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THE REGIONAL SCHEME.

LAST week we commented on the possibility that the regional scheme had met with difficulties which were the cause of the protracted delay in any official announcement as to whether or not the scheme would be adopted and proceeded with. Sanction to proceed with the Potters Bar transmitter has now been granted, but the B.B.C. promise nothing before twelve or fifteen months' time. We have heard it suggested, too, that if the regional scheme as a whole receives official sanction, we cannot expect the change-over to alternative programmes (which it was the original intention should be provided by such a scheme) to come about for at least three years. The regional scheme was, of course, prepared mainly on the basis of theoretical considerations, and it was not until the establishment of 5GB that it became possible to test out the practical results which could be expected when the scheme was in operation. It would seem, therefore, that the fate of the regional scheme must be decided largely upon the correct answer to the question, "Is 5GB a success or a failure?" whilst a subsidiary point, which it has not yet been possible to test out in practice, is whether the wave-band allotted to British broadcasting stations is sufficiently extensive to permit of the inclusion of all the proposed stations of the regional scheme without serious risk of mutual interference or "multiple programmes" with crystal sets and valve sets of the unselective type which the British Broadcasting Corporation has consistently recommended.

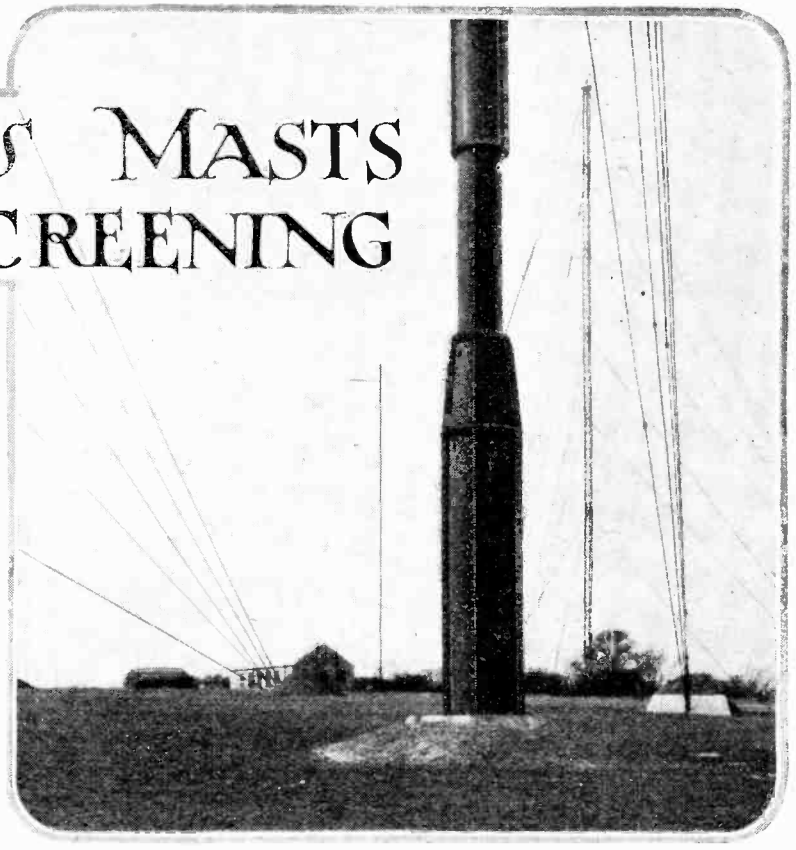
Is B.B.C. Research Necessary?

On the question of the time that the regional scheme will take to put into force, we think the suggestion of three years unreasonable, unless the engineers of the B.B.C. have so little confidence in the proposals that they feel they must build the stations one at a time and try each one out before the next is started. We have heard a rumour that all the stations of the regional scheme will be designed by the engineers of the B.B.C. themselves, and that those firms who are given orders for the manufacture of the apparatus will be required to follow the specification of the B.B.C. engineers; but the experience of the B.B.C. engineers can hardly be as wide as that of some of the commercial wireless concerns, who for years have been accustomed to the design and development of stations for all sorts of purposes. The B.B.C. might do well to abandon the rôle of designers of stations and leave that to commercial companies whose legitimate business it is to cater for such requirements. We have often heard it remarked that the B.B.C. attaches too much importance to its own research and development work; the B.B.C. can have at its disposal the experience and co-operation of all the commercial concerns which would be ready to supply them with stations which, we imagine, would be at least equal to anything which the engineers of the B.B.C. could themselves design and, under contract, could be obliged to keep stations right up to date and complying with the most modern practice.

Losing Touch with Commercial Firms.

But what actually appears to be happening is that the B.B.C. is endeavouring to become, as far as possible, independent of the experience and assistance of commercial wireless companies, which is, in our opinion, not necessarily the wisest policy to adopt nor the policy which will be in the best interests of the public, for a few years might well see the B.B.C. engineering staff hopelessly behind in comparison with the commercial companies whose facilities far exceed anything which it would be reasonable for the B.B.C. to provide.

WIRELESS MASTS AND SCREENING



The Aerial Support and its Effect on Signal Strength.

By R. L. SMITH ROSE, D.Sc., Ph.D., A.M.I.E.E.

FROM the earliest days of the construction of high-power wireless transmitting stations the problem of the relative advantages of wooden and steel masts for aerial supports has been debated by wireless engineers. The possibilities of a reduction in the effective height of the aerial and of loss of energy by eddy currents in the mast have been investigated theoretically, and in some cases attempts have been made to carry out measurements with a view to obtaining more definite information upon the point. The general result of experience up to a few years ago in the construction of the comparatively long-wave transmitting stations was that from a wireless efficiency point of view there was not much to choose between the different types of mast available. The availability and cost of material more often governed the choice.

Insulated and Uninsulated Masts.

One of the advantages claimed by the adherents of the wooden mast was that the necessary material could in general be obtained on or close to the site of the station, in whatever part of the world this might happen to be; the cost of transporting large and heavy mast sections from the steel works to the site was thereby eliminated. The steel mast was favoured by many engineers on account of its greater strength, although it is to be recalled that for many years the wooden masts of the San Paolo station at Rome, 714 feet high, were among the highest in the world. In a few cases steel masts have been set up and insulated from earth, notably at Hanover, where a steel mast 825 feet high was supported on a glass ball and socket arrangement, and insulated with a similar joint at a height of 495 feet; in this way it was presumably hoped to combine the advantage of both the steel and wooden masts, in so far as the latter formed a support for the aerial insulated from earth. The most notable example of such construction is the Post Office high-power station at Rugby, where all the masts, 820 feet in height, are insulated from earth on a porcelain and granite block construction. The results of tests on the effect of earthing these masts were given in a paper by Mr. E. H. Shaughnessy[1] read before the Institution of Electrical Engineers in 1926. From observations made on the radiation from the station it was found that the ratio of the effective height of the aerial with the masts insulated to the effective height with the masts earthed was 1.22. That is to say, for the same current in the aerial in each case the field strength in the radiated waves was about 22 per cent. greater with insulated masts than with the masts connected to earth. It was also found, however, that the aerial resistance with the masts insulated was greater than with the masts earthed, the values at the working wavelength of nearly 19,000 metres being 0.7 and 0.55 ohms respectively. This will tend to reduce, although it does not eliminate, the difference in effective height, and it still requires some 20 per cent. more power in the aerial to produce the same radiation with the earthed as with the insulated mast system. Whether such a saving in power is worth the comparatively heavy cost of insulating tall masts is a question of economics, although it must be stated that there are practical limitations in the way of increasing the aerial current in order to compensate for the reduction in effective height obtained with earthed masts.

It is probable that the first time that the effect of masts in altering the distribution of radiation from the aerial was definitely observed was when the London broadcasting transmitter (2LO) was moved to Oxford Street. In

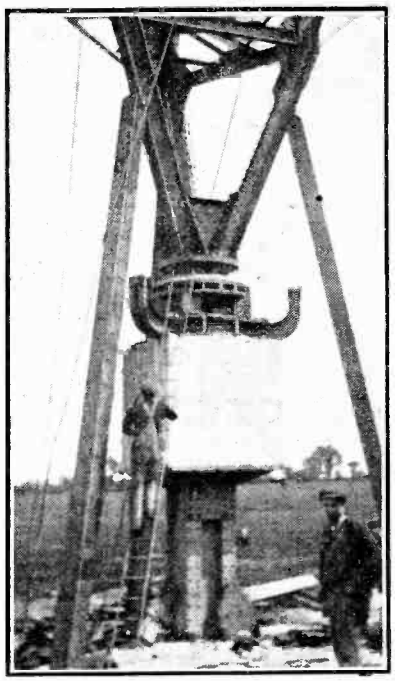
[1] Journal I.E.E., 1926, Vol. 64, p. 706.

Wireless Masts and Screening.—

that case the steel masts erected on the roof of a steel-framed building were found to cast definite shadow effects in the radiated waves. More recently a good deal has been heard about the shielding of the aerial of Daventry (5GB) by the taller masts of 5XX, and now the distribution of the radiation from the 5GB aerial is found to be affected by its own supporting masts. It will, perhaps, enable some readers to understand these various phenomena if a simple explanation is given of the effect of a steel mast placed in the path of radiated wireless waves.

Action of Untuned Masts.

The shielding action of a steel mast on an aerial which it supports is due to the field created by the currents induced in the mast by the external electromagnetic field. The mast, in fact, behaves in the manner of a vertical aerial, untuned and directly connected to earth. In Fig. 1 is represented a vertical aerial placed in the path of arriving wireless waves, which in the ordinary way have their electric force, E_1, practically vertical. This force induces an electromotive force in the aerial exactly in phase with it, and as a result a current flows up the aerial. This current causes an electric charge to build up at the top of the aerial, with the result that a secondary electric field, E_2, is produced around the aerial. At points near the earth it is evident that this secondary field is vertical, and is thus parallel and opposite to the primary electric field of the arriving waves. It is thus obvious that if the phases of the two fields can be made similar a reduction of the electric field of the arriving waves will take place round the base of the aerial. A consideration of the case outlined above shows that the correct phase relationship is brought about when the natural wavelength of the aerial is much less than that of the arriving waves. For aerials of height up to 100 feet or so, and wavelengths in the broadcasting band of 300 to 500 metres, this condition is fulfilled by simply connecting the aerial to earth untuned. In this condition, of course, the current flowing may be very small, and it is to be expected that only a small reduction of field in the neighbourhood of a single wire aerial will be produced. It is further to be pointed out that near the upper half of the aerial the direction of the secondary electric field is materially different from that of the primary field, and thus the reduction in strength of the latter may be small in this region.



The insulated base of one of the Rugby masts. The side struts shown were only a temporary measure during construction.

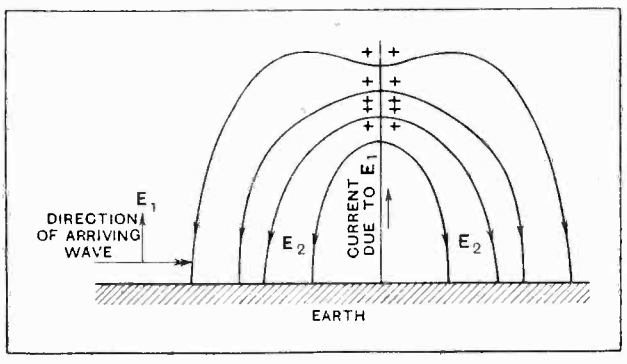


Fig. 1.—The arriving waves E_1 induce a current in an untuned vertical aerial which creates an electric field E_2.

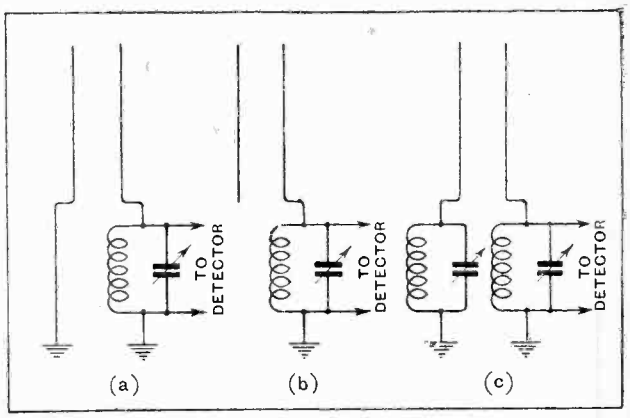


Fig. 2.—Arrangement of two vertical aerials to demonstrate mutual screening effects.

Experiments with Screening Cage.

In the case of receiving aerials these facts may be simply demonstrated by arranging two aerials in the manner shown in Fig. 2. With aerials of 20 to 40 feet in height set at about 3 or 4 feet apart it will be found that the signals from, say, 2LO received on one of the wires will be unaffected in strength by the earthing or tuning of the other wire. When the distance between the wires is decreased to less than a foot, the earthing of one wire in the untuned condition produces a definite decrease in the signal intensity received on the other wire. As the height of the screening wire is increased relative to that of the receiving aerial, the screening effect becomes more and more marked. The reduction in signal strength is also considerably increased by using a cage of several screening wires. For example, in an experiment carried out some two or three years ago a vertical aerial 40 feet high was erected inside a cage formed of vertical wires fixed at the top and bottom to the sides of a wooden frame five feet square erected round the aerial in the manner shown in Fig. 3. Both the aerial and cage were supported by pulley arrangements, so that either could be raised or lowered at will. With the cage formed of four wires only and hauled up so that it projected about two feet above the top of the aerial the screening effect

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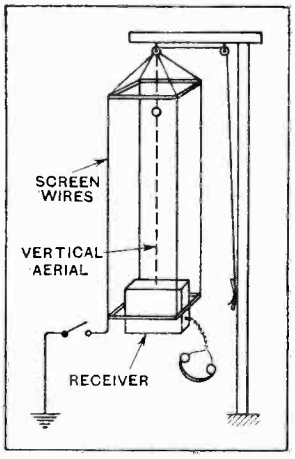

Fig. 3.—The adjustable wire screening cage surrounding a vertical aerial which was used in experiments to demonstrate the screening effect of masts.

Natural Wavelength of Mast.

From these experiments and the theoretical reasoning given above, it will be understood that a large steel lattice mast can effectively screen a relatively small aerial placed near it, provided that the wavelength employed is materially greater than the natural wavelength of the mast. These deductions have recently received confirmation in some quantitative experiments carried out by S. Klinke, in Dresden[1], who has shown that the electric field from a local broadcasting station was reduced to 10 per cent. of its normal value at a distance of two or three feet from the base of a lamp-post some twenty-five feet in height. Klinke's measurements are also useful in showing that the screening effect of the lamp-post becomes detectable on the ground at a distance from the base of the mast approximately equal to its height.

(To be concluded.)

[1] "Experimental Wireless," February, 1928, p. 97.

TRANSMITTERS' NOTES.

Honorary Members of Spanish Radio Society.

The Association E.A.R. has, we understand, elected the following British transmitters to the honorary membership of its society: Mr Gerald Marcuse (G 2NM), Mr. H. Bevan Swift (G 2T1), Mr. C A. Jamblin (9 6BT), and Miss B. Dunn (G 6YL).

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Proposed Amateur Wave-bands.

We have received the following letter from Mr. K. B. Warner, the secretary of the American Radio Relay League:—

"The restrictions upon the amateur wave-bands which will result on January 1st next as a result of the recent International Radiotelegraph Conference offer a very perplexing problem for the continuation of international two-way amateur communication. Some form of co-operation between the amateurs of various parts of the world is essential, in the circumstances of all amateurs of the world operating in the same narrow bands, if international contact is to be preserved.

"This question received careful consideration at the recent annual meeting of the board of directors of the American Radio Relay League. At that meeting a plan for international amateur co-operation was formulated, and it is now being put forth as a suggestion on the part of the A.R.R.L. as representing the best scheme which it is able to devise to meet the need. The plan was outlined in an editorial in the April issue of *Q.S.T.*, a reprint of which I attach.

"The League desires to lay this plan before the amateurs of the world as a suggestion for their consideration, soliciting comments and reaction. We believe that you may be interested in reporting it in your columns, and we shall be grateful for whatever you can do to bring it to the attention of the amateurs of your country."

The article in *Q.S.T.* to which he refers draws attention to the difficulties likely to ensue if amateurs all the world over use the full limits proposed for the 20-metre and 40-metre wave-bands, and suggests an amicable sub-division of these wave-bands whereby the amateurs of North America should work on the upper half, those in Europe on the lowest quarter, and the rest of the world on the intermediate quarter. Thus North America would only use 7,000 to 7,150 kc. and 14,000-14,200 kc.; Europe, 7,225 to 7,300 kc. and 14,300 to 14,400 kc.; and the rest of the world, 7,150-7,225 kc. and 14,200 to 14,300 kc.

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Broadcast Reception in Nepal.

A correspondent sends us an extract from a letter received from the chief electrical engineer of the State of Nepal, who reports excellent results with a short-wave set, having received 5SW, PCJJ, A 2FC, and WGY regularly. He especially mentions the programme from 5SW on February 25rd. Big Ben's chimes at 7 p.m., he states, were heard "just as well as we did at home, and perhaps you can imagine the thrill of this!"; also "For the first 1½ hours it was better, I think, if that is possible, than any reception of 2LO which I have heard at home—no fading, no noise, and you could hear the speakers taking breath." Eindhoven, Sydney, and Schenectady, he says, were also good, but fading was somewhat troublesome, and a good deal of echo was experienced in the Sydney reception.

His short-wave set consists of a detector with reaction followed by two L.F. transformer-coupled stages.

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Radio Jargon.

We have never disguised our dislike of the use of Anglo-American abbreviations in written correspondence, and are, therefore, fully in sympathy with the advice to correspondents given by our contemporary, the *T. and R. Bulletin*, from which we quote the folllowing extracts: "Please don't write postcards in Morse; it may be clever, but they take time to translate"; and "ham language also has to be translated and should be avoided"

"Ham language," or "Radiese," is undoubtedly of great service when used legitimately as a kind of shorthand in Morse transmission, or even, possibly, in "QSL" cards, where space is restricted, but it is a nuisance in written correspondence, often involving double translation from "Radiese" into American and thence into English. We are frequently sorely tempted to consign such letters to the W.P.B. (another abbreviation which might with advantage be incorporated in a glossary of "ham language"). Even the international "Q" code becomes tiresome when used indiscriminately in correspondence. It is surely as easy to write the word "fading" as the separate capitals "QSS," and, after all, the strict meaning of "QSS" is: "Are my signals affected by fading?" As a matter of fact, with about four exceptions, the regular "Q" code is seldom used by professional operators.

Frankly, we are often inclined to ascribe the misuse of the "Q" code and other abbreviations in written correspondence to a desire on the part of an immature transmitter to display his newly acquired knowledge.

AMPLIFICATION AND HIGH QUALITY.

Permissible Gain per Stage for Good Reproduction.

By N. W. McLACHLAN.

IN the early days of broadcasting, when one was inventing microphones, amplifiers, loud-speakers, and the like, it was not quality which disturbed one's slumbers, but quantity. One had to get something which worked—never mind how!—and which gave plenty of noise. This was the average conception of value for money. I well remember, in 1922, that no loud-speaker would be accepted, however excellent in quality, unless it rose above a certain "noise" level. It was hopeless to design for quality, because a good loud-speaker was wasted on bad amplifiers and still worse microphones.

This article by Dr. McLachlan will be welcomed by all experimenters who are striving, with the aid of moving coil loud-speakers, to produce the best quality in broadcast reception. Brief reflection will recall that the many useful factors to which attention is here drawn profoundly modify the results obtained in practice.

All this is changed now, and we can get both quantity and—quality of a kind. Any form of reproduction is faulty, but fortunately there are not so many people who really know it.

As design improves, as we become more and more critical, our pet apparatus fails to please us, and we strive to improve it still further. There are certain minor improvements which are swamped by inferior loud-speakers, but brought into the limelight by a well-designed coil drive—although this often shows up badly on speech and pianoforte music. But this is not always the fault of the receiving apparatus. The search for elements in the receiver which cause distortion has been intensive. To the unscientific and business mind we experimentalists never seem to get quite there. Some elusive condition always seems to find its way into the apparatus, thereby introducing its own distortional tricks, and causing us to commence another detective hunt. Thus, to the outsider, we appear to go on and on without attaining any degree of finality. In my opinion it is just this five or ten per cent. extra efficiency which is more difficult to obtain than to originate the invention. To discover anything is difficult; to perfect it quantitatively is almost impossible.

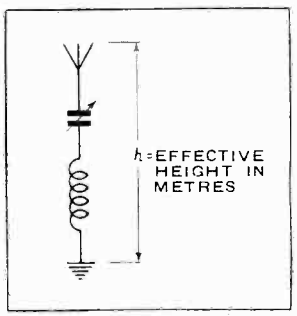

Fig. 1.—Simple tuned circuit, possessing moderately flat tuning and suitable for use in a receiver giving good quality local reception.

Our search into the minutiæ of design is concerned with the amplification or gain per stage of a receiver which is permissible without introducing serious distortion. To simplify the problem we can start operations upon a receiver designed to operate near a main broadcasting station. There will be immunity from interference, excepting, of course, that type which emanates for neighbours, tramway systems, and the like. Moreover, the tuning of the system can be quite flat. We can, therefore, be quite content with an aerial circuit of the type shown in Fig. 1, or a variation as illustrated in Fig. 2. Now, the tuning is usually flat enough for all practical purposes. If it is not, a resistance can easily be inserted in the earth lead; Nature usually accommodates us in practice by having it there beforehand. The aerial will therefore feed to the rectifier V_1 a carrier wave accompanied by a pair of unattenuated side bands, so that all audiofrequencies will be represented in equal degree over the musical scale.

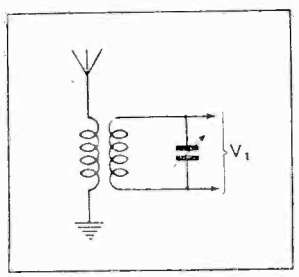

Fig. 2.—Owing to aerial resistance, this circuit may be reasonably flatly tuned.

Quality and Selectivity.

The reader will ask: What has this got to do with gain per stage? Well, the inductance coil tuning the aerial acts as an amplifier, since in general the voltage across it is greater than that induced in the aerial by the incoming wave. Let us turn to Fig. 3, which is equivalent to Fig. 1. The electromagnetic waves induce in the aerial a voltage $V = vh$ where v is the voltage gradient per metre down the aerial, and h is the effective electrical height of the aerial. V, the induced voltage, acts on the aerial as on an oscillatory circuit at resonance, and sends a current (I) through it equal to $\frac{V}{R}$ where R is the A.C. resistance of the complete aerial, including the earth. But the voltage applied to the rectifier is that across the inductance. The voltage (E) across the inductance—neglecting its resistance—is $E = 2\pi fLI$, which is more usually written as ωLI, using ω as an abbreviation for the factor $2\pi f$. But we have already seen that the current $I = \frac{V}{R}$ so that the voltage across L is $E = \frac{\omega LV}{R}$. Now, V was the voltage collected by the aerial

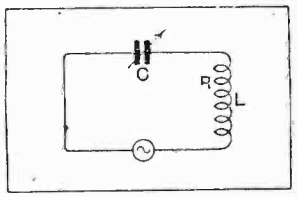

Fig. 3.—The equivalent circuit of a tuned aerial system comprising capacity (C), inductance (L) and resistance (R) in which the electromagnetic waves are represented by the alternating current generator. The voltage induced (V) is the product of the voltage gradient per metre down the aerial (v) and effective aerial height (h).

