTED.

YOUNG Man (19), keen, adaptable, first class P.M.G. July last, secondary education, seeks position test or lab. assistant.—Box 8481, c/o *The Wireless World*. [2631

BUSINESSES & PROPERTY FOR SALE, TO BE LET, OR WANTED.

ELECTRICAL and Radio Business for Sale at valuation price; about £1,500.—Apply Fogg, Tatlow and Co., Chartered Accountants, Llandudno. [2602

BOOKS, INSTRUCTION, ETC.

FREE; Inventor's Guide on Patents.—T. A. A., 253, (W), Gray's Inn Rd., London, W.C.1. [1888

"WIRELESS MANUAL" (1930 edition). By Captain J. Frost.—A popular, practical, non-technical guide to choice of set, installation, use and maintenance; learn how to secure perfect reception.—Illustrated, 5/- net, from a bookseller, or Pitman's, Parker St., Kingsway, W.C.2. [1145

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