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from the ether, and we apply $\frac{\omega L}{R}$ times this to the rectifier. Thus the gain must be $\frac{\omega L}{R}$.

Translating this amplification formula into numerical values, let us assume the aerial to be an extremely good one, whose resistance (plus coil) is only 11 ohms. This can be assumed to allow 7 ohms for the aerial and earth and 4 ohms for a low-loss coil of 200 microhenries inductance. Taking a frequency of 800,000 (800 kilocycles), which is in the neighbourhood of 2LO, we find ω or $2\pi f$ is about 5 million (i.e., 5×10^6). Thus $\frac{\omega L}{R} = \frac{5 \times 10^6 \times 200 \times 10^{-6}}{11} = 90$, this being the stage gain, and a very good one, too.

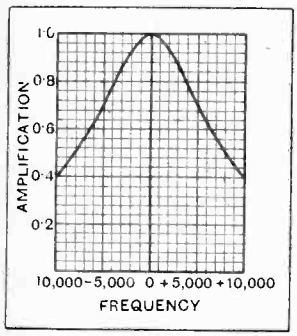


Fig. 4.—Resonance curve of speech modulated oscillations. If the tuning of the receiver be too sharp then quality will be impaired owing to the omission of the higher note frequencies.

Turning to Fig. 4 we see the selectivity curve of our aerial system. This arrangement is clearly useless for faithful reproduction, since only 40 per cent. of the side bands come through at 10,000 cycles. Thus we must conclude that our aerial system is too efficient, and an amplification of 90 is much too high. By reducing the amplification to 25, i.e., increasing the resistance to 40 ohms, we more nearly approach the ideal case, because the selectivity curve has a sensibly flat top over the range 0 to 10,000 cycles. Let us say, then, that an aerial voltage amplification lying between 25 and 30 is the maximum permissible for the best quality conditions in reproduction.

Valve Rectification and Gain.

Proceeding onwards we have next to confine our attention to the rectifying valve. We choose, advisedly, anode bend rectification, the rectifier being resistance condenser coupled to the first low-frequency valve, as shown in Fig. 5. To the average person the process of rectification is one which is wrapped in mystery. Everyone knows that the rectifier alters radio into audio, but few realise the complications concomitant with the transformation. The theory of rectification is rather tedious and dull, but it is well to recount some of the salient features. It can be shown mathematically that the average rectifying valve introduces distortion, but under certain conditions the degree of distortion is negligible. An ideal rectifier would have a characteristic akin to that shown in Fig. 6. This is two straight lines, AB, BC. The portion BC, being linear, ensures freedom from distortion. Conversely, if BC is curved, distortion is introduced. The characteristic of an average rectifying valve can be regarded as, especially when a high resistance is connected in its anode circuit, a curved portion, and a sensible straight portion as shown in Fig. 7. So long as we work on the sensibly straight portion XY nothing serious happens. It is the curved bottom bend which may be dangerous.

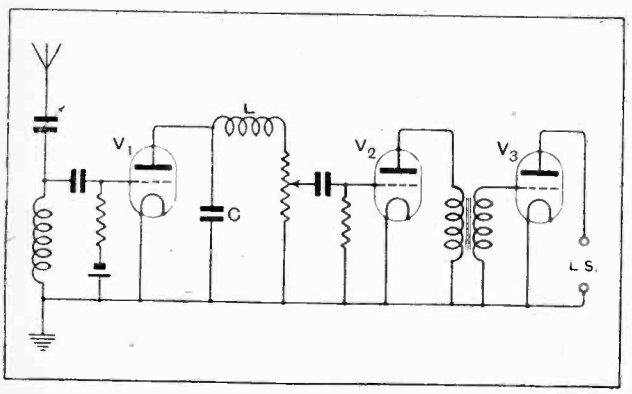


Fig. 5.—Typical receiving circuit. V_1 is the detector valve.

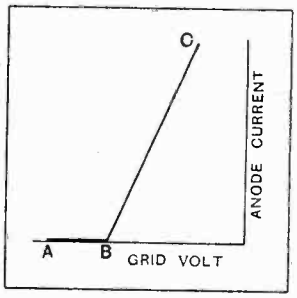


Fig. 6.—The desirable characteristic for an ideal anode bend rectifying valve.

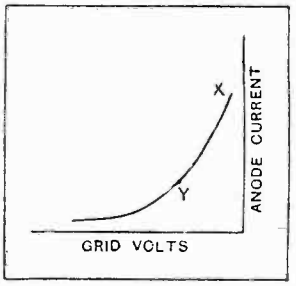


Fig. 7.—The characteristic of a rectifying valve being curved, distortion is unavoidable, but by working on the sensibly straight portion XY the distortion is almost negligible. It is the curved bottom bend which is undesirable.

If the modulation of the carrier wave were 100 per cent., then the curved portion of the characteristic used for weak signals would cause harmonics or overtones of the incoming audiofrequencies to be introduced. For example, an audiofrequency of 1,000 cycles would give rise to 2,000, 3,000, etc. Now, the proportion of these harmonics to the fundamental diminishes with reduced modulation. For average modulation of 20 per cent. the harmonics are not large. In practice, however, the carrier should be sufficiently strong, i.e., we should work with strong signals to operate the rectifier at a point such as Y on the straight portion of the characteristic. Here the percentage modulation is of much less account than it is at the bottom bend.

Is 0.0002 mfd. Satisfactory as a By-pass Condenser?

The transformation of the radiofrequency into audiofrequency is not accomplished by some electrical dividing agent which reduces the radio to an audio value. The change takes place due to the carrier wave beating with the side bands. The result after rectification is the difference between the two radiofrequencies, i.e., an audiofrequency. In this subtraction process the radiofrequencies do not disappear. They are there, but clad in somewhat different raiment. Since they are a sort of unwanted residue the only method of dealing with

Amplification and High Quality.—

them is that known as electrical filtration. Moreover, in the anode circuit of the rectifier a filter is inserted to prevent the radiofrequency having access to the low-frequency part of the amplifier. This is shown in Fig. 5. L is a radiofrequency choke which prevents the radio wandering outside its prescribed orbit, and C is a condenser whose impedance is small enough to shunt the radiofrequency. In other words, the L and C combination are such that the radiofrequency voltage at the anode of the rectifier is extremely small compared with the audiofrequency. For condenser C to be really efficient it should not be less than 0.0002 microfarad. An example will make this quite clear. Taking a carrier of 800 kilocycles as before, we find the impedance of the condenser is $\frac{1}{\omega C} = \frac{10^{12}}{5 \times 10^{6} \times 200} = 1{,}000$ ohms. Assuming the effective resistance in the anode circuit is 0.25 megohms $= 2.5 \times 10^{5}$ ohms, the percentage voltage ratio $\frac{\text{radio}}{\text{audio}} = \frac{1000 \times 100}{2.5 \times 10^{5}} \times$ modulation ratio $= \frac{10}{25} \times 5 = 2$ per cent, which ought to be fairly harmless.

High Note Loss.

We have now to examine the influence of the 0.0002 mfd. condenser on the audiofrequency. The impedance of this condenser at 10,000 cycles is 80 times that at 800 kilocycles. This amounts to $80 \times 1{,}000 = 80{,}000$ ohms, or about one-third that of the anode resistance. Thus the condenser will reduce the amplitude of a 10,000 cycle note to one-third of its actual value. To obviate this we must reconsider the design, and reduce the anode resistance to 100,000 ohms. At 10,000 cycles the condenser will reduce the amplitude to about 0.65 of its actual value. By reducing the anode resistance

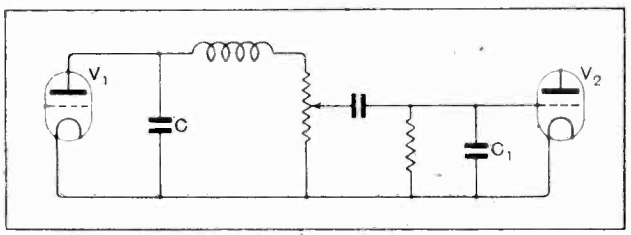


Fig. 8.—Attention is drawn to the input impedance of a valve (V_2) as a factor governing quality of reproduction. C_1 is the condenser due to the interelectrode capacity of V_2. This is a fictitious condenser but the effect on V_1 in practice is stimulated thereby. Actually the major part of the current passes into the anode circuit of V_2.

still further, the effect of the condenser can be counteracted still further. But, in view of present-day loudspeakers, we have gone quite far enough, and shall stay at 100,000 ohms. To get a large amplification we should use a rectifier with an internal resistance of the order 10,000 ohms. This, however, is at the moment out of the question, and we are more likely to encounter a rectifying valve with an internal resistance of megohms. Taking a DEH610 with a magnification of 40, we can assume an internal resistance of 400,000 ohms. The amplification will be $\frac{100{,}000}{500{,}000} \times 40 = 8$. Remembering that the modulation of the carrier is only one-fifth, we get a net amplification of 8/5, i.e., 1.6, which hardly seems to be value for money.

Next we must deal with the first audiofrequency amplifying valve. I have deliberately chosen a transformer to follow this valve for reasons stated previously in this journal. This arrangement was first introduced two years ago in my article on the design of speech amplifiers,[1] and has been used with success in many designs.

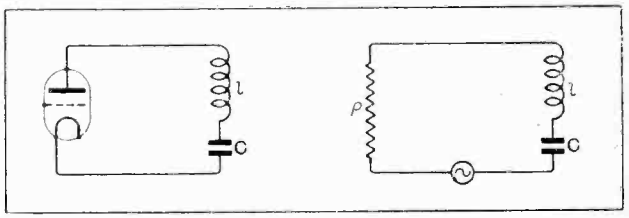


Fig. 9.—Equivalent circuit of a transformer at 5,000 cycles. l, leakage inductance. C, equivalent capacity of primary winding.

In the article on "Supersonic Transformers,"[2] Part V, it was shown that the input impedance of a valve following one of these transformers reduced the resonant frequency by a considerable amount. The input impedance of the valve in the case considered was equivalent to a condenser across the secondary of the transformer. The present case is somewhat different, for we have to consider the input impedance of the valve V_2 of Fig. 5 in whose anode circuit is situated a transformer of high primary inductance. The input impedance across the grid and filament of V_2 due to the transformer varies with the frequency. At low frequencies the transformer impedance is substantially that of the primary inductance. The input impedance is then a negative resistance in series with a condenser. So long as the amplification factor of the valve is not too high, this input impedance is not serious. At frequencies of 2,000 to 6,000 cycles the transformer behaves substantially as a condenser, and the input impedance can be regarded as a condenser in series with a resistance. Neglecting the resistance, since the impedance of the condenser is much larger, the input impedance can be regarded as a condenser across the grid leak, as shown in Fig. 8. Its value is approximately $(m + 1) \times$ anode to grid capacity of V_2 + filament to grid capacity, m being in this case the amplification factor of the valve (very nearly). Let each of the electrode capacities be 7 mmf. Then with a DE5 valve, whose m value is 7, we have the input capacity as $(7 + 1) \times 7 + 7 = 56 + 7 = 63$ mmf. The shunting effect of this condenser will not have any serious effect in reducing the higher audiofrequencies. It is well to bear in mind, however, that the actual physical state of affairs is not quite that of a condenser of 63 mmf. from grid to filament. The condenser current actually flows from grid to anode, and not from grid to filament, although it arrives at the latter electrode ultimately. Thus, if there were no radio-

[1] *The Wireless World*, January 13th, 20th, 27th, 1926.
[2] *The Wireless World*, January 5th, 1927.

Amplification and High Quality.—

frequency choke and no by-pass condenser, the radio-frequency current would be by-passed by the input condenser effect of V_2. In reality the radiofrequency would flow from the grid to the anode of V_2, and thence to earth *via* the primary and secondary of the transformer. Ultimately there would be a radio voltage impressed on the grid of the power valve.

If a valve with $m = 20$ were used, the input condenser would be 154 mmf., and this would have an appreciable effect in shunting the higher audiofrequencies since it is in parallel with the 0.0002 (= 200 mmf.)

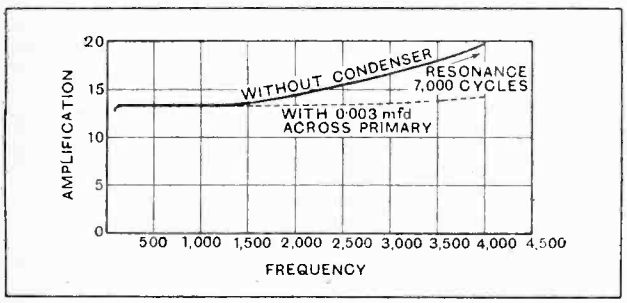


Fig. 10.—Rising amplification characteristic of a transformer due to the resonance which depends upon magnetic leakage, primary inductance, and the self and mutual capacities of the windings. A rising characteristic produced by a transformer with a valve of low internal resistance is helpful in counteracting the high note loss arising from sharpness of tuning and shunt capacity in the detector stage.

condenser used for by-passing the radiofrequency. Thus we can see that a valve having an "*m*" value of from 5 to 7 is suitable for use in conjunction with the transformer.

Transformer with Rising Characteristic Desirable.

Before leaving this stage it is essential to introduce the question of magnetic leakage between the primary and secondary windings of the transformer. This is of importance above 5,000 cycles, and the equivalent circuit is shown in Fig. 9.[1] Clearly the leakage inductance *l* resonates with the condenser (this being due to the self and mutual capacities of the windings). The resonance frequency depends upon the percentage leakage, the primary inductance and the self and mutual capacities. Usually it varies from 7,000 to 10,000 cycles. The effect of this resonance is shown by the rising curve of Fig. 10. The degree of rise depends upon the effective resistance of the primary winding and the internal resistance of the valve. When the latter is relatively low (5,000 to 8,000 ohms) the curve rises more rapidly than it does with a valve having a resistance of 30,000 ohms. A resistance of this magnitude usually causes the curve to droop.

Now this rise is very beneficial in counteracting the effect of aerial tuning, the by-pass condenser on the rectifier and the equivalent input condenser on the grid of V_2. In fact, I always use this arrangement to obtain compensation. If the transformer has a condenser across one winding, it ought to be removed, as will be seen from Fig. 10. Since transformers with rising characteristics are desirable, I fail to see why manufacturers always strive to make the characteristics flat topped. Passing on to the power valve, we have to consider its input impedance, since this affects the secondary winding of the transformer.

Assuming the loud-speaker to be one of the coil-drive variety, the load is a condenser at low frequencies and an inductive resistance at high frequencies. The input impedance of V_3 (the power valve) is therefore a condenser in series with a negative resistance. The latter is too small to cause oscillation, but the condenser will increase the capacity of the transformer, thereby lowering the resonance frequency due to leakage. The "*m*" value of the power valve is about 4. At a frequency of 5,000 cycles the effective magnification is, roughly, 2.5, so that the condenser will be relatively small. Nevertheless, it will be a fair fraction of the self-capacity of the secondary winding of the transformer. The input impedance effect is more marked when two or more power valves are connected in parallel. Obviously under these conditions the proper thing is to use power valves of lower "*m*" value.

The above analysis shows the existence of various factors which in themselves are apparently insignificant but act in the aggregate to cut off the upper audiofrequencies. Although only one tuned circuit has been treated (the aerial), it may be possible in the near future to deal with additional tuned stages incorporated with the H.F. amplifying valves. Moreover, the present argument applies mainly to reception near a main broadcasting station. By careful observation, using a coil drive loud-speaker whose diaphragm is free from serious resonance in the upper register, experimenters will be able to verify the various items for themselves. Although one particular item in itself may appear trivial, it is the sum total of many items which has to be considered in the long run.

[1] See also *The Wireless World*, January 27th, 1926.

COIL CALCULATIONS.

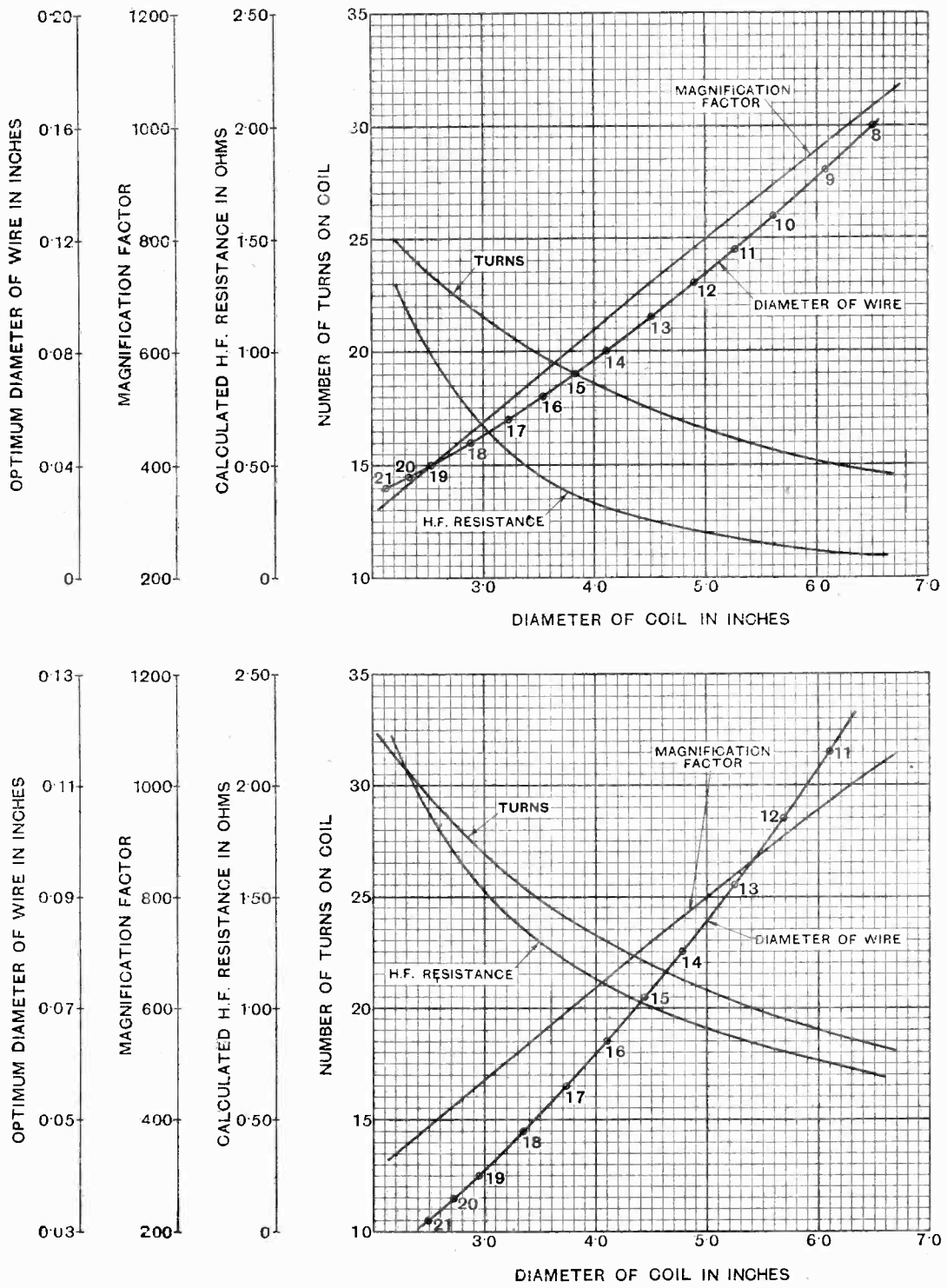
Design Data for Short-wave Coils.

CURVES have already been published in previous issues of *The Wireless World* giving design data for coils which cover the long and medium waves in common use for broadcasting.[1]

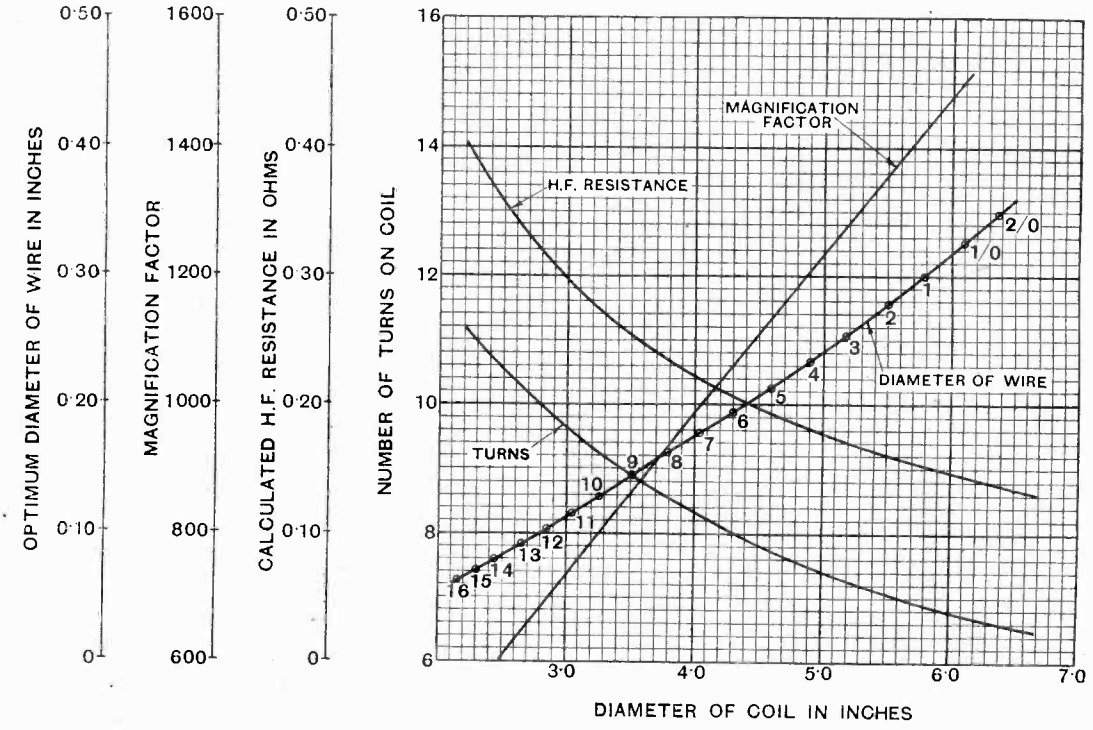
The curves shown here cover wavebands of 40-110 metres and 100-240 metres respectively, using parallel tuning condensers of 0.0003 mfd. and 0.0005 mfd. as for the previously published curves. It will be observed that, in the larger diameter coils, the gauge of wire tends to become somewhat heavy, and in view of this it is probably not out of place to remind users of these coils that the figure given for "diameter" of the coils is an overall figure and not the diameter of the former.

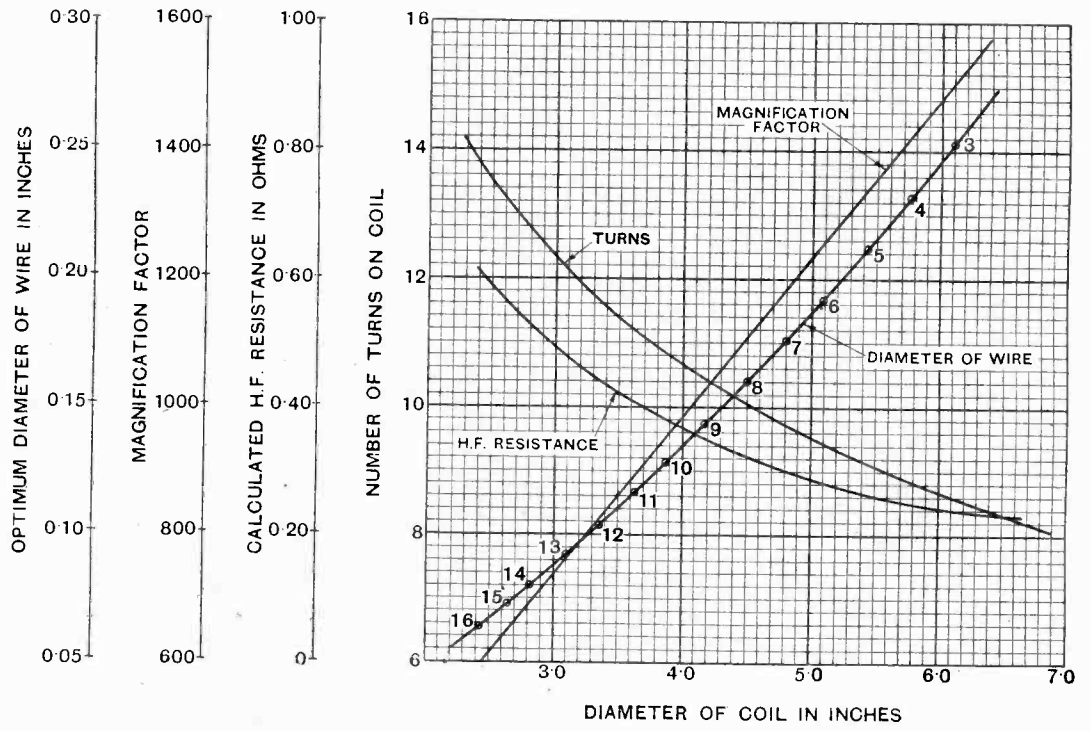
F. J. A. P.

[1] *The Wireless World*, January 11th and April 11th, 1928.



The upper curves give the design data for 35 microhenry coils in which the winding length is 8·15 × diameter. The lower curves give the data for 55 microhenry coils in which the winding length again is 8·15 × diameter





The upper curves give design data for 7 microhenry coils, while the lower curves are for 11.5 microhenry coils. In each case the winding length is 8/15 × diameter.

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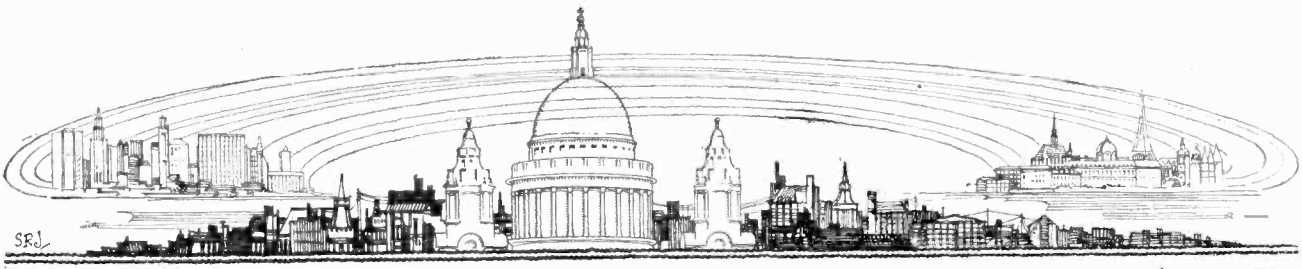

CURRENT TOPICS

Events of the Week in Brief Review.

TIME EXTENSION ON ATLANTIC 'PHONE SERVICE.

As from Sunday last, April 29th, the Transatlantic telephone service is open daily from 11.30 a.m. to 2 a.m.—an extension of two hours in the service period.

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A MYSTERIOUS LEAK.

The Clerk of the Cornforth (Co. Durham) Council recently reported that the Council's electric lamps at West Cornforth were "burning very dim." On inspection it was found that the wires were being fouled by an aerial belonging to a resident.

A committee has been formed to inspect all the aerials in the parish.

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PCJJ'S NEW TIME-TABLE.

Changes in the time schedule of transmissions from the Dutch short-wave broadcasting station, PCJJ, at Hilversum, are notified by the owners, Messrs. Philips Lamps, Limited. The revised schedule is as follows :—

Tuesdays and Thursdays: 17.00 to 21.00 (B.S.T.).
Fridays: 24.00 to 3.00 (B.S.T.).
Saturdays: 16.00 to 19.00 (B.S.T.).

PCJJ's wavelength is 30.2 metres.

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CANADA-AUSTRALIA BEAM SERVICE.

The Canadian Marconi Company announces that the Canada-Australia beam service is expected to open shortly for commercial working. The usual series of exhaustive tests which are necessary before new long-distance circuits are put into commercial operation are now being carried out.

Rumours that the contractors have been experiencing unexpected difficulties at the Canadian end are contradicted.

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IRISH LISTENERS DISAPPOINTED.

Irish Free State listeners who had hoped that Mr. Blythe, the Finance Minister, would include in his Budget proposals a reduction in or the abolition of the tax on imported wireless apparatus were disappointed when the Budget speech was delivered in the Dail on Wednesday last.

Mr. Blythe stated that the Government's intention was to do as little as possible in the way of imposing new taxes or increasing old ones, but the wireless tax was not mentioned.

A HINT FOR 5SW ?

"When a broadcast station wants to increase its range, it increases its power. When an amateur short-wave operator wants to increase the range of his station, he changes the wavelength and does not increase power at all."

—Extract from a statement by the American Radio Relay League.

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DISCUSSION ON "SCREENED-GRID VALVES."

An informal discussion on "Screened-grid Valves" will be opened this evening by Mr. M. G. Scroggie, B.Sc., at a meeting of the Wireless Section of the Institution of Electrical Engineers. Particulars will be found under "Forthcoming Events."

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MARCONI WORKS IN POLAND.

It has been decided by Marconi's Wireless Telegraph Company to begin the manufacture of wireless apparatus of all types in Poland.

This decision is due partly to the difficulty experienced by the Marconi works at Chelmsford in coping with orders, and is partly to enable the company to develop trading operations in Eastern Europe. The orders received during the first three months of 1928 for execution at the Chelmsford works exceeded orders received during the same period of 1927 by 20 per cent.

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TANTALISING.

Having been presented with a wireless set, Mr. Fred Hall, the Labour M.P., erected an aerial across the street at Barnsley. By order of a subsequent meeting of the Housing Committee, attended only by Labour members, Mr. Hall had to take it down.

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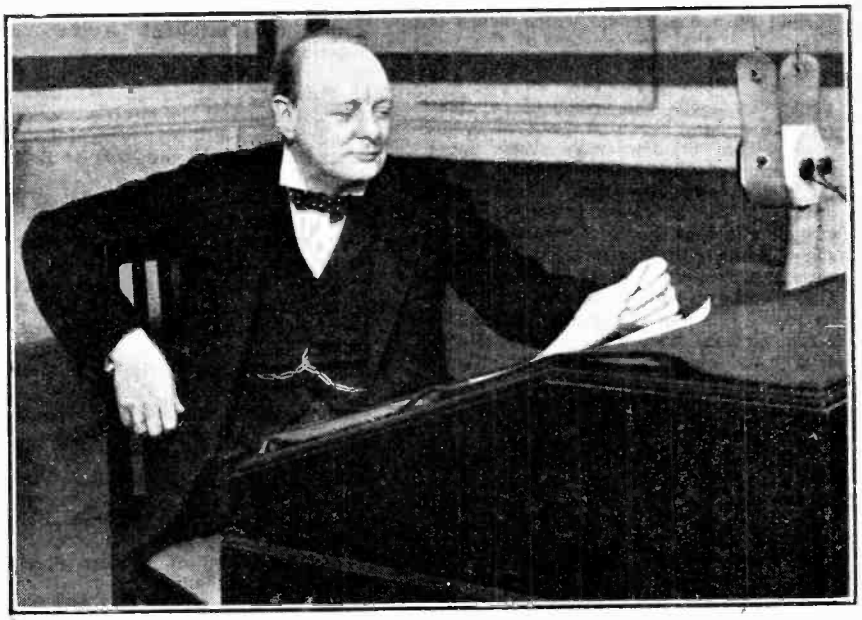
LECTURES ON THERMIONIC VALVES.

A special course of six lectures on "Thermionic Valves: Their Uses in Wireless and Electrical Engineering," will begin on Wednesday next, May 9th, at the Polytechnic, Regent Street, London, W.1, the lecturer being Mr. W. H. Date, B.Sc., A.M.I.E.E. The lectures,



A BUDGET BROADCAST. Mr. Winston Churchill, Chancellor of the Exchequer, giving his explanatory talk on the Budget from 2LO on Wednesday last.

which will be given every Wednesday (except May 30th) from 6.30 to 8.30 p.m., should prove of great interest to amateurs, students, and others who are anxious to keep pace with the rapid developments now taking place in valve design and operation.

The subjects dealt with include the following: The two-electrode valve, smoothing and filter circuits, the third electrode, characteristic curves, indirectly heated cathode valves, the valve as an amplifier, the four-electrode shielded valve, etc. Each lecture will be followed by a demonstration. The fee for the course is 7s. 6d.

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HIGHER POWER FOR JO'BURG.

A wider audience for the Johannesburg broadcasting station is indicated by the news that new plant has arrived which will feed 15kW. into the aerial. It is hoped that much better reception will be possible in the Rand, Pretoria, and rural districts. The old transmitter at JB will probably be moved to Bloemfontein.

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AUSTRALIA ON A PORTABLE.

The majority of users of portable sets are satisfied to be able to pick up the nearest broadcasting station. Not so Mr. C. G. Allen, who, with a "McMichael" six-valve portable superhet., succeeded a few days ago in picking up 3LO (Melbourne) and also a New York station, both at loud-speaker strength. Incorporated in the set were Osram D.E.L.210, D.E.H.210, and D.E.P.215 valves. Mr. Allen's feat testifies to the high efficiency of this receiver and the 2-volt steep slope class of valve.

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SINGING COAL SHOVEL.

The peace of the ancient and picturesque little town of Kalmar, on the east coast of Sweden, has recently been disturbed by a coal shovel which hangs on the wall in the headquarters of the local fire brigade (writes a correspondent). A few days ago the shovel suddenly assumed the *rôle* of a local entertainer, and began to speak, sing, and play. The firemen were very much startled, and the rumour quickly spread about the town, attracting a large audience. After a close investigation it turned out that the performance of the shovel synchronised with the local broadcasting programme. It was further found that it was suspended on the wall so as to touch the power line of the Kalmar radio station, and that it reproduced clearly and distinctly everything sent out from that station.

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SEVEN MILLION SETS.

The total number of wireless receivers now in use in the United States is estimated by the National Electrical Manufacturers' Association to be in the neighbourhood of 7,000,000. New York State is credited with the largest number, viz., 876,000, California being a good second with 704,000. The States with the smallest number are Delaware and Nevada, with 15,000 each.

AMATEURS AND "WORTHLESS" WAVES.

An interesting report on the work now being carried on by amateurs with the so-called "worthless" wavelength of 10 metres has been issued by the American Radio Relay League.

FORTHCOMING EVENTS.

WEDNESDAY, MAY 2nd.

Institution of Electrical Engineers, Wireless Section.—At the Institution, Savoy place, W.C.2. At 6 p.m. (Light refreshments at 5.30.) Informal Discussion on "Screened Grid Valves," to be introduced by Mr. M. G. Scroggie, B.Sc.

Tottenham Wireless Society.—At the Institute, 10, Bruce Grove. At 8 p.m. Discussion on "The Best All-round Receiver," opened by Mr. F. Dyer. To be preceded by Business Meeting.

THURSDAY, MAY 3rd.

Leyton and Leytonstone Radio Society.—Discussion on Neon Tubes.

FRIDAY, MAY 4th.

Wigan and District Technical College Radio Society.—Discussion of members' problems and experiences.

MONDAY, MAY 7th.

Hackney and District Radio Society.—At the Electricity Showrooms, Lower Clapton Road, E.5. Demonstration of Loud-speaker and Battery Eliminator by Mr. Bowden.

TUESDAY, MAY 8th.

Hounslow and District Wireless Society.—At Trinity Hall, Bulstrode Road. At 8 p.m. Lantern Lecture on "L.F. Amplification," and demonstration of the "Interdyne" Receiver by Messrs. R. I. and Varley, Ltd.

At the International Radiotelegraph Convention at Washington (says the report) engineers pointed out that the lowest useful wave was in the neighbourhood of 13 metres. The amateurs immediately petitioned for a band in the vicinity of 10 metres for their exclusive use; the band was given them and became available for their use a few weeks ago. Since that time an increasing number of American amateurs has been constructing apparatus for transmitting and receiving on these extremely high frequencies. It is believed to be only a matter of time before the possibilities of 10-metre communication are ascertained, according to Kenneth B. Warner, secretary of the League, who says: "It has always been the lot of the amateur to explore and develop new territory. When we asked for the 10-metre band we did so with a full knowledge of adverse technical opinion. We do not expect too much in the way of success, but, at least, if there are any possibilities in this wavelength we will soon find it out."

EXPERIMENTAL WIRELESS.

Some Articles Appearing in the May Number.

The Reflecting Layer of the Upper Atmosphere.—An estimation of the height of the Heaviside Layer based on observations of the effect of sunlight on signal strength.

By G. H. Munro, M.Sc.

Retro-action in Amplifiers.—A mathematical treatment of the increase in amplification resultant on the use of reaction.

By H. A. Thomas, M.Sc.

The Power in a Modulated Oscillation.—An expression of the mean power of the wave forms produced by modulation.

Dielectric Losses in Single-layer Coils at Radio Frequencies.

By W. Jackson, M.Sc.

The Establishment of Formulæ for the Self-inductance of Single-turn Circuits of Various Shapes.

By R. G. Allen, B.Sc., M.I.E.E.

The Harmonic Comparison of Radio-frequencies by the Cathode-ray Oscillograph.

The Study of Signal Fading.—An account of the work of the Peterborough Research Station of the Department of Scientific and Industrial Research. An extract of a Paper read by Prof. E. V. Appleton, F.R.S., before the Wireless Section, I.E.E.

A Short Survey of Some Methods of Radio Signal Measurement.

The Demonstration of a New Precision Wavemeter Condenser.

By W. H. F. Griffiths, A.M.I.E.E.

A Bridge for the Measurement of Inductance and Capacity.

AMERICA AND THE "BRITISH CHALLENGE."

Speaking last week on the wireless and cable situation, Mr. Harbord, president of the Radio Corporation of America, declared that the unification of the cable and wireless companies of Great Britain should be answered by a similar movement in America, if America was to meet the British challenge for supremacy in world communication.

He urged that both cable and wireless should be exempted from anti-trust legislation, though the Government should supervise the rates charged to the public.

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A RADIOTIC FARMER.

Few subjects have enriched the English language with a more lavish hand than wireless. The latest word to add to the wireless vocabulary is "radiotic"—an adjective which apparently signifies a tendency towards ultra-enthusiasm in pursuit of radio. The word has been coined by Mr. Geoffrey Mitchiner, a youth of Croydon, who recently emigrated to Canada with a party of others. Before his departure Mr. Mitchiner, who is an ardent wireless amateur, asked the officials of the Canadian National Railways to place him with a farmer who would co-operate with him in wireless experiments. He has since written to an official of the company in London stating that his ambitions have been realised, as he is now working with a "radiotic" farmer of Burketon, Ontario, and that he hopes soon to be communicating on short waves with 5BY, Croydon, every Sunday morning.

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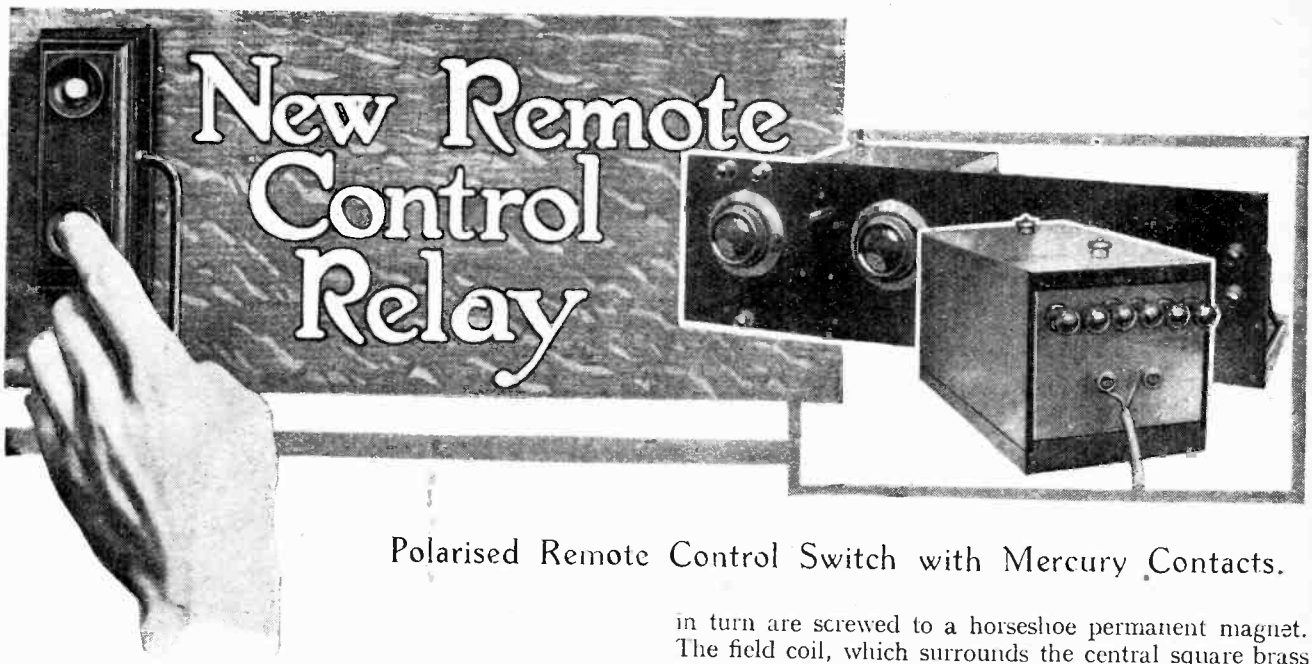
"GUILTY THROUGH IGNORANCE."

Still another excuse in the repertoire of the wireless "pirate" came to light at the Saffron Walden Police Court a few days ago when John Thomas Pope, charged with working a wireless set without a licence pleaded "guilty through ignorance." He thought that the licence was included in the purchase price of the set. He was fined 10s.

New Remote Control Relay



Polarised Remote Control Switch with Mercury Contacts.

WITH the advent of moving coil loud-speakers, H.T. battery eliminators, and A.C. valves, the need for a remote control that will handle currents up to 6 amps. and potentials up to 350 volts becomes apparent. Most commercial controls will only handle a fraction of this power, and at the best break only two separate circuits. Further, the commercial designs require a steady current to pass through the windings to operate them, and if A.C. valves are used this necessitates a special accumulator, the charging of which we have already been at pains to eliminate by installing indirectly heated filament valves.

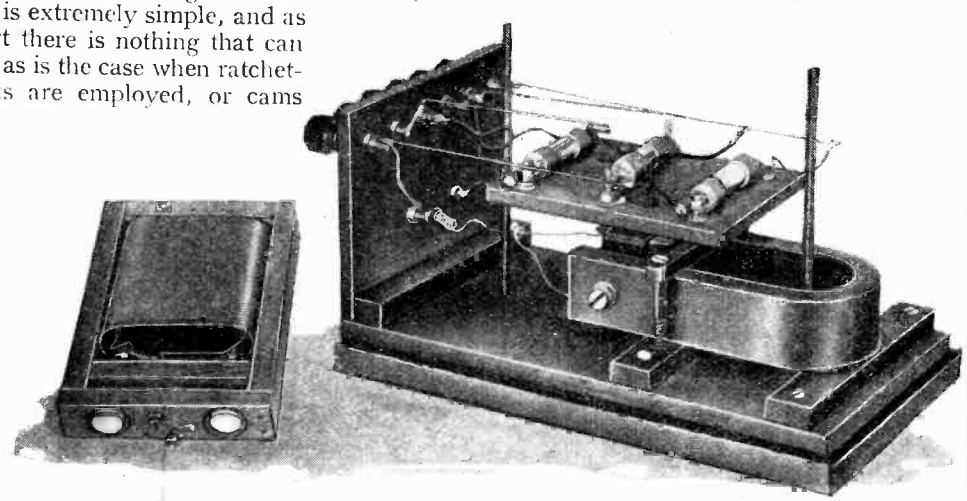
It was with a view to overcoming these difficulties and obtaining the aforementioned requirements that the remote control about to be described was designed. The construction of the apparatus is extremely simple, and as there is only one moving part there is nothing that can readily get out of adjustment, as is the case when ratchet-operated mercury cup breaks are employed, or cams driving spring catches.

How it Operates.

Three mercury breaks (any number may be used in practice) are mounted on an ebonite platform. This platform in turn is secured by a 4BA screw to one end of a soft iron armature which is pivoted at its centre so that it can rock through a few degrees inside a square brass tube. Round this tube is a coil, and on either side of the coil are two U-shaped soft iron pole pieces, which in turn are screwed to a horseshoe permanent magnet. The field coil, which surrounds the central square brass tube, is connected by means of a double-pole two-position switch to a small flash-lamp battery. The contact breakers [1] consist of small glass tubes with short pieces of platinum wire sealed in the ends, a slight well being made at each "pinch." The tubes are evacuated of air after the introduction of a small quantity of mercury. Brass end caps are provided having slots for securing and making contact.

Now if the platform to which the tubes are attached is horizontal, the bead of mercury will bridge the platinum wire contacts and close the circuit; at the same time the ends of the vertical armature will be in close proximity to the poles of the permanent magnet and the magnetic flux will hold it in this position.

[1] Obtainable from W. G. Flaig & Sons, 57, Hatton Garden, London, E.C.1.



Mercury contact tubes are mounted upon a balanced platform which is tilted to one side or the other by applying a momentary current to an easily home constructed relay. A flash lamp battery with a pair of press buttons is used for switching on and off by producing current reversals.

New Remote Control Relay.—

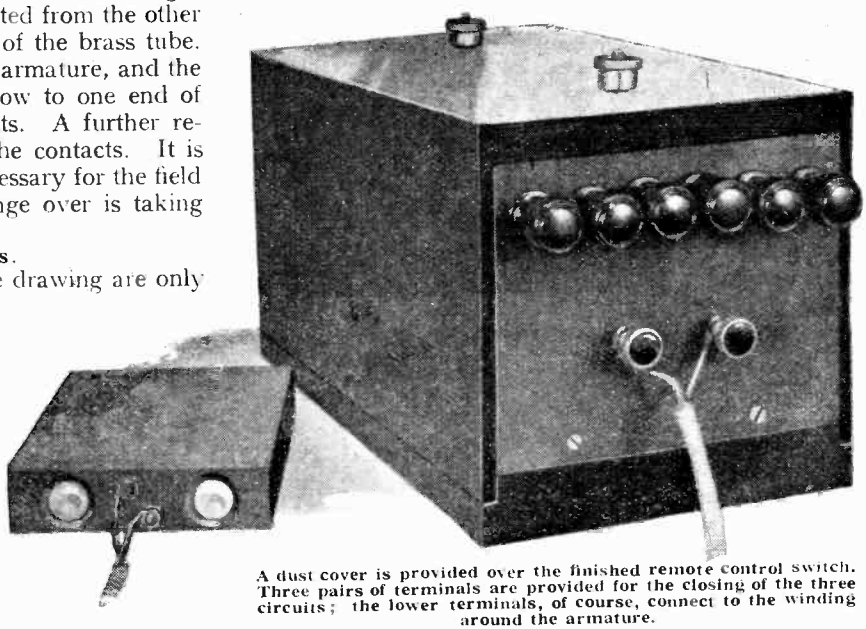
If, now, the two-position switch is operated so as to reverse the flow of current in the armature, the magnet poles adjacent to its ends will then be of a similar sign, and repelled on the one side and attracted from the other it will jump over to the opposite side of the brass tube. The platform is thus tilted over by the armature, and the mercury in the breaks is caused to flow to one end of the tubes, thus opening all the circuits. A further reversal will, of course, again restore the contacts. It is important to observe that it is only necessary for the field current to flow whilst the actual change over is taking place.

Constructional Details.

The several dimensions given in the drawing are only as a guide, because these will differ according to the type of horseshoe magnet used. Practically any kind can be suited for the purpose, and these may be obtained quite cheaply at the time of purchasing the mercury contact tubes.

Having obtained the necessary magnet, one can proceed with the construction of the armature and its brass tube. The armature is filed to shape from $\frac{3}{8}$in. × $\frac{3}{8}$in. square soft Swedish iron rod. An "L" is formed at one end and tapped 4BA to get a fixture for the platform. The centre of the armature is also drilled and tapped 4BA. The brass tube, which is $\frac{1}{2}$in. square, is now cut to the desired length, and two notches filed on opposite sides of the ends, and 4BA clearance holes drilled through the centre as shown.

The armature can now be slipped inside the tube, and a short length of 4BA rod screwed into it through the holes in the tube, with the ends left projecting slightly either side. A blob of solder is then applied to the projecting ends with a very hot iron so that it will run into the joint, and afterwards the whole is filed flush with the tube. The armature should now rock easily on the screwed rod, and, if it has been adjusted correctly, have a slight clearance either side.



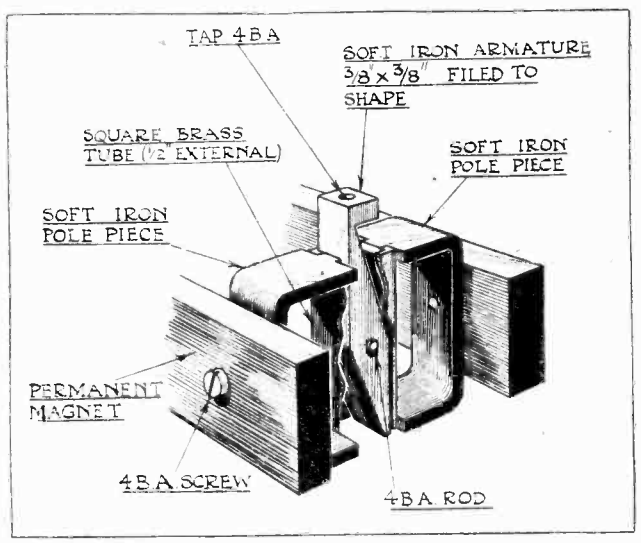
A dust cover is provided over the finished remote control switch. Three pairs of terminals are provided for the closing of the three circuits; the lower terminals, of course, connect to the winding around the armature.

The field coil may next be wound. This is best done on a separate former, and afterwards bound with tape and slipped over the brass tube. About $\frac{1}{4}$ lb. of No. 26 S.W.G. enamelled wire is required, producing a resistance of approximately 8 ohms. A momentary current of about 0.5 amp. will be required if a flash-lamp battery is used, and as the application of current is only required for a fraction of a second the life of the battery should be some months with ordinary use.

The exact dimensions of the pole pieces can now be decided upon. These are shaped, drilled and tapped as shown. Notches are cut to fit those in the ends of the brass tube. In order to prevent the armature sticking to the pole faces and so necessitating a heavy current to overcome the flux of the permanent magnet, quite a thick blob of solder should be placed on the face of each notch.

At this juncture it is as well to test the apparatus, and if the armature refuses to move it may be attributed to two faults. The armature may not be loose enough on the spindle, in which case the movement must be taken apart and the thread reduced with emery cloth, taking care to apply a little thin oil before reassembling. Too great a flux across the gap may also cause the armature to stick, in which case it should be reduced by placing an iron keeper across the ends of the permanent magnet, fine adjustment being obtained by placing thin card between the keeper and the poles.

Having obtained a definite "snap" of the armature on reversal of the current, the platform may be cut out of some light insulating material such as $\frac{1}{8}$in. presspahn, and screwed to the armature. Before fixing the breaks, however, they should be placed in a position so that an even balance is obtained. As the mercury will move to one side when tilted, the platform should be slightly over-



Constructional details of the armature and pole pieces. The brass tube which serves as a bearing for the pivot of the armature is surrounded by a spool of No. 26 enamelled wire.

New Remote Control Relay.—

balanced to the opposite side. Any error may be adjusted afterwards by the slots in the brass caps or by adding small brass screws as balance weights along one edge of the platform.

Terminals may be conveniently mounted as shown and connected to the breaks by light flexible wire, such as frame aerial wire. If the control is used for switching current from the mains, then it is advisable for safety's sake to make the leads from the terminals to within half an inch of the breaks, with very stiff copper wire, say 14 S.W.G., and the remainder only with flex. This will obviate the danger of two wires touching.

A suggested form of distant control switch is shown in the illustrations. It consists of a small wooden containing box which houses a flash-lamp battery, together with a bridging piece of wood carrying contact studs and a pair of press buttons. The bridging piece of wood is fitted at either end with a pair of 4BA screws nutted on the underside. The stems of the four screws are connected across with two wires in the form of an X, and the battery contacts press against one screw at each end. A pair of phosphor-bronze springs, some $\frac{3}{8}$in. in width by 3in. in length and bent over at the ends, are attached to the top of the container by the screws which form the terminals. Percelain press buttons forcing down upon the springs at either end press them into contact with the screw-heads, and, depending which button is pressed, so the current may be applied in one direction or the other.

As the resistance of the winding around the armature is only of the order of 8 ohms, it is necessary to avoid the introduction of excessive resistance in the leads between the control switch and the relay. Ordinary bell wire will usually be found satisfactory. A. R. T.

NEWS FROM THE CLUBS.

A Pick-Up Demonstration.

At the last meeting of the Kensington Radio Society, held on April 19th at 136, Holland Park Avenue, Mr. Alford, of Messrs. The Igranic Electric Co., Ltd., gave an interesting demonstration and lecture on the "Igranic" pick-up.

The society welcomes new members. Hon. secretary: Mr. G. T. Hoyes, 71a, Elsham Road, Kensington, W.14.

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American Sets of To-day.

"Modern American Radio Apparatus" was the subject of an interesting lecture-demonstration given before the Tottenham Wireless Society at 10, Bruce Grove, on April 18th, by Mr. L. C. Ford, of Messrs. R. A. Rothermel. The lecturer explained that for many years American radio engineers and experimenters concentrated on the production of super-selective and long-range receivers. More recently they had turned their attention to the production of good quality. That they had met with considerable success was proved by the demonstrations carried out during the evening. The first instrument, a low-frequency amplifier, was used for the electrical reproduction of gramophone records, and an interesting refinement was the introduction of a scratch filter. Two receiving sets were demonstrated; the first was a very handsome cabinet set known as the "Grebe Syncophase Seven." The second was one of the most popular cheap receivers of the States, the "Crossley Band Box," sometimes referred to as the "Tin Lizzie" of radio. Both sets were tuned by one dial only and gave remarkable results. Mr. Ford concluded with a description of the latest American components.

Hon. secretary: Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

Short-Wave Sets Compared.

A "Short-Wave Night" was the attraction provided by the South Croydon and District Radio Society on April 19th at the Surrey Drovers' Hotel. It was the occasion of friendly competition, various members demonstrating their short-wave sets and comparing results. Reception conditions were excellent, and a great opportunity was provided to hear 2XAD, Schenectady, as well as various European stations and amateurs in many countries. The sensation of the evening was the set of the vice-chairman, Mr. Remington, which gave remarkable results.

Hon. secretary: Mr. E. L. Cumbers, 14, Campden Road, South Croydon.

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Waiting for Television.

At a meeting of the Dorset Wireless and Television Club on April 19th, the president, Dr. T. Colley, F.R.C.S., dealt with the problems of light and the relationship of the eye to a television receiver. He pointed out that with the existing knowledge and equipment, one had to look a long way ahead for perfect television. Dr. Colley concluded with a demonstration of a four-valve receiver (1-v-2), the H.F. side designed from details given in "The Wireless World" and the L.F. side modelled on the well-known instrument in the South Kensington Museum.

Hon. Secretary, Mr. N. W. Wright, 13, Royal Arcade, Esplanade, Weymouth.

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Slade Radio's Sister Society.

The Slade Radio Society of Birmingham has arranged with some friends in Nairobi to start a sister society there for transmission and reception between the two societies.

The Society has an interesting programme ahead, including a visit to 5XX on May 5th and a mystery station competition on June 3rd in connection with the Sutton Motor Club.

Hon. Secretary, Mr. H. Clews, 8, Victoria Road, Erdington, Birmingham.

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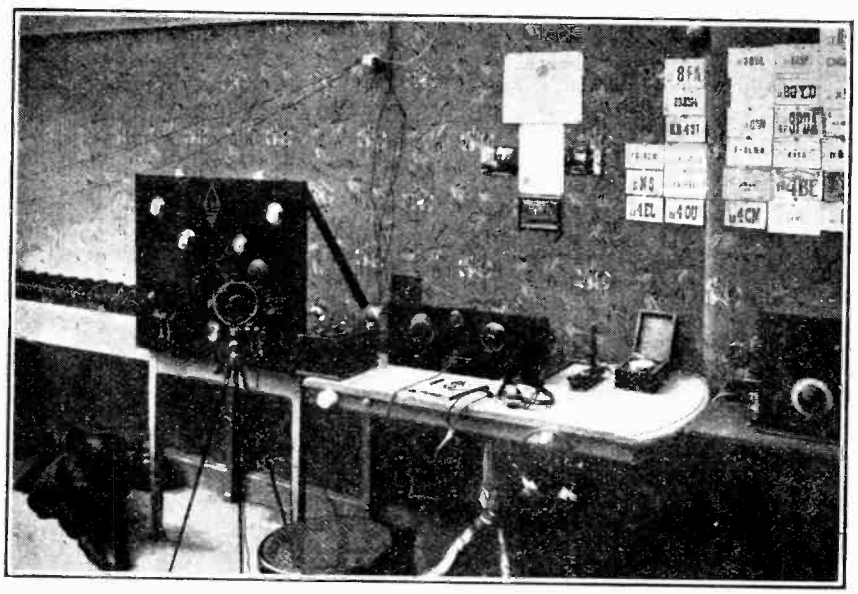
Pure Reproduction with Transformers.

A lecture entitled "Pure Reproduction on the Loud-speaker" was given before the Woolwich Radio Society on April 4th by Mr. Garside, of Messrs. Ferranti, Ltd. The speaker demonstrated a three-valve set with several Ferranti transformers. After a brief discussion on the fundamentals of musical tone reproduction, the lecturer pointed out that if the lower or higher frequencies were not amplified in the same proportion as the medium frequencies, such loss would be squared by using two stages of L.F. amplification instead of one. Among other dicta, Mr. Garside gave the following:

A common complaint is that cone loud-speakers are too deep, but a loud-speaker only puts out what is put into it. External resistances in detector and amplifying stages should be kept as low as possible. Valves should always be run at their stated filament voltage, never less, otherwise the internal resistance is increased.

Hon. Secretary, Mr. H. J. South, 42, Greenvale Road, Eltham, S.E.9.



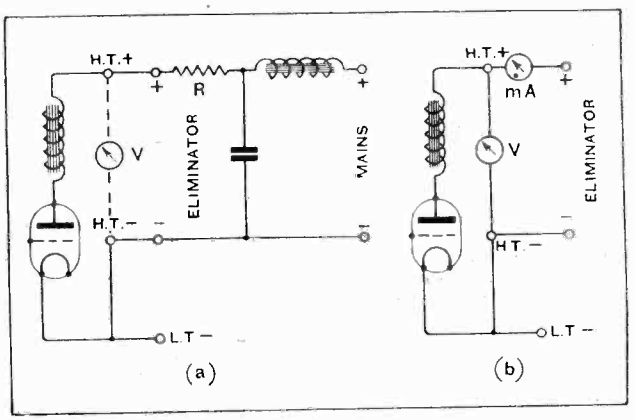
A BELGIAN AMATEUR STATION. EB 4CD owned and operated by M. A. Deporter at 63, Digue de Mer, Middelkerke. The transmitter is a 2-valve "Mesny," and the receiver an 0-v-1 Schnell for short-wave work. Another receiver for broadcast work is shown on the extreme right. M. Deporter is district manager of the Reseau Belge and extends a hearty welcome to British amateurs visiting his neighbourhood.

THE ELIMINATOR OUTPUT.

Some Hints on Simple Voltage Measurements.

By "RADIOPHARE."

THERE is nowadays a general appreciation of the fact that the reading of a voltmeter connected across the output terminals of an eliminator is likely to be misleading. In extreme cases it may be found that the meter will indicate no more than, say, 20 volts, although the set may be working quite well; it will be of interest to some readers to know why this obvious disparity between real and indicated voltages should exist. In the accompanying diagram (a) are shown the essential connections of an output valve and an eliminator, in which R is a voltage-reducing resistance (or part of a potential divider winding). Now, under working conditions a steady current will be passed by the valve, and there will be across the terminals of R a constant voltage drop, the amount of which will depend on the value of the resistance and on the current flowing. Let us imagine that a voltmeter is connected in the position shown, where in effect it is in parallel with the valve; consequently, the current drawn will be increased. This increase will depend on the meter resistance; if the valve is of the comparatively high-impedance type, and the meter an indifferent moving coil instrument, the latter will consume considerably more current than the valve, and the voltage drop across R (and across the D.C. resistance of the smoothing choke, which must often be taken into account) will be several times greater than under normal working conditions. If, on the other hand, the meter consumes very much less current than the valve, its reading will indicate more nearly (but not exactly) the true applied voltage.



Why a meter reads eliminator voltages incorrectly (a), and, (b). how to obtain an accurate reading.

In spite of the foregoing, it must not be thought that a voltmeter is useless for measuring eliminator outputs; provided a little care is taken, it is by no means difficult to obtain a sufficiently accurate idea of the actual applied voltage, particularly as modern worth-while circuits seldom call for critical H.T. adjustment.

A True Voltage Reading.

A method of measurement involving the use of a milliammeter as well as of a voltmeter is shown in diagram (b); this is applicable only if the current consumption of the voltmeter is less than that of the valve (or valves). With the filaments at normal brilliancy, and with appropriate grid bias, a milliammeter should be inserted in the position shown (between the output of the eliminator and the H.T. terminal) and its reading carefully noted. The voltmeter is now connected across the H.T. terminals of the set in such a way that the current which operates it flows also through the milliammeter, the reading of which will now be increased. The next step is to reduce the current (as indicated by the milliammeter) to its previous value by increasing the negative bias applied to the valve, by dimming its filament, or by a combination of these two operations. When the original current reading is restored, the voltmeter will indicate the true voltage applied under working conditions. If this is sufficiently near the required figure, an alteration must be made to the eliminator potential divider tapping, or series resistance, and the process repeated.

High-resistance Instruments.

As already stated, this method can only be applied when the voltmeter consumes less current than the set (or an individual valve, if fed from a separate terminal). At this stage it will be as well to explain how the current consumption of a meter can be ascertained. These instruments are rated in "ohms per volt"; this means that an H.T. meter reading up to 120 volts and rated at 200 ohms per volt, will have a resistance (in ohms) of 200 × 120 (the full-scale reading), or 24,000 ohms. The current taken for a full deflection is calculated by dividing the applied voltage by the internal resistance, the figures in this case being 120 ÷ 24,000 = 0.005 amp., or 5 milliamps. Meters with an internal resistance much higher than the figure mentioned above are obtainable, but it may be pointed out that it is not a difficult matter to increase the resistance of an existing instrument. Taking the case of the one mentioned above, it may be made to read 120 volts with a consumption of only 1 milliamp. by inserting in series with it a resistance of four times its own ohmic value: in this instance 96,000 ohms, making the total resistance 120,000 ohms. With this addition, the figure shown by the meter must be multiplied by five. This means that the scale will be restricted, but it will be quite possible to obtain a sufficiently close reading.

A voltmeter modified in this manner may be used, in conjunction with a milliammeter as already described, to obtain what is practically an exact reading of the voltage applied to any valve or group of valves taking more than one milliamp. Alternatively, it can be applied direct to the H.T. terminals of the set; and, on account of its high resistance, will give a fairly accurate reading, provided always that the valves are taking a current much greater than is the instrument itself.

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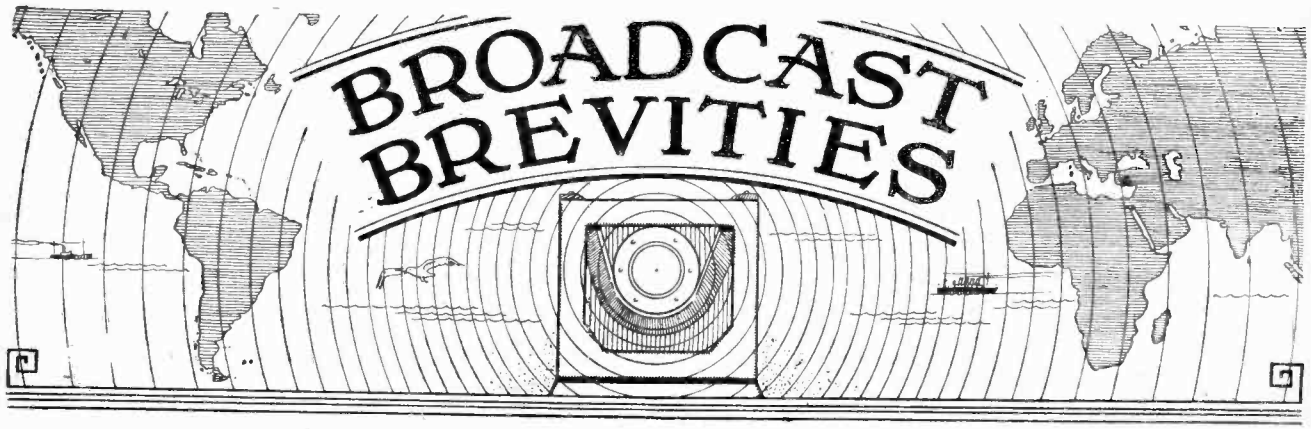

News from All Quarters: By Our Special Correspondent.

Enter the Regional Scheme!—A "Portable" at the Cup Final.—Relays from America.—Programmes Eighteen Months Ahead!—The Northern Stations' Scheme.

The Regional Scheme.

The B.B.C. announcement on Thursday last that the Post Office had sanctioned the erection of the first new high-power twin-wavelength station of the Regional Scheme followed swiftly on the demand in *The Wireless World* editorial columns that the public should be informed how matters stood.

Although the bare and cautious statement now issued relates only to the station "in the North of London," I learn that it is correct to say that the P.M.G. has also given qualified approval of the Regional Scheme as a whole.

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Southern Station Ready by Christmas.

The Northern regional station, which, as *Wireless World* readers know, is situated midway between Potters Bar and Hatfield, will probably be ready for experiments in six or seven months' time. It is the Chief Engineer's ambition to have the station running regularly by Christmas. If the other stations can be completed with the same speed we may yet have the whole regional scheme before the end of 1930.

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With the "Everyman Portable" at Wembley.

Though children can still win the distinction of receiving personal mention at the microphone, there are few adults who can hope for a similar honour; still fewer can ever aspire to be the subject of a running commentary.

A correspondent signing himself "Everyman" achieved an apotheosis of this sort at Wembley on the occasion of the Cup Final. He writes: "Believing that my chances of securing a seat in the Stadium were more remote than the Split Star, I hastily assembled the 'Everyman Portable' described in this week's *W. W.* with the idea of picking up what I could of the running commentary while strolling round in the vicinity. By a piece of luck, however, I soon found myself past the turnstiles, and eventually reached a seat near the skyline. Here I enjoyed a unique experience.

Mentioned at the Microphone.

"I do not doubt for a moment that, despite a limited acquaintance with the niceties of football, I secured a better idea of what was taking place than most of my colleagues on the bench. Mr. Allison's running commentary via 2LO came through splendidly and, by means of his remarks, I was able to identify the players in a manner which would have been quite impossible without my trusty portable, which, incidentally, created a good deal of interest among those around me. Those who borrowed it showed a reluctance to give it up, and at one time I feared that it was gone for ever.

A CHIEF AT THE MICROPHONE. Sir Ofori Atta, Paramount Chief of the Gold Coast, whose speech at the opening of Takoradi Harbour by the Rt. Hon. J. H. Thomas, M.P., was projected by loud-speakers.

"My hour of triumph came during a lull in the game when Mr. Allison, who was scanning the audience with his field glasses, suddenly remarked that an enthusiast had brought his portable wireless set.

"As a witness and a listener at the same time I cannot speak too highly of Mr. Allison's description of the game. Nothing seemed to miss him, and he managed to keep pace with all that happened in the field."

Hats off, then, to Mr. Allison!

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Bravo, "Everyman"!

Hats should also be doffed, I think, to Mr. "Everyman" for showing us all that it is not necessary to wallow in an armchair in order to follow a running commentary. "Everyman" is a pioneer in a new era of broadcast reception in which the sporting public will be able to watch its favourite game with an understanding eye, aided by expert comment on the spot.

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The "Sarah Bernhardt" of Variety.

Listeners of the older generation may be interested to learn that that celebrated French *chanteuse* of pre-war days, Yvette Guilbert, is to broadcast from 2LO and 5XX on June 5th. Mademoiselle Guilbert, who has been regarded as the "Sarah Bernhardt" of the variety stage, made her first appearance in 1888 in Paris. She enjoyed triumphant seasons at the London Coliseum in 1910, 1911, 1913 and 1915.

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No Relays from America?

Whatever demand there may be for B.B.C. relays of American broadcast transmissions (the existence of such a demand is very problematical), it is not likely to be satisfied in the near future.

In consequence of rumours that the Chelmsford spaced-aerial system would shortly be employed for this purpose I sought for information at Savoy Hill. An official said: "It is true that experi-

ments in this direction have recently been carried out, but we are still not satisfied that the quality of the received signals comes up to the B.B.C. standard of service. Nevertheless, we are always open to consider relays of events which are of such transcendent importance that technical faults of a minor character could be overlooked. So far as any regular relays are concerned, the B.B.C. is not even now within measurable distance of assuring a sufficiently high standard of reception."

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U.S. and British Programmes.

The technical aspect of the Transatlantic relay question is not, however, the only one that counts. Some of the American transmissions, to judge from their programme value alone, can hardly be said to justify the labour and expense entailed in relaying them in this country. Many readers will agree that there is a sufficiently American flavour in the B.B.C. programmes already, and a change over from the nasalities (good word, this) of the Savoy ballroom to the nasalities-cum-morse of the Western hemisphere suggests as much enjoyment as a change of shift in a chewing-gum packing yard.

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The Promenade Concerts.

With signs of incipient summer all around us, it seems a far cry to the programme arrangements for next winter. But the Promenade Concerts, which can be said to usher in the winter season, are worthy of discussion at any time, and it is interesting to note that Sir Henry Wood and his orchestra will stage their "first night" on Saturday, August 11th. The season will run for eight weeks.

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Eighteen Months Ahead.

An innovation next winter will be the broadcasting of a series entitled "Great Plays," to be carried out on similar lines to other series, such as the National Concerts, Promenade Concerts, and Grand Opera, with the exception that the plays will be "inside" events.

Incidentally, I hear that the Programme Department has mapped out a general schedule for as far ahead as August, 1929!

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U.I.D.R.

The next meeting of the Union Internationale de Radiophonie is to be held early this month at Lausanne.

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A Wireless Mantrap.

The directors of Radiostation Zürich have hit upon an artful method of keeping people at home on Sunday afternoons in order to listen to the programme. This is how they do it:—

Sunday, May 6th.

13.00 wetter.
16.00 ? ? ? ? ? ?
18.00 Konzertubertragung.

With curiosity gnawing at his vitals, who could enjoy himself outdoors at 16.00 o'clock—unless, of course, he had a "portable"?

Northern Stations' Programme Scheme.

The programme co-ordination plan which is now being acted upon by the Northern stations of the B.B.C., with Manchester as the pivot, is really a foretaste of the regional scheme.

Under the regional scheme the Pennine station will be situated near Manchester, which will naturally become the mouthpiece of musical towns like Leeds, Sheffield, Liverpool, Bradford and Hull.

Meanwhile a very fine orchestra, comprising nearly all the members of the famous Hallé orchestra, has been got together and will probably form the nucleus of the musical resources of the new regional station.

FUTURE FEATURES.

London and Daventry (5XX).

MAY 7TH.—Dutch National Programme.

MAY 9TH.—Old British Music, a programme arranged and described by E. Sims Hilditch.

MAY 10TH.—"Wun Tu" or "The Seventh Heaven," a play by Frank Cochrane and Dion Titheradge.

Daventry Experimental (5GB).

MAY 6TH.—Light Orchestral Programme from Birmingham.

MAY 7TH.—Robert Browning Programme.

MAY 10TH.—"The Mastersingers," Act I, from Covent Garden.

MAY 11TH.—"East and West," a programme of two Hemispheres from Birmingham.

MAY 12TH.—"Œdipus Rex," opera oratorio in two acts after Sophocles.

Cardiff.

MAY 8TH.—The Merrymakers in Rhyme, Rhythm and Revelry.

MAY 9TH.—"The Southern Cross," orchestral and vocal programme.

Manchester.

MAY 10TH.—"Looking Backward," an orchestral and vocal programme.

MAY 12TH.—A Musical Story, the station orchestra and two vocalists.

Newcastle.

MAY 12TH.—Arthur Prince and Jim (ventriloquist).

Glasgow.

MAY 11TH.—Finalists of Diploma Class "A," soloists competing for the Gervase Elwes Memorial Trophy at the Eighteenth Glasgow Musical Festival.

Glasgow.

MAY 8TH.—"Sandy McRowe," a humorous radio story in the Aberdeenshire doric by Arthur Black and C. B. Forbes.

Belfast.

MAY 8TH.—"The Dreamer," a play in one act by A. E. Colville.

A New Orchestra.

There are 27 members of the new orchestra; many of them are well known not only as orchestral performers, but as soloists. Mr. T. H. Morrison is the conductor and Mr. John Bridge, leading violinist. The deputy leader is Mr. Don Hyden. Other well-known members of the new orchestra are: Leonard Hirsch, principal second violin; Frank Park, principal viola; Clyde Twelvetrees, principal 'cello; Otto Paersch, first horn; and Sam Holt, first trombone.

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The Music of Holland.

The works of Dutch composers will figure in the next National Music programme, to be given from 2LO on Monday next, May 7th.

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A Dramatic Silence.

Not many days ago a well-known Fleet Street editor was struck dumb. It happened thus.

The editor, hearing complaints about the alleged unfairness of certain dramatic criticism emanating from 2LO, pursued the topic with an "editorial" in his own paper, chastising the B.B.C. for permitting reckless criticism.

He was tackled on the 'phone by a B.B.C. official, who insisted that the gentleman in question had been misreported. The editor expostulated, whereupon the B.B.C. man, playing his trump card, said: "Well, after all, the fellow happens to be your own dramatic critic!"

After the customary interval of silence the telephone girl cleared the line.

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A Concert from Hastings.

A concert by the Hastings and St. Leonards Municipal Orchestra is to be relayed to 2LO and 5XX on Saturday next, May 5th, from the White Rock Pavilion, which was opened by the Prince of Wales last year.

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At the R.A. Dinner.

Prince Arthur of Connaught, the Rt. Hon. W. C. Bridgeman, First Lord of the Admiralty, and Lord Hewart, Lord Chief Justice, are speaking at the Royal Academy dinner on May 5, and their speeches will be relayed to 5GB.

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Broadcasting Advertisements.

The broadcasting of advertisements has always been strictly "verboten" in this country, although some people have said that they could more easily endure a few chatty nothings about Somebody's chewing gum than certain of the talks. Be that as it may, there is, I hear, a distinct possibility that stations actually in the British Isles may be putting out advertising matter in the not far distant future.

The Irish Free State is still in the British Isles, and it is from there that we may first hear publicity puffs via the microphone.

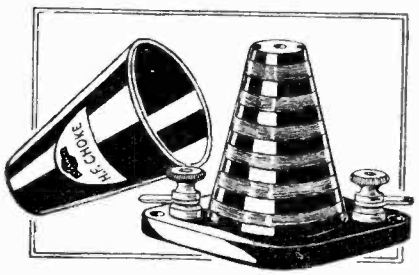
The topic was discussed by the Free State Broadcasting (Advisory) Committee at a recent meeting under the chairmanship of the Assistant Secretary to the Post Office.

WIRELESS WORLD LABORATORY TESTS

A Review of Manufacturers' Recent Products.

MAGNUM H.F. CHOKE.

Designed for wavelengths between 150 and 3,000 metres, this choke has an inductance of 160,000 microhenries and self capacity of 8 micromicrofarads. The winding is divided into six sections wound in slots in a cone-shaped former. The



"Magnum" cone-type H.F. choke.

diameter and number of turns in each section increase progressively and each differs in electrical properties from the adjacent sections, the object being to avoid resonances which would produce "blind spots" in a tuner employing reaction. The D.C. resistance is just over 400 ohms.

The price complete with moulded cover is 7s. 6d. and the manufacturers are Messrs. Burne-Jones & Co., Ltd., Magnum House, 281, Borough High Street, London, S.E.1.

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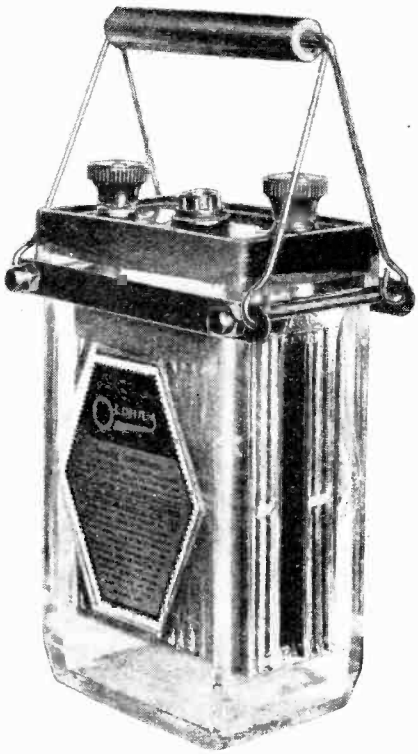
OLDHAM U.V.D. CELL.

The introduction of improved power valves in the 2-volt category is extending the use of low-voltage filament circuits to three and four-valve sets. To meet the demand for a 2-volt cell capable of supplying the necessary filament current for long periods Messrs. Oldham & Sons, Ltd., Denton, Manchester, have introduced the U.V.D. accumulator, which has a capacity of 40 ampere hours and a normal discharge current of 1 to 3 amperes. With modern filaments few four-valve sets take more than 0.6 amps., a current which is well within the capacity of the cell; just sufficient, in fact, to keep it in good condition.

The construction is similar to the smaller Oldham cells. The glass container has an ample acid capacity, and there is a deep well under the plates for silt, if any. The positive and negative plates are each built up of three laminations spaced and bonded on each side by burnt lead bridge pieces, a method of construction which combines strength with considerable surface area.



Oldham U.V.D. cell with carrying handle.

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FOR THE "EVERYMAN PORTABLE."

Readers who are about to construct the "Everyman Portable" and who are handicapped by lack of facilities for woodworking, will be interested to learn that the framework on which the loop aerial is wound and in which the apparatus comprised in this receiver is mounted is being manufactured by the Artcraft Co., of 156, Cherry Orchard Road, Croydon, Surrey.

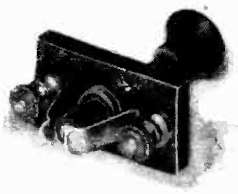
"Artcraft" plywood framework.

Plywood is used in construction, and as the holes for mounting the variable condensers and switch are already drilled and the frame aerial slots cut, the amateur's task resolves itself into one of little more than assembly and wiring. The dimensions are those given in the constructional article which appeared in *The Wireless World* for April 18th.

At the price of 3s. 6d. the framework may be considered good value. It is also supplied in a well-finished solid leather attache case for £1 complete.

GOTHIC SWITCH.

The design of this push-pull switch has been developed along conventional lines, the only deviation being the use of a round head screw for shorting the spring



"Gothic" push-pull switch.

contacts, which are of plated phosphor bronze. The price is 1s., and it is supplied by the Gothic Electrical Supplies, Ltd., 5-9, Severn Street, Birmingham.

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RIPAULT H.T. BATTERIES.

As far as we are aware, Messrs. Ripaults, Ltd., King's Road, London, N.W.1, are the first manufacturers of dry cell H.T. batteries to give definite data in connection with the capacity of their cells and the number of hours of useful life which may be reasonably expected under normal conditions. A table has been prepared by the company which shows the useful life of each of the four different types for various rates of discharge in milliamperes both for 100 and 150 hours' aggregate use per month. In addition to indicating the maximum current for which each type has been designed, figures are given for at least three different rates of discharge for each size of cell, and it is interesting to make comparisons between the different capacities of the cost per hour for a given current; the economy of using a larger capacity than is strictly necessary is clearly brought out. In preparing this comprehensive table the makers must have realised that they were putting into the hands of the purchaser a means of checking the performance of his battery, and this in itself implies unusual confidence in the consistent quality of their products.

The cells are described as of the "self-regenerative" type, and it is claimed that the useful life in working hours is the same whether the battery is discharged at the rate of 100 or 150 hours per month.

As an indication of the amount of useful information to be gleaned from the table, the following particulars of the "Standard" (Model CM Chocolate Label) battery in the 99-volt size may be quoted :—

Rate of Discharge (Milliamps).	100 Hours per Month		150 Hours per Month.	
	Life in Hours.	Life in Months.	Life in Hours.	Life in Months.
5	550	5½	550	3⅔
7	360	3⅔	360	2½
10	225	2¼	225	1½

Max. discharge advised ..... 7 mA.
Recommended for use with 3-valve receiver or single stage "power" amplifier.
Size ..... 9¾ × 5½ × 3in.
Weight ..... 6 lbs. 3 oz.
Price 16/6

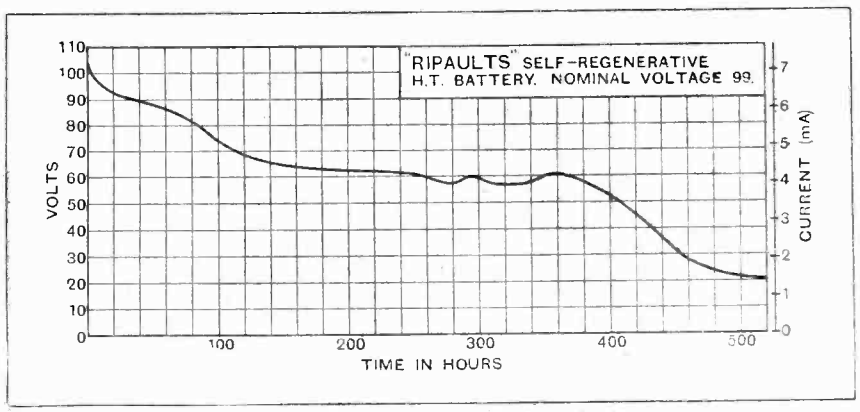
To check the maker's figures one of these batteries was discharged intermit-

Ripault "Self-Regenerative" H.T. battery (Model CM, Chocolate Label).

tently by means of an automatic switching device for 3-hour periods with 3 hours for recovery, readings being taken every 24 hours. A constant resistance was used so that the current fell with the voltage, this being a closer approximation to broadcasting condition than the method in which the cells are discharged at constant current. In plotting the discharge curves the recovery periods were eliminated from the time base which represents consecutive working hours. It will be seen that a useful life of 400 hours may be expected with an initial current in the vicinity of 7 mA. and a steady value of about 4.5 mA. before the "cut off" at 400 hours. These figures fit in very well with the particulars quoted above. The slight irregularity at 300 hours was due to a short spell of warm weather, the rise in temperature affecting the E.M.F. of the cells.

In addition to the "Standard" Model, suitable for discharge currents up to 7 mA., there is the Double (Model CHM, Blue Label) up to 12 mA., Treble (Model HM, Orange Label) up to 18 mA., and the Quadruple (Model THM, Black Label) up to 25 mA.

We hope that other dry battery makers will follow Messrs. Ripaults' lead and come out into the open with details of the average life which may be expected from their cells.



Discharge curve for the Ripault Model CM battery.

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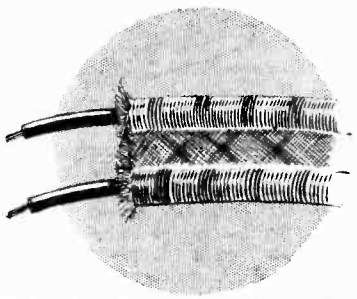
"HARBROS" WIRE.

Messrs. Hart Bros., Electrical Manufacturing Co., Ltd., 4, Queensway, Ponders End, are specialists in the production of insulated wire, and in particular have introduced several original woven silk coverings with the object of reducing the self capacity of twin extension leads.

The "Easyfix" flexible wire consists of two rubber-covered, 14-strand leads running parallel and spaced ⅛in. apart by a silk web interwoven between the two flex leads. The spacing apart of the wires in this way gives a marked improvement over ordinary twisted flex in the matter of self-capacity, which is often the cause of serious high-note loss when using long extension leads to the loud-speaker. Further, the appearance of the extension leads is much improved, the "Harbros" wire lies flat and can be secured by pins which are available in various colours to harmonise with the walls of the room. No damage is done to panels or plaster such as is likely to occur when using ordinary fibre-insulated staples with twin flex.



"Harbros" twin flex with woven spacing to reduce capacity.

By measurement the capacity of "Harbros" wire comes out at 11 micromicrofarads per foot. A specimen of the "black and red" variety worked out at 18.5 mmfd./ft., and "maroon" at 19 mmfd./ft.; a length of twin bell wire had a capacity equivalent to 36 mmfd./ft., and showed considerable dielectric losses. All measurements were made with the wires stretched out straight and away from the wall.

The "Harbros" wire may be purchased by the yard or made up into 8ft. lengths, with terminal tags and spades. Other products of this firm include multiple stranded battery cables.

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.

ANODE AND GRID RECTIFICATION.

Sir,—I see in your issue of April 11th Mr. Sowerby's reply to my letter on the subject of anode versus grid rectification. I am afraid, however, that I cannot quite agree with the point that he makes as to the relative strength of different items transmitted by the B.B.C. I am fully aware of the difficulty that he refers to, but surely the difference in strength is a difference in depth of modulation, and not in carrier wave; and since the figures that I gave for input to the detector refer to carrier wave they are not affected by changes in modulation (except, of course, that deeply modulated signals are always more difficult to rectify without distortion).

After all, it is not really difficult to ensure getting the right load on the detector, for all that one needs to do is to design the L.F. amplifier so that with the correct load on the detector the final output from the set is of the desired strength, after which the use of some type of volume-control working before the detector will automatically ensure that the latter is getting approximately the correct input.

The subject is, I am afraid, much too difficult to deal with by means of correspondence, but I do put forward as a personal opinion, based on considerable work on the subject, that, although the grid rectifier is by no means perfect, it is in most cases superior to the anode rectifier. P. K. TURNER.

Slough.

April 11th, 1928.

IDENTIFICATION OF STATIONS.

Sir,—Mr. Dallas Bower, in his article on the identification of stations, which appeared in *The Wireless World* of February 22nd, wrote: "Practically everyone with any education at all has a rudimentary idea of the Greek alphabet." I am surprised, sir, that you allowed such a statement to appear; it is hardly accurate and closely approaches the offensive.

The scheme appears to me to be quite impracticable. It not only requires both speech and buzzer, but there are surely not enough letters in the Greek alphabet which are available for the purpose, if we consider the groups pi, phi, chi, psi, and xi; beta, theta, eta, and zeta; mu and nu and upsilon and epsilon, it is evident that quite a number of letters must be omitted, or confusion will result.

The proposed method of indicating the particular station by a number of dashes does not appear to be materially simpler than morse. After all, morse is only a combination of dots and dashes, and as the signals would be sent automatically they would be sent slowly and accurately, and it would not be difficult to put them down on a piece of paper as they came, if necessary. Should morse signals be adopted, wireless papers, when giving lists of stations, would be sure to give the call in dots and dashes so that the listener would not even require to know the meaning of the various combinations. Many astronomers all over the world, both amateur and professional, learned to read the scientific times signals sent out by Bordeaux, and each of these times for a long while consisted of two groups, each containing seven figures.

A further objection, though perhaps not a serious one, lies in the different ways that different nations have of pronouncing the names of the Greek letters—zeta might become tsayta

The principal objection to morse signals seems to be that many people think that they will have to learn to read morse, and that to do so requires a lot of practice. To learn to read morse well enough to transcribe code messages sent at the rate of 25 to 30 words a minute must certainly require a great deal of practice, but to be able to jot down a short combination of dots and dashes sent slowly and accurately is a very different thing, and requires hardly any practice. Had the suggestion first been made that the identification signals should take the form of combinations of dots and dashes, sent slowly, and the word "morse" never mentioned, I think there would have been much less objection to such a scheme.

W. M. WORSSELL.

129, Yeo Street, Johannesburg, South Africa.

March 22nd, 1928.

GRAMOPHONE REPRODUCTION.

Sir,—I note with particular interest Mr. H. R. Webb's letter in your issue of April 18th suggesting the use of an absolute tangential carriage for gramophone pick-ups, having given some consideration to the design of such a device myself.

Before overcoming all the "snags" to my own satisfaction, however, I came to the conclusion that the error with such a carriage was probably as great as with a short tone arm. The ideal carriage or tone arm is presumably one in which the locus of travel of the needle is identical with that of the recording stylus. So far as I can gather, the recording stylus does not travel along a perfect radius, but performs a flat curve.

The very finest gramophones and electric reproducers utilise long tone arms, the locus of travel of the needle being an arc of a circle of some 11in. radius, and the needle only being at a tangent to the groove at the middle of a 12in. record. It is only reasonable to suppose that the firms manufacturing records for their machines make them so that reproduction will be as nearly perfect as possible—that is, with a recording stylus following a similar locus of travel.

Should my supposition be incorrect, possibly some better informed reader will correct me.

In the meantime, I incline to the longest convenient tone arm; long tone arms are difficult to obtain and expensive, and other experimenters with electric pick-ups may be interested to know that short tone arms can be conveniently lengthened by cutting the straight part and connecting up with a length of hose or a rubber "brewers' joint." S. E. NEEDHAM

Goodmayes.

April 18th, 1928.

Sir,—I am glad to see that Mr. Webb, in his letter published in yesterday's issue, raises the question of what is generally known as "needle track alignment."

The importance of good alignment in a soundbox or pick-up does not appear to be properly appreciated by many amateurs. Apart from the obviously detrimental effect of bad alignment on quality, it may easily occur in a really bad case that a record is completely ruined in less than a dozen playings. I refer, of course, to modern electrically-cut records.

While Mr. Webb correctly states the conditions necessary for perfect alignment, I am afraid he is wrong in assuming that nothing can be done with the ordinary tone arm. In all good makes of gramophone the alignment is made to conform to the ideal as nearly as is necessary for practical purposes.

The generally accepted standard for needle track alignment is this. At one point at least (preferably midway) in its travel across the record the face of the soundbox must be exactly at right angles to a line drawn from the turntable spindle to the needle point where it touches the record. Else-

where the deviation from the right angle must not exceed 5 degrees. If this specification is adhered to when building a radio-gramophone there need be no fear of undue pick-up chatter or record wear; but if a gramophone tone arm is used to carry the pick-up it should be one of a reputable make, for with cheap illegitimate tone arms it is practically impossible to get anywhere near decent alignment. If any difficulty is found in checking alignment with the pick-up employed, any ordinary soundbox may be conveniently substituted.

I hope Mr. Webb will not view these remarks in the light of a disparagement of his idea of a sliding carriage. Of course, this is the proper way to mount a pick-up, but many people have neither the facilities nor the mechanical aptitude for constructing such a device, while a *good* gramophone tone arm, if properly aligned, can be perfectly satisfactory.

I believe that a special protractor for checking needle track alignment is now commercially available. A. O.

N.W.5.

April 19th, 1928.

5GB PROGRAMMES.

Sir,—I agree entirely with Mr. McMillan's letter in your April 4th issue re 5GB.

The reception of this station in this district is, as he says, atrocious. Fading is very, very bad, and, furthermore, distortion is present on many occasions.

Not only have I noticed it, but many of my friends complain and say they cannot rely on the alternative programme.

I receive Frankfort, Langenberg and Hamburg quite 100 per cent. better than 5GB, and yet the B.B.C. seem satisfied.

Warrington. J. SPEAKMAN.

April 5th, 1928. BRS.98.

TALKS.

Sir,—I do not desire to enter into this controversy as such, especially as between your special correspondent and "F," but there is a point of view which Mr. Sackett ignores, and that is the revenue by which he himself gets his entertainment.

We all know that the wireless service is a democratic one subscribed to by all in equal share, and so, having availed himself of it, Mr. Sackett desires to deprive the minority of their just due.

No matter how distasteful some talks may be to Mr. Sackett and myself, for instance, they certainly please some, and those somebodies have a claim to be catered for.

The suppression of minorities is not a British characteristic and his ungenerous reference to the able men and women who speak to us is just nasty and bad taste.

Do you not think, sir, that a wireless licence may be too cheap at ten shillings a year? It would seem that this very cheapness begets an intolerance in some quite at variance with the true spirit of broadcast service.

London, W.4. W. A. TALBOT.

April 4th, 1928.

THE PATENT POSITION.

Sir,—Your recent leader was welcome, but hardly goes deep enough. The Marconi Co. has been the progressive instrument in wireless commercial development, and is undoubtedly entitled to collect royalties from users of their patents; but the home constructor is faced by an apparently impenetrable fog. It is understood there is no patent on transformer coupled L.F. amplification, yet royalties are claimed. The Marconi Co. will sell a valve and an R.C.C. unit, and at the same time publish a threat against using them together without further payment. This hardly appears logical. A clearly expressed schedule of basic patents would assist the user and benefit the owners. Royalties, at present withheld by ignorance of the position, would be paid if the constructor was relieved of the feeling of being "had." BM/BLDN.

April 14th, 1928.

BATTERY ELIMINATORS.

Sir,—In the April 4th issue of *The Wireless World* we notice that your correspondent, Mr. A. W. Scott, comments on the fact that very few manufacturers of H.T. battery eliminators state the current obtainable at specified output voltages. It has been the practice of this company to publish graphs showing the respective outputs of all models, and these outputs are guaranteed.

From the particulars of current and voltage given by the graphs, it is easy to decide on the eliminator most suitable for any particular purpose, and obviously it is extremely important to select an instrument which is designed to give the output that would be required from it.

We fully agree with Mr. A. W. Scott that no one should buy an H.T. supply unit without knowing definitely the current available at a specified output voltage.

THE RADIELLE COMPANY, LIMITED.

April 14th, 1928. F. R. Payne, Director.

PROGRAMMES.

Sir,—It is ungrateful to complain when the licence for wireless reception costs only ten shillings yearly; but comparison is provoked by the B.B.C. programmes for Sunday evening, April 15th, and those at Frankfurt (Boris Godounov), at Hilversum (Faust), and at Kalundborg (Aïda).

We should be thankful both that we are not like our neighbours, and also that these stations are of ample power.

Battersea, S.W.11. April 16th, 1928. F. C. RAY.

"PIONEERS OF WIRELESS."

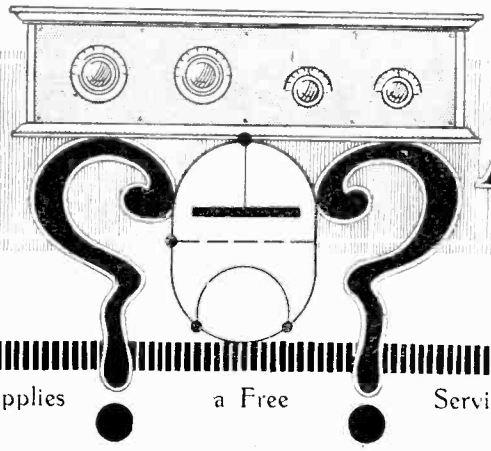
Sir,—In dealing with my "Pioneers of Wireless" (pp. 178-9 in your issue February 8th) your reviewer criticises the book in a manner that may lead to a misconception as to its scope and contents.

Professor Fleming states that it would have been better if less space had been devoted to the efforts of the early workers, so that more space would then have been available to deal with the modern developments of electric wave telegraphy and telephony, "which alone concerns us at the present time." No attempt was made to deal with modern developments for the simple reason that *the whole object of the book is to deal particularly with the researches of those who laid the foundation of wireless.* I pointed out in my preface: "As the title of this book implies that it deals with 'those who go before to prepare the way for another,' it should, strictly speaking, end with the consideration of those whose work dates prior to the time of Marconi."

Surely your reviewer is not serious when he says that we are concerned at the present time *only* with electric wave telegraphy and telephony. Modern developments in any science can never be allowed to obscure completely the historical side, even though this aspect may not be of equal interest to everyone.

We all admire the continued persistence with which Professor Fleming puts forward his claim to have himself alone invented the Thermionic Valve. It is quite clear throughout the book that the credit for the *original* invention is his, and I point out in my preface that the book includes a short account of the valve, "of which Fleming must be regarded as being the pioneer." But, after all, de Forest *did* introduce the third electrode, and that has given us broadcasting and the many other modern developments. Because de Forest endeavoured to claim priority in the invention of the valve in its original state, and failed (according to the judgment in the U.S. Courts), there is no reason why his pioneer work with the third electrode should be discredited. Facts are facts, and history is history, although it certainly would have been more pleasing to the undersigned to have recorded the invention of the complete valve in its present form as standing to the credit of a British pioneer.

Your reviewer is obviously under a total misapprehension as to the scope of the book, and his review is therefore likely to mislead your readers. The book was planned and written to deal with the very subjects to which Professor Fleming thinks too much space is devoted. Such subjects as "the marvel of modern broadcasting and the beam system" cannot be said to enter into any historical survey of the "Pioneers of Wireless," the date of whose work, strictly speaking, is prior to the time of Marconi. ELLISON HAWKS.



READERS' PROBLEMS

"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

Combating Microphonic Noises.

My receiver is an 0-v-2 and I am troubled with microphonic noises, which, when the loud-speaker is brought near to the set, build up to a roar. Can you suggest a remedy for this, please?

B. C.

This is probably due to the use of a rigid detector valve holder which does not permit the valve to vibrate independently. Microphonic trouble can be mitigated by employing a good non-rigid valve holder, or alternatively you could mount your present valve holder on a piece of sponge rubber. Should the latter expedient fail, it would be as well to try the effect of covering the detector valve with cotton wool, which can be held in position with rubber bands.

○○○○

Effect of Grid Current in H.F. Circuits.

I have built a neutralised H.F. unit for my 0-v-2 set, but the performance of this does not appear to me to be satisfactory. With my present set, which employs leaky grid rectification, the H.F. stage cannot be made to oscillate by varying the neutralising condenser, whereas when an anode bend detector valve is added to the unit any movement of the neutralising condenser either side of the balancing setting renders the amplifier unstable. Can you please advise me what to do to obtain satisfactory results when using the unit with my set? L. P.

The leaky grid method of rectification heavily damps the associated tuned circuit, which in the present case is the secondary circuit of the high frequency transformer, this being due to the flow of grid current in the grid circuit of the detector valve. This would be analogous to shunting the tuned circuit by a resistance. In the case of an anode bend detector, grid current is not present owing to the negative bias being applied so that the secondary of the H.F. transformer is not damped, and the transformer is, therefore, more efficient. When leaky grid rectification is used, the detector should be connected across a portion only of the secondary coil, and this can be arranged by tapping the secondary at about two-thirds the total number of turns, counting from the low potential end.

○○○○

Reaction in the Everyman Four.

I have endeavoured to add a reaction circuit for use on the long waves in the "Everyman Four" receiver, but so far without success. Can you inform me, please, how to apply this without impairing the efficiency of the set on the medium wavelengths?

C. S. S.

The judicious use of reaction on the long waves in this receiver will lead to a slight increase in sensitivity, and its application was recommended in the "Readers' Problems" columns in our issue of August 31st last. In certain cases instability may be experienced on the medium B.B.C. wavelengths, unless the reaction coil is short circuited as well as the loading coil; however, this can be arranged by replacing the existing switch by one provided with an extra contact.

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The Reason Why.

In the "Wireless World Super Seven" I notice that the grid leak of the first detector valve has a 1½ volt cell connected in the low potential end. Usually the grid leak is returned to positive filament, and I should be obliged if you would explain the function of this cell? T. G. M.

The 1½ volt grid cell is included in the circuit to give a negative bias to the first detector valve, so that this will function as an anode bend detector. The presence of the grid leak and condenser does not indicate that the leaky grid method of rectification is employed, the function of the condenser is to block off H.T. from the grid of the valve, and the grid leak provides the path for applying the required bias.

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Designing a Frame Aerial.

Is there any easy way of determining the number of turns on a frame aerial intended to cover the normal broadcast waveband in conjunction with a 0.0005 mfd. variable condenser?

S. A. A.

As a rough-and-ready guide, and assuming that a fairly conventional size and method of winding is adopted, you will find that the use of seventy-five feet of wire will provide an approximately correct inductance value. A "rule of thumb" of this kind must be used with some caution, but it is most helpful, and, at the worst, you will only have to add or remove one or two turns if you find on trial that the desired waveband is not adequately covered.

RULES

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

A Faulty Potentiometer.

My "All Wave Four" receiver is fitted with a high-resistance potentiometer of the type in which a graphite track provides the resistance element. I find that the set works only when the brush of this potentiometer is at the extreme limit of its travel; in any other position a violent rattling noise akin to "motor boating" is produced in the loud-speaker. As the performance of the set is far from satisfactory, I feel convinced that my detector valve is not working properly, and should be obliged for a suggestion as to how the trouble may be overcome. P. B. R.

We think it probable that the fault lies in your potentiometer. It may be that there is an open circuit in the resistance element, or that the brush is not making proper contact with it. We suggest that you would be well advised carefully to overhaul the potentiometer and if necessary to rub more graphite on to the track.

When using a high-resistance potentiometer you should on no account omit the grid return circuit by-pass condenser shown in the original diagram at C_5.

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Phones and Loud-speaker.

A hint as to how telephones may best be connected in series with the loud-speaker would be appreciated. I find when they are joined in the normal manner that the signal strength in the phones is altogether excessive, but at the same time the addition reduces loud-speaker volume quite appreciably. N. F. R.

We suggest that you should connect your telephones in series with the loud-speaker in the ordinary way, and then connect across the former the winding of a 400-ohm potentiometer (arranged as a simple variable resistance by joining leads to one end of the winding and to the terminal in contact with the slider brush—this is generally the centre terminal). You can then adjust the resistance to give comfortable volume in the headphones. Assuming the output from your last valve to be sufficient for good loud-speaker reproduction, ample control will generally be obtained if you use a resistance of the value recommended above, but if phone volume is insufficient, you must increase its value.

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Long Waves on the "Everyman Four."

I have added long-wave reaction to my "Everyman Four" in the manner described in the "Readers' Problems" section of your issue for August 31st, 1927. The addition has achieved its object as far as the reception of Daventry 5XX is concerned, but the stability of the set on the normal broadcasting waveband is impaired; indeed, on this band it is necessary to remove the reaction coil and to short-circuit its holder. This does not make for a convenient waveband change-over, and I should be obliged if you would suggest how the necessary circuit alterations may be made with a single switch, preferably of the type already used for short-circuiting the long-wave loading coil. A. M. S.

The necessary alterations are shown in Fig. 1. Instead of your present "push-pull" switch you must substitute one with contacts for short-circuiting both loading and reaction coils. A suitable pattern would be the Edison-Bell double-pole switch No. R/337, the connections of which are given in our diagram. A consideration of this diagram will show you that when the plug is pushed in both coils are short-circuited. When it is pulled out these are in circuit, and, after transferring the aerial to A_3 and switching off the H.F. valve, the set is ready for long-wave reception.

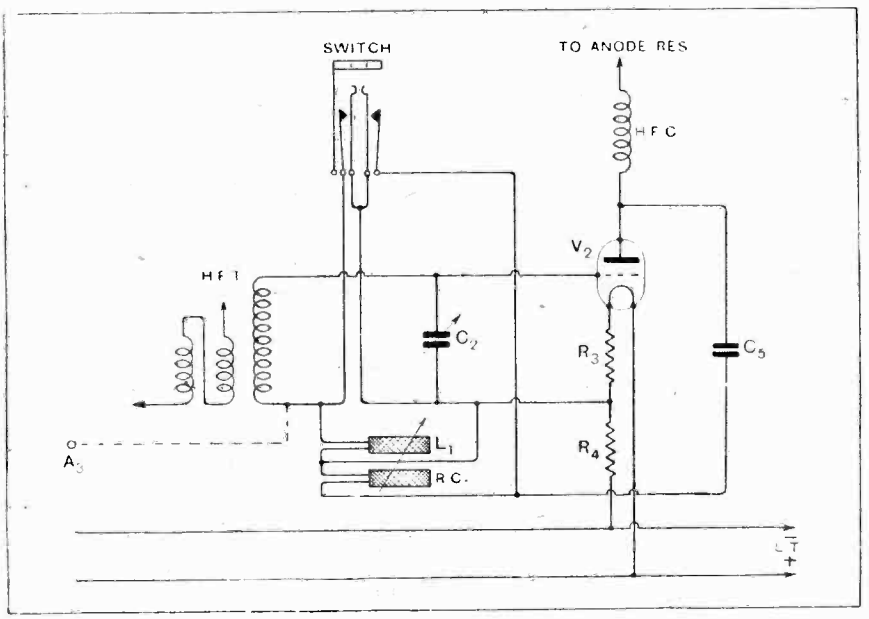

Fig. 1.—Adding long-wave reaction to the "Everyman Four." The lettering V_2, C_5, etc., refers to the original circuit diagram. "R.C." is the added reaction coil.

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Designing a Portable.

Although I am an old reader of your paper, I find myself at a loss in deciding on the best circuit for my proposed two-valve portable (phone reception only). I want it to be light in weight and of small dimensions, but require fairly good sensitivity. On this last count it would seem desirable to use an H.F.-detector combination, but I have observed that the detector-L.F. seems to be more popular. Which do you recommend? P. D. W.

It is not easy to give a definite answer to your query, but we may point out definitely that considerable difficulties lie in the way of designing a really satisfactory "H.F." set of this kind, as it is almost impossible to keep down the weight and bulk and at the same time to retain reasonably efficient H.F. amplification. The sensitivity of a detector-L.F. set with well-controlled reaction, even when it is used with a small frame aerial, is almost incredible. As quality of reproduction is not of vital importance for phone reception, it is our opinion that this would be the best circuit for you, always provided that your requirements as to range are not too exacting.

oooo

Interacting Frame Aerials.

The disposition of the long- and short-wave frame aerials in my self-contained receiver is as shown on the attached sketch. The set works perfectly well on the medium broadcast band when the long-wave frame is removed, but when it is placed in the position shown, results are most disappointing. I should be obliged if you could suggest how the trouble may best be overcome. G. S.

We think it certain that the effect you have noticed is due to the fact that the two frame aerials are placed in close proximity to each other; it is quite possible that the long-wave frame is acting as an absorption circuit; in conjunction with small incidental capacities it may resonate at some wavelength in the medium broadcast band. The natural wavelength of a long-wave frame aerial is often quite low, as the winding is generally of low self-capacity. We suggest that you might try the effect of short-circuiting the long-wave frame, but, much better, we recommend that you should arrange to break its circuit at one or two points—say at its centre. This can be done by means of a switch, or by a plug and socket arrangement.

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GIFT HORSES.

A YEAR or so ago the question of equipping hospitals with wireless receivers, so that patients could enjoy the wireless programmes, was taken up with commendable enthusiasm, and really large sums of money were subscribed to a central fund organised by the *Daily News*, and the example so set was followed by private individuals, wireless societies, and other bodies in arranging for the equipment of their local hospitals with necessary apparatus. Now, in the majority of cases these wireless installations have been a success; the apparatus has been installed by competent engineers and has given satisfaction ever since. But there are also a great many cases which have come to our notice as the result of a recent investigation, where either the receivers have practically ceased to function or else the reproduction is so atrocious that speech is almost unintelligible and musical broadcasts unfit to listen to, but the hospital authorities, knowing that the installation has been presented without cost to the hospital, feel considerable diffidence in making any complaint, and in many cases prefer that the installation should fall into disuse, a state of affairs which is quickly developing on account of the poorness of quality. It is quite natural that the hospital authorities do not care to look a gift horse in the mouth and, under these circumstances, it is difficult to see how a remedy can be effected by any action taken by the hospitals themselves.

Probably the best solution would be for the Trade Association of Wireless Manufacturers to form a voluntary committee to undertake an inspection of the various hospital equipments and report on what changes are necessary to the installations in order that they may give satisfactory service.

Amongst our readers there must be many who have had experience of hospital installations as they are working at present, and we should appreciate reports from them which, if necessary, would be treated confidentially, in order that we may be able to gather experiences of the performance of hospital equipments over a much wider area than it has been possible for us to do in the investigations which we have made up to the present.

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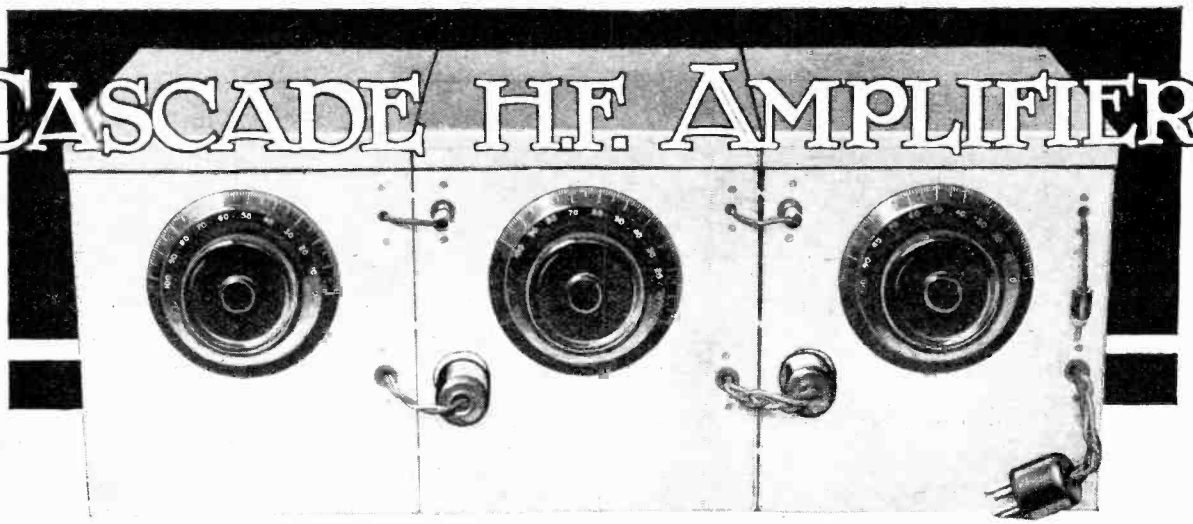
CAPT. ECKERSLEY IN MANCHESTER.

TOWARDS the end of last month Capt. Eckersley paid a visit to Manchester and gave an address before a meeting organised by the Association of British Radio Societies in Manchester. His address met with a mixed reception and there was considerable heckling, mostly on the score of the poor performance of 5GB in the Manchester district.

It must be a new experience for Capt. Eckersley to face an unsympathetic audience, because he is normally such an extremely popular figure. In this case we think the reception is very largely due to a misunderstanding which Capt. Eckersley has now endeavoured to clear up, although we think it is a pity that these points were not made clear many months ago, so as to avoid such misunderstandings.

It is now explained that Manchester was never intended to be served by 5GB as an alternative station, that 5GB has always been experimental, and that the B.B.C. efforts have been in the direction of establishing a station which would give an alternative programme for the Midlands, the station being, we believe, directional (as far as observations indicate) south and south-east and reception north being very poor. We are not quite clear even now whether this state of affairs is the result of accident or design; whether the B.B.C. definitely set to work to make 5GB directional towards the south, or whether it was an accident of circumstances that the station, after erection, gave that performance.

CASCADE H.F. AMPLIFIERS



A Super-sensitive Receiver "by Instalments."

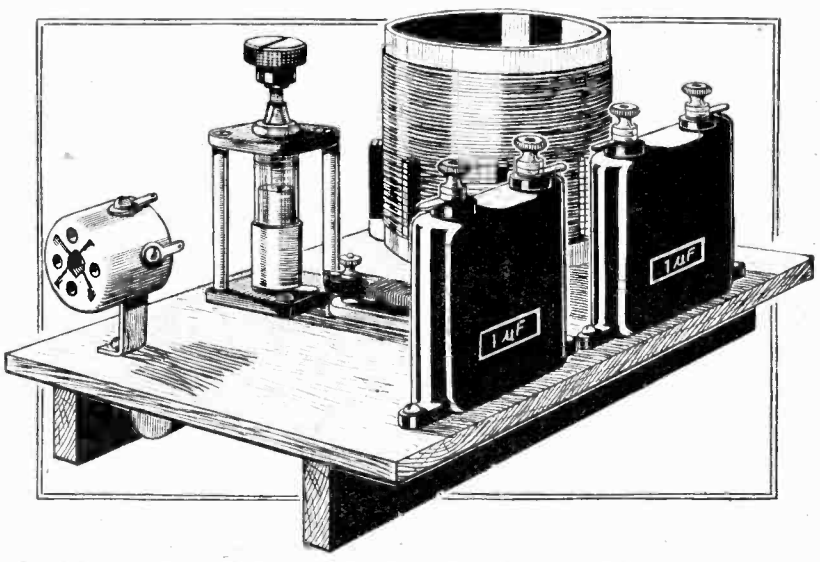
By H. F. SMITH.

ALTHOUGH the construction of a set with more than one H.F. stage is not so difficult as is sometimes imagined, it cannot be denied that satisfactory realisation of such a receiver is something of an achievement, particularly if a high degree of magnification is to be obtained. Now most amateurs have no means of deciding whether each valve is doing its proper share except by comparing results when listening to signals; these comparisons are most easily and conclusively made when each H.F. amplifier is interchangeable, and it seems certain that the chances of failure or only partial success are reduced to a minimum when something on the lines of the unit system described in this article is adopted. It has the additional advantage of allowing the use of as much H.F. amplification as may be required for the reception of the desired signals, or of none at all. Against this we must take into account a slight increase in cost and the fact that the apparatus is less compact than a complete receiver.

The Unit System.

The diagram, Figure 1, shows that the circuit is the conventional arrangement of transformer-coupled H.F. valves, but each valve with its associated apparatus is contained in a screening case, as is the separate aerial tuner. The H.F. units being identical, values of components are given only on the first. The detector valve is also shown, for the sake of completeness, although it is not proposed to describe this part of the receiver. It will in many cases be found possible to modify an existing set with anode bend rectifier and one or two L.F. valves by fitting suitable sockets into which may be inserted the output plugs of either the aerial tuner (for local station work) or of an H.F. unit. Batteries are permanently connected to the detector-L.F. unit.

The general arrangement of each H.F. amplifier is shown in the perspective sketch. A wooden baseboard, of a size suitable for fitting into the screening case, and raised on battens 1¼in. in depth, carries all the components except the variable condenser, which is mounted on the case. An Athol valve holder, supported by a brass bracket supplied by the makers, is placed so that it fits into a hole cut in the front of the box. Its sockets serve as inter-connections for H.T. positive, L.T. positive, common negative, and grid return leads. A Clix adaptor plug, with four pins, is joined to flexible leads, which are passed out through a hole on the right-hand



Showing construction of baseboard and arrangement of components, as seen from the front. The valve holder is behind the H.F. transformer.

Cascade H.F. Amplifiers.—

side, this plug being inserted into a corresponding valve holder in the succeeding H.F. amplifier or detector-L.F. unit, as the case may be.

An insulated plug socket, connected to the valve grid, is mounted at the top left-hand side of the front of the metal box, while another hole, also bushed with ebonite, in a corresponding position on the right-hand side, passes a wire terminating in a plug for insertion into the grid socket of the succeeding valve. These are the high-potential inter-connections; in the diagrams the plugs are indicated by X and the sockets into which they are inserted by Y.

In order that the screening boxes may be sufficiently rigid to be self-supporting, it is necessary that they should be made of moderately heavy sheet metal; those illustrated were constructed to the writer's specification by the Camden Engineering Co. in aluminium of about $\frac{1}{32}$in. in thickness, the outer dimensions being 7in. wide, 8in. deep, and 8in. high, with a closely fitting lid. The fronts of these boxes are drilled with holes of the sizes and in the positions shown in Fig. 3. Small rectangular

LIST OF PARTS—H.F. UNIT.

1 metal case (as for Aerial Unit).
1 variable condenser, 0.0003 mfd. ("Simplicon").
1 neutralising condenser (J.B.).
2 condensers, 1 mfd. (Dubilier).
2 valve holders—1 with supporting bracket (Athol).
1 semi-fixed filament resistor ("Varo-fix", Lamplugh).
1 dry cell.
1 insulating tube, 3in. dia., 3½in. long ("Pirtoid").
1 4-pin adaptor ("Clix").
Wire, screws, ebonite, etc.

Approximate cost, 40/-.

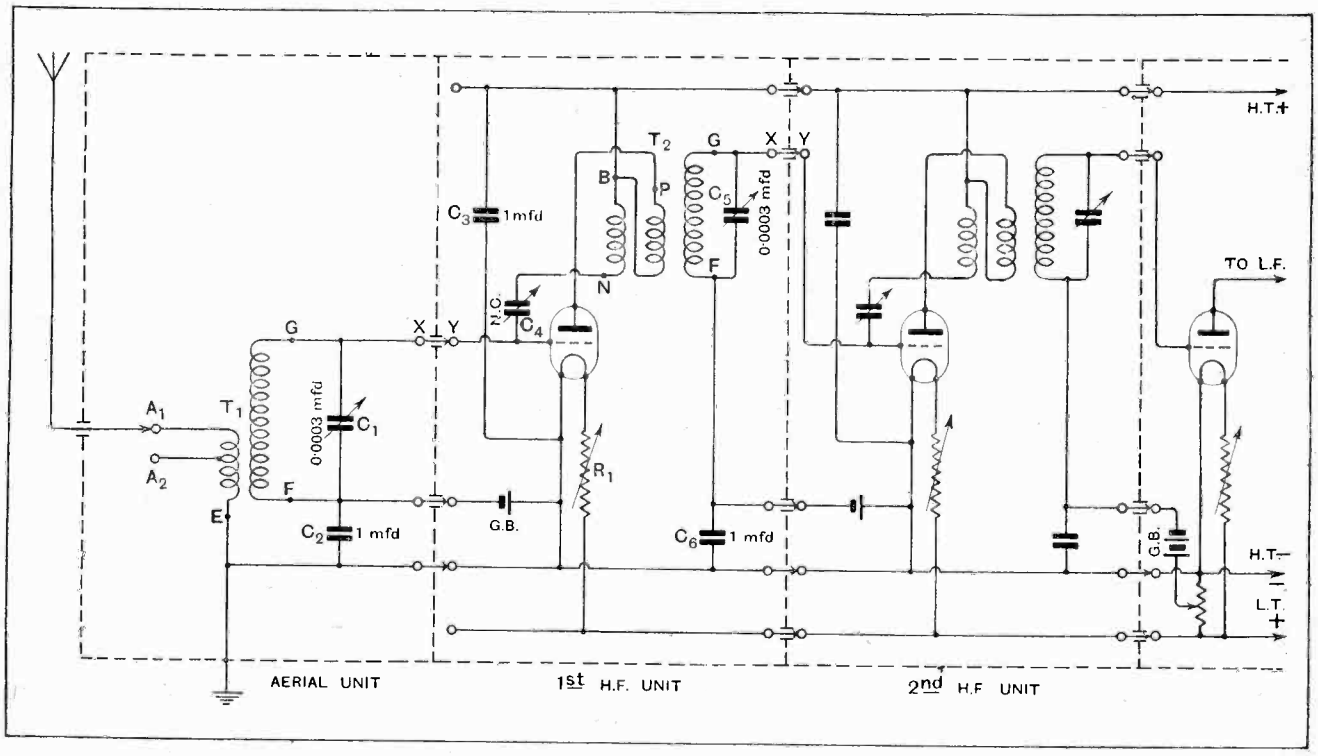


Fig. 1.—The theoretical circuit diagram. T_1, aerial-grid transformer; T_2, H.F. transformer. Connections to a detector valve are shown.

LIST OF PARTS.—AERIAL UNIT.

1 aluminium screening case, 7in. wide, 8in. deep, 8in. high (Camden Engineering Co., Ltd.).
1 variable condenser, 0.0003 mfd. ("Simplicon"; Williams & Moffatt).
1 condenser, 1 mfd. (Dubilier).
1 4-pin adaptor ("Clix"; Lectro Linx, Ltd.).
1 porcelain terminal block, 2-way (Athol).
1 insulating tube, 3in. dia., 3½in. long ("Pirtoid"; H. Clarke & Co. (Manchester), Ltd.).
Wire, screws, ebonite, etc.

Approximate cost, 30/-.

pieces of ebonite, indicated by dotted lines, are screwed to the metal behind these, and are drilled with slightly smaller holes, thus serving as insulating bushings. An aperture for the aerial terminal block must also be cut in the back of the aerial unit container, and another hole drilled for an earth socket or terminal, which is, of course, in contact with the metal.

High-frequency transformers generally present difficulties in construction, but an attempt has been made to design those used in these units (which cover the normal broadcast band) in such a way that they can be made by those having but a meagre equipment of tools. The secondaries are in the form of a closely wound single-

Cascade H.F. Amplifiers.—layer solenoid with a total of 70 turns of No. 26 D.C.C. wire on a former 3in. in diameter, through which are passed two screws serving as points of attachment for the ends of the winding. The aerial section has 12 turns of No. 30 D.S.C. wire, tapped at the 8th turn from the earthed end, and spaced from the secondary by insulating strips in the manner now familiar to the majority of readers. Where facilities do not exist for preparing grooved spacers, plain pieces of insulating material, or even match stems, may be used, although it is necessary that one of the strips should be heavy enough to carry three screws which act as connecting points for the ends of the winding and the tapping. Turns should be wound about 32 to the inch, with a space of about $\frac{1}{4}$in. between eighth and ninth turns to clear the screw. Spacing between primary and secondary should average about $\frac{1}{16}$in., so some eight to twelve strips will be necessary, depending on their thickness.

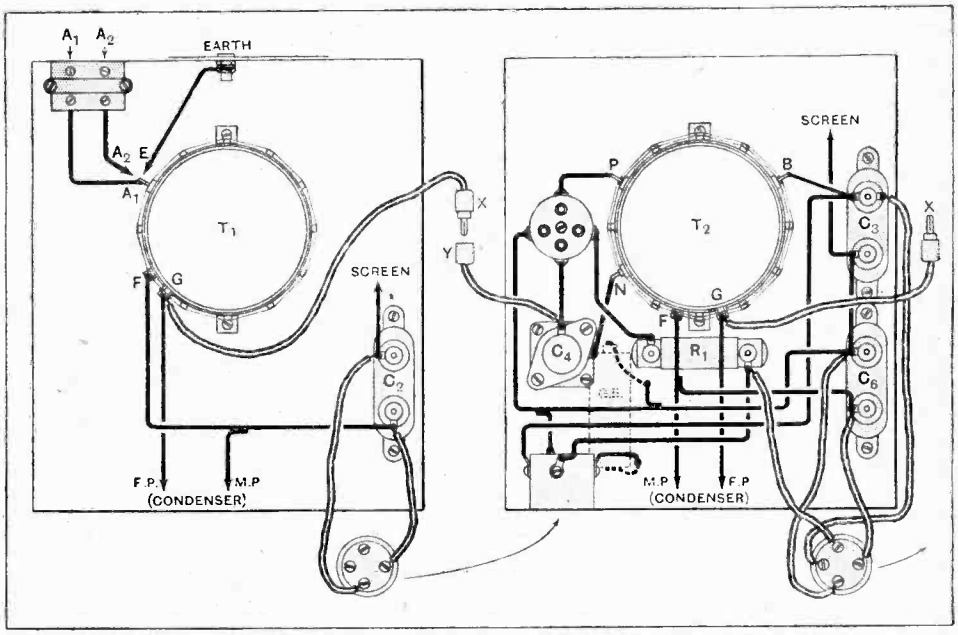


Fig. 2.—Practical wiring plans. On the left, the aerial unit, and on the right, an H.F. unit. The flexible connectors to the variable condensers are marked F.P. (fixed plates) and M.P. (moving plates).

H.F. Transformer Details.

Instead of winding the H.F. transformer primary and neutralising sections side by side—a form of construction which renders imperative the use of grooved spacers—they are put on in separate layers. First comes the primary, wound over the low potential end of the secondary in the manner already described, and having 15 turns of No. 40 D.S.C. wire spaced out to occupy a length of $\frac{5}{8}$in. Again the distance between primary and secondary must be about $\frac{1}{16}$in., and three of the spacers should be of ebonite, one carrying a small terminal screw (No. 8 or 10 B.A.) at each end, while the two others have a single screw at one end. The neutralising winding is over the primary and separated from it by $\frac{1}{32}$in., this spacing being provided by strips of Paxolin, Pertinax, or similar material of that thickness, one of which is placed over each primary spacer and temporarily secured by a rubber band. The relative positions of the windings, as well as the ultimate connections of the various ends, is shown in Fig. 4, in which the lettering G, F, B, P and N corresponds with that in the theoretical circuit diagram and practical wiring plan. The transformers are fixed to the baseboard with two light brass brackets; grid leak clips were actually used.

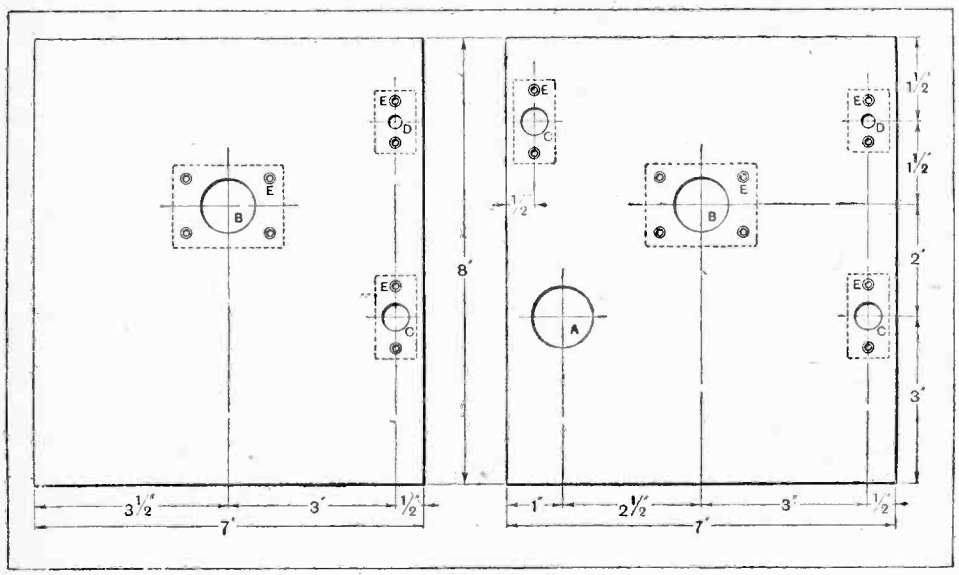


Fig. 3.—Drilling of the box fronts. Left: aerial unit; right: H.F. unit. A, 1 1/8in. dia. B, 1in. dia.; C, 1/2in. dia.; D, 1/4in. dia.; E, 1/8in. dia., countersunk for No. 6 B.A. screws.

In Fig. 5 is shown the exact position of the various components, excepting that of the single bias cell, which is secured to the underside of the baseboard by a metal clip; its position is indicated by dotted lines in Fig. 2.

In wiring the units the constructor should be guided by Fig. 2, noting that

Cascade H.F. Amplifiers.—

flexible leads must be used for connections to the plug adaptor, the screen, variable condenser, H.F. input socket Y, and H.F. output plug X. All these wires will be finally cut to length and joined to their appropriate points after the unit is inserted in its case, to

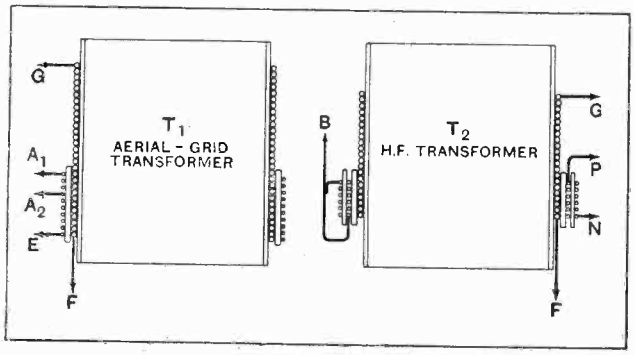
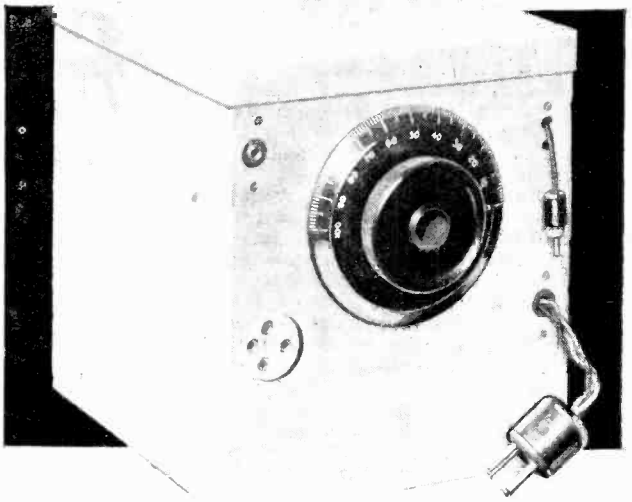


Fig. 4.—The H.F. transformers. The lettering corresponds with that in the other diagrams.

which it is fastened by passing two screws through the bottom of the container into the baseboard battens.

The H.F. transformers are designed for valves having an impedance of between 20,000 and 30,000 ohms, so there is a large choice available in all L.T. ratings of the popular "H.F." class. The aerial unit should be tested by connecting it to the detector-L.F. portion of the receiver; this combination will, of course, have a very limited range, as there is no reaction. The next step is to interpose one of the H.F. units, and to balance it by operating the neutralising condenser knob (with the help of a screwdriver) in the manner often described in this journal, until there is no sign of self-oscillation when the condensers are brought into tune at any part of their scales. When one unit is satisfactorily adjusted, it should be replaced by the next, repeating the operation of balancing out valve-capacity.

It will be observed that each valve is provided with a filament rheostat of the semi-fixed variety. If the valves used are of the type rated at the full voltage of the L.T. battery, or if the filament supply is passed through a rheostat in the detector-L.F. portion of the receiver, these may be omitted. Attention may also be drawn to another modification often made necessary in the immediate vicinity of a powerful station. Although a receiver with two H.F. stages such as those described



A single H.F. unit.

is highly selective, it is necessary under these conditions to guard against shock excitation, which may be responsible for some spreading of local signals. To minimise trouble of this kind, it is suggested that selectivity should be improved—at the expense of some sensitivity—by fitting an eight-turn aerial winding with a tapping at the fifth turn from the earthed end instead of that specified.

Two H.F. stages, constructed in the manner described without any special precautions, will be perfectly stable over the whole tuning range, and will provide as much amplification as is required or can be conveniently dealt with under average conditions; indeed, except on the comparatively rare occasions when there is an almost complete absence of atmospherics and "untunable" spark interference, the writer generally finds it better to use a short

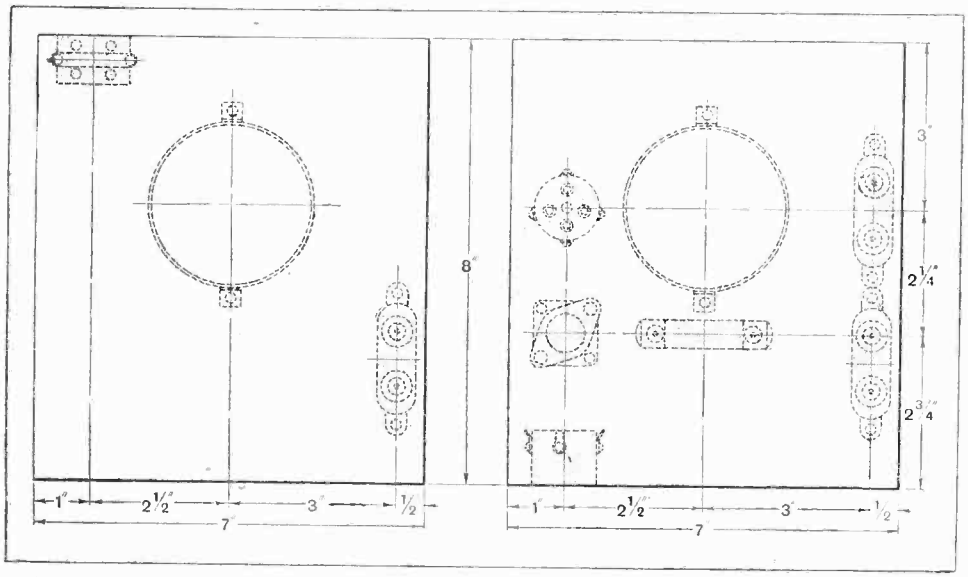


Fig. 5.—Layout of components on the baseboards. H.F. unit on the right.

Cascade H.F. Amplifiers.—and comparatively inefficient aerial in place of a full-sized one. Three stages are normally not quite stable at the lower end of the tuning scale, but can be made so by using screening boxes with well-closed joints and adopting the "de-coupling" system of wiring described in the article "Scientific Wiring," which appeared in *The Wireless World* for April 25th last.

TRANSMITTERS' NOTES.

International Grenfell Association.

The short-wave station of the International Grenfell Association is the hospital base at St. Anthony, Newfoundland, whose call-sign is NE 8AE, has attracted considerable attention, so that it will doubtless be of interest to our readers to have extracts from a report from Mr. F. Dearlove, the Operator-in-Charge, for which we are indebted to the courtesy of Messrs. Eversheď & Vignoles, Ltd., who supplied the hand generator to which he refers.

Mr Dearlove arrived at St. Anthony last June and proceeded to instal the station 8AE, using the hand generator until the regular source of power supply was in operation. He says "at first a little difficulty arose due to the load on the machine when keyed, but this was soon remedied by using an artificial load operated by a relay direct by the key. A master oscillator and power amplifier type of transmitter was used and results were splendid. Communication was effected with U.S.A. and England quite consistently. Reports showed that the note was perfectly steady and pure D.C., whilst the steadiness was due in a great measure to the master oscillator and artificial load. I tried using it on an ordinary circuit without the artificial aerial (a carbon resistance, variable) and I had even then no difficulty in turning the machine with my right hand whilst sending with my left. The valve in use was a Mullard S.W.50 and the current taken from the generator varied from 15 milliamperes to 25. Best results were obtained with the smallest plate current."

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After fitting up NE 8AE Mr. Dearlove proceeded to Northwest River, Labrador, a somewhat trying journey, first by steamer then 360 miles by dog-sleds across snow-covered country with the thermometer below zero, and finally a voyage of 160 miles in an open boat. On his arrival he proceeded to fit up another station, with the call-sign NE 8WG, where he again used the hand generator with every success until the more permanent M-L converter was fitted.

He returned to St. Anthony in the autumn and fitted up an experimental station, NE 8FD, at his residence, about half a mile from the main station, 8AE. There he found the hand generator an unfailing standby, and especially useful on nights when the thermometer registered 30° below zero, and a journey of even half a mile to the main station was a thing to be avoided.

Mr. Dearlove expects to return to England when the ice breaks up, probably next June or July.

Short-wave Transmissions.

The officer-in-charge of the station at Rose Belle, Mauritius, tells us that they are now experimenting on short-wave transmissions with an input of 100 watts and wavelengths of 20 and 38 metres. The circuit used is that described in our issue of June 29th, 1927, and the call-sign of the station is BLGX. Reports and intercommunication will be cordially welcomed. He also states that he regularly receives 5SW on an "Empire" short-wave receiver with an extra stage of L.F.

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Radio LL, Paris, is now transmitting on 47.5 metres on Mondays, Wednesdays and Fridays, between 9.30 and 11.30 p.m. The same programme is also sent simultaneously on 370 metres.

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7MK, "*Radioposten's*" station at Copenhagen, has changed its wavelength to 32.05 metres.

CLUB NEWS.

Television Club Seeks New Members.

At the last meeting of the Dorset Wireless and Television Club, Capt. Linnitt, a vice-president of the Club, lectured on magnetism and electricity, his remarks being of great value to the beginners who were present.

The club is endeavouring to increase its membership. All those interested are asked to communicate with the hon. secretary, Mr. N. W. Wright, 13, Royal Arcade, Esplanade, Weymouth.

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Manchester Research Scheme.

A vigorous research campaign has been opened by the Radio Experimental Society of Manchester. At the annual general meeting on April 27th it was decided that the Society should obtain a club room and laboratory, and that the members should, under the leadership of a special committee, form groups for serious research work on lines set out by the Society's technical staff. The scheme will be under the control of Mr. A. K. Bentley, of the Manchester College of Technology.

All those in the Manchester district who are seriously interested in wireless research should communicate with the hon. secretary, Mr. J. Levy, 19, Lansdowne Road, West Didsbury, Manchester.

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Accumulators and Trickle Chargers.

Some useful hints on accumulator maintenance were given by Mr. F. E. R. Neale in his lecture before the Tottenham Wireless Society on April 25th. The value of testing the battery and the voltmeter with a hydrometer was emphasised. Hints were given on how to charge an accumulator, and the lecturer concluded with a short description of modern types of trickle chargers.

Hon. secretary, Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

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Popularity of Summer-time Wireless.

Confidence in the popularity of summer-time wireless has led Slade Radio, Birmingham, to decide upon weekly meetings during the summer months.

The Society was founded in November last with 18 members; there are now 68 members, and there is every prospect of a continued increase.

At a recent meeting Mr. Reuben Heaton demonstrated a *Wireless World* "Everyman Four" receiver operating a coil-driven loud-speaker (Haynes type), both of which were of his own manufacture throughout. The loud-speaker contained one or two modifications, the cone unit being turned out of ebonite with a gap of $\frac{5}{8}$ in. It was operated from three valves (detector and two L.F.), with two, four, six, and eight volts on the pot at 0.8 to 0.9 amps. The tone was excellent, Mr. Heaton being congratulated on the success of his production.

Hon. secretary, Mr. H. Clews, 52, St. Thomas Road, Erdington, Birmingham.

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Captain Eckersley in Manchester.

Captain P. P. Eckersley, the popular Chief Engineer of the B.B.C., was the guest of honour at a meeting held under the auspices of the Association of British Radio Societies in the Albert Hall, Manchester, on April 26th.

Dealing with the service area of the stations of the future, Captain Eckersley dwelt on the importance of the "fewer stations—higher power" principle which was becoming increasingly urgent in view of international difficulties, and the jamming of stations. In conclusion, he touched upon the problem of linking up the various European stations by land line.

Hon. secretary, Mr. L. A. Gill, Hope House, South Reddish, Stockport.

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"Fin du Saison."

The South Croydon and District Radio Society held the last meeting of the season at the Surrey Drovers' Hotel on Wednesday, April 25th. The president, Mr. H. R. Rivers-Moore, B.Sc., gave a lecture and demonstration on "The Indirectly Heated Cathode Valve."

Hon. secretary, Mr. E. L. Cumbers, 14 Campden Road, S. Croydon.

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Posers for Broadcast Engineers.

The troubles which beset radio engineers in providing a reasonably good broadcasting service were outlined by Mr. T. J. Monaghan, B.Sc., Department of Posts and Telegraphs, Irish Free State, at a meeting of the Wireless Society of Ireland on April 27th. Among the peculiar problems dealt with were signal fading, the interference prevalent in a highly electrified city, and financial difficulties. Mr. Monaghan's paper, the fruit of experience in the Engineering Branch of the Post Office, dealt fully and clearly with the questions raised, and helped the audience to appreciate the task which lies ahead of all who seek to serve the public with broadcasting.

Hon. secretary, Mr. H. Hodgens, 12, Trinity Street, Dublin, C.I.

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A Novel Short-Wave Set.

An interesting short-wave receiver was described at a recent meeting of the QRP Transmitters' Society by Mr. Page, G6PA, the constructor. A feature of the set was the design of the coils, which were wound with fine D.S.C. wire on tin. formers. The signal strength was about 80 per cent. as loud as that of a receiver using ordinary low loss coils, but the entire absence of atmospherics and "mush" greatly facilitated the reading of weak signals; which might have been unreadable on the usual short-wave instrument.

Hon. secretary, Mr. C. D. Abbott, G6TA, 120, Cavendish Road, Balham, S.W.12.

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In a Valve Factory.

"Radio Valves and Distortionless Amplification" was the title of a lecture given before the Wigan and District Technical College Radio Society on April 20th by Mr. G. E. Burgess, of the Mullard Wireless Service Co., Ltd. The lecturer dealt very carefully with the construction of the modern valve, its characteristic curve, and the calculation of amplification factor and impedance. The second half of the lecture was illustrated by lantern slides, which dealt with the processes involved in the manufacture of Mullard valves.

The Society is arranging an interesting programme during the summer months, among the fixtures being a ramble on June 2nd, and a visit to the works of Metropolitan Vickers, Manchester, on June 16th.

Hon. secretary, Mr. M. M. Das, B.Sc., Library Street, Wigan.

CAPACITY-CONTROLLED LOOSE-COUPLING.

The Various Methods of Aerial Coupling Summarised.

THE Chief Engineer of the B.B.C. in the talk he broadcast a short time ago dwelt on the need for reasonably good selectivity in receiving sets. He was speaking, of course, with reference to the proposed Regional Scheme, and his implication was that very many receivers now in use are by no means selective. Indeed, one hears this complaint on all sides, and even some modern designs leave a good deal to be desired in this respect.

It is becoming very evident that greater selectivity will be indispensable in the near future, and a "Junk" crystal set which now gives an excellent result a few miles from a main station will, literally, sing a different tune when called on to separate two equally strong stations emitting signals even many kilocycles apart.

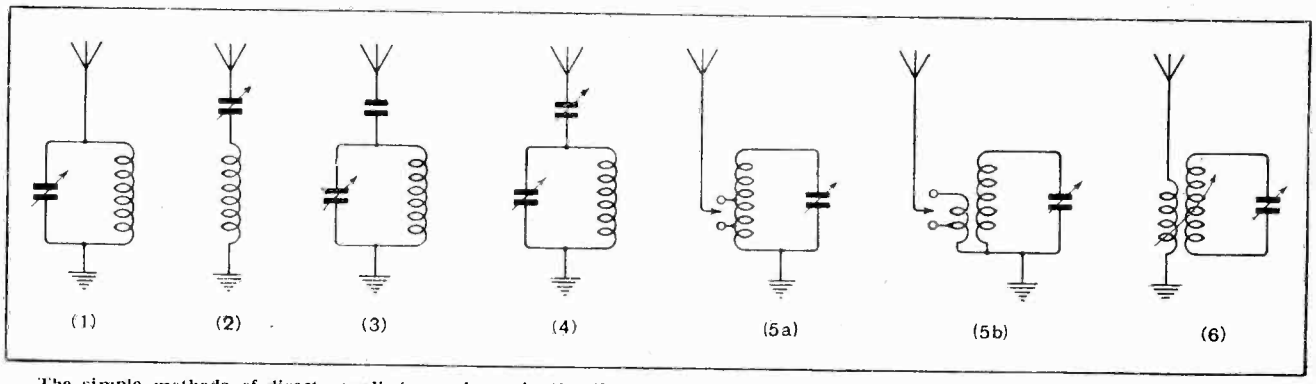
It is not the purpose of this article to deal with the various devices by which the valve user can sharpen his tuning; it will suffice to mention the H.F. stage with tuned anode or tuned transformer and the dearly-loved but much-abused reaction. It is proposed to deal with the tuning of the incoming signal so as to supply as pure and strong a tuned oscillation as possible, to be dealt with in any manner which may commend itself to the experimenter.

Methods of Direct Coupling.

Tuning may be effected by leading the aerial direct to an inductance tuned by a condenser in parallel. This is the simplest but least satisfactory method and is shown in (1). Again, a variable condenser may be placed in series with the inductance on the aerial side (2). This is somewhat better and allows the use of a larger inductance to receive the same wavelength. A small fixed condenser in series may be used, and the inductance tuned as in case (1). This is again better for reasonably strong signals as it reduces the aerial damping (see 3). If we combine methods (1) and (2) we get the circuit shown in (4), and we allow ourselves an infinite variation of signal strength and selectivity limited by the coil losses. But at once we are confronted with two tuning dials, and, as we shall see, these can be better used in a different manner. We now turn to the aperiodic tuning coil, brought to such perfection in the "Everyman Four" aerial transformer. This method allows of tappings on the aerial coil, which can be either overlaid on insulating strips or interwound with the secondary, which is of fixed value and tuned with a parallel variable condenser (5b). The use of more turns on the primary gives a stronger signal and less selectivity, and is more suitable for wavelengths round 5GB, while tapping to fewer turns can be used for the same strength and selectivity with wavelengths below 2LO. For a "single tuner" a coil such as this is probably the best that can be used.

Loose-coupling and Capacity-coupling.

We must turn now to loose coupling. Here the customary method is to place two inductances in such a manner that they are coupled together electromagnetically, which coupling can be varied by a relative movement of the coils. They can swing, rotate or slide from a position of maximum coupling when they are close up to one another, to a minimum when they are at right angles to one another or so separated that their fields of force are virtually non-overlapping. The secondary coil is tuned by a variable condenser, while the primary, to which the aerial is connected, may be untuned (6), in which case we have a special form of the aperiodic system, or tuned by either a series or parallel condenser (7*a*) and (7*b*). Here, then, we have three variables to manipulate, the aerial tuning, the secondary tuning and the coupling, and in general a variation of the coupling will necessitate a retuning of the secondary. The aerial tuning is far less critical than that of the secondary, but it is to be remembered that the system must be considered as a single unit, and as



The simple methods of direct coupling are shown in (1), (2), (3) and (4). In (5a) auto-coupling is shown, while in (5b) and (6) inductively coupled circuits are represe ted.

Capacity-controlled Loose-coupling.—the coupling and the secondary tuning condenser are so sharply interdependent it becomes almost a matter of necessity to have a fine motion control and a position indicator on the coupling device. The advantages of the system are increased signal strength in the secondary, due largely to absence of aerial damping, and increased selectivity. The disadvantages are almost obvious. There are three controls, two of them critical, so that it is difficult to reproduce a setting exactly.

There is another method, however, of coupling two tuned circuits which gives excellent results if suitable coils are chosen. This method uses electrostatic coupling between the primary and secondary coils in the shape of a small variable condenser connecting the high potential ends of the two coils which are themselves set at right angles and reasonably far apart so that their electromagnetic coupling is as small as possible. Coming to actual working details, the writer has wound two similar coils of 27/42 Litz each 70 turns on a 3in. ribbed ebonite former and mounted with "banana" plugs so as to be interchangeable. The only difference in them is that one has 8 and the other 12 turns of primary wire interwound at the earth end—as in the coils described on page 121 of the issue of *The Wireless World* dated February 1st, 1928.

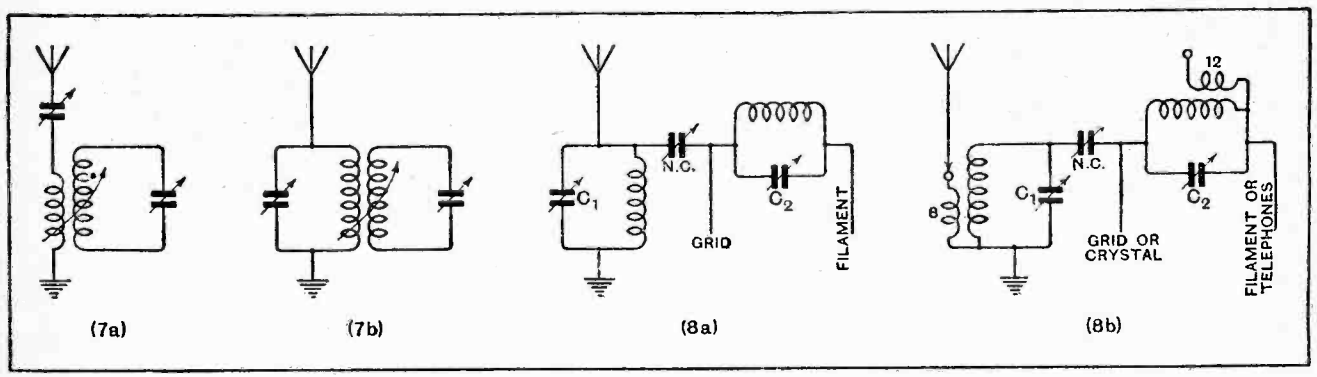
Critical Tuning.

The high potential ends are connected by a small neutralising condenser. Any type will do provided it has a pointer or indicator to show how far the plates overlap. Diagram 8a represents the arrangement. The coils just described are set at right angles and a few inches apart, and each is tuned with a 0.0005 variable condenser; C_2 should have a slow motion control, as the tuning is otherwise very difficult. For the medium band of wavelengths 0.0003 mfd. would be preferable, but as the coils are interchangeable with long wave coils the larger condensers were used. For the sharpest tuning the eight-turns aerial coil should be put in the first position and the neutro-condenser set at zero. Changing the coils so as to put the twelve-turn coil in the aerial sockets gives a louder signal with flatter tuning on C_1, but has very little effect on the sharpness of C_2 tuning.

Superior to Wave Trap.

For higher wavelengths it is advantageous to tighten the coupling by slightly increasing the value of the coupling condenser. The signal strength is improved but at the expense of somewhat decreased selectivity, but in any case very small values of NC are required, and a change of this setting will necessitate a slight adjustment of C_2. The writer has used this method for a crystal detector and for a valve set with results superior to any arrangement with a wave trap. The fact that there are three variables is not the nuisance that would appear, as the neutralising condenser is set at or near zero for almost all the stations, while C_1 is not critical, and it is a simple matter to calibrate the condensers once and for all so that the tuning of any desired station can be repeated by glancing at the two figures on a chart. It may be mentioned also that any reaction howling set up at a later stage is not fed back to the aerial to any appreciable degree provided the coupling condenser is near zero, at which position the coupling is ample, as already stated. By providing an aerial terminal for the tapping on the second coil base it is easy to use the system as an ordinary single coil tuner. For this purpose the first coil is removed, and C_1 and NC both set at zero.

A. J. W.



In (7a) and (7b) both aerial and secondary circuits are tuned. In (8a) and (8b) the primary and secondary coils are shown electrostatically coupled by means of a small condenser N.C.

BOOKS RECEIVED.

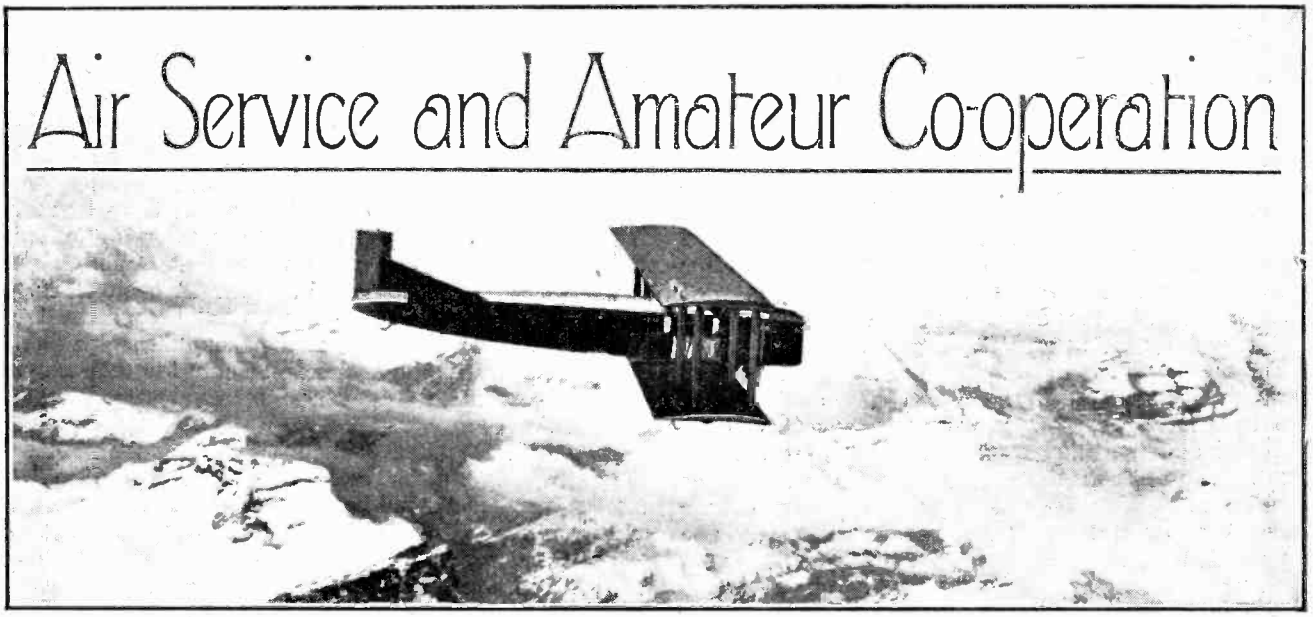
Popular Guide to Radio, by B. F. Dashiell.—A manual in which the functions of receiving and transmitting circuits and associated subjects are explained in non-technical terms. Published by Baillière, Tindall and Cox, London. Price 16s net.

° ° ° °

A B C de la T.S.F.—No. 1.—Théorie élémentaire de la T.S.F. The first of a series of nine monographs written in simple language for the non-technical reader. Pp. 28, with 55 diagrams. Published by E. Chiron, Paris. Price 4.50 francs.

Intermediate Electricity and Magnetism, by R. A. Houston, M.A., D.Sc.—A textbook for students preparing for the Higher Certificate of the Oxford and Cambridge Schools Examination Board, the London University Matriculation, and similar examinations. Pp. 170, with 155 illustrations and diagrams, and typical examples of examination questions. Published by Longmans, Green and Co., Ltd., London. Price 4s. 6d.

Air Service and Amateur Co-operation



The American Coast-to-coast Air Route Described.

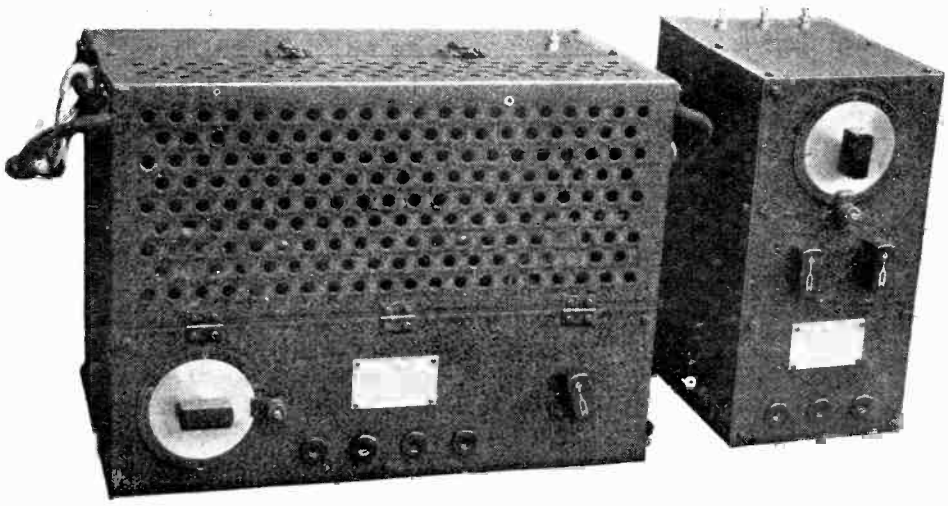
By H. de A. DONISTHORPE.

LAST month saw the inauguration of an aeroplane service in America between the two coasts.

An interesting feature of this new service to wireless enthusiasts is the up-to-date apparatus with which the aeroplane is equipped.

The sole plane covering this new service carries a competent radio operator, and relief is provided half-way across the American Continent at one of the forty-six cities and aviation centres that are touched during the 10,000 miles coast to coast and return air service.

Through the elaborate radio equipment which has just been designed, a continuous telephone and telegraph communication with the ground throughout the flight is accomplished. For this purpose arrangements were made with the ship coast stations of America, and others which co-operate by communicating with the plane. The known points where stations co-operated are at Tuckerton, New Jersey; Bush Terminal, New York; Philadelphia, Chatham, and Boston, Massachusetts; Baltimore, Washington, Cleveland, and Chicago, Illinois; New Orleans, Galveston, and Los Angeles. The study of a map will show the disposition of these radio stations and will illustrate the long distance work that is achieved during the flight of the aeroplane between the two coasts.



The transmitting equipment used in the American trans-continental flight service.

The Amateur Assists.

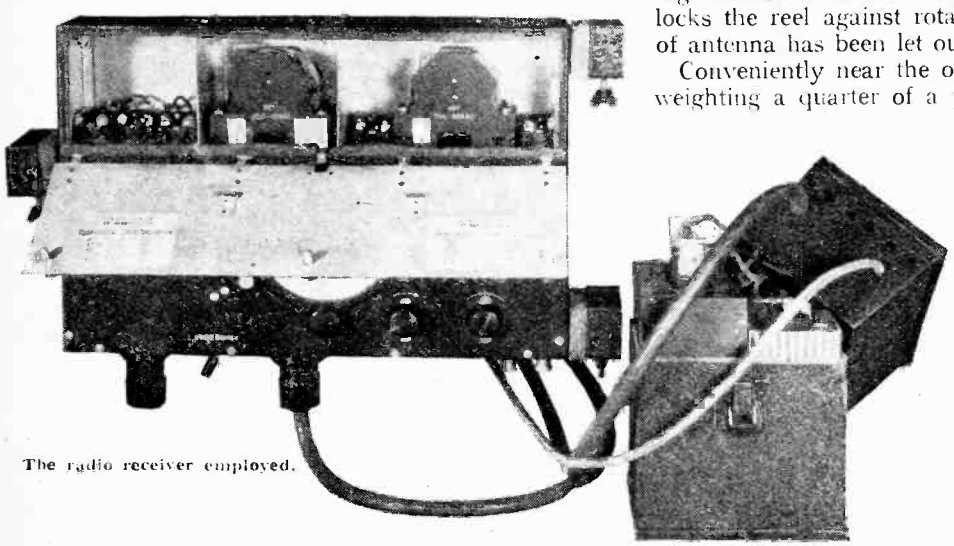
The aid of the radio amateur was also enlisted by special arrangements made through the American Radio Relay League to some 2,000 of the most able amateurs in the country. As a further incentive the *New York American*, an American daily paper, offered three cups as prizes which were awarded (1) to the amateur who received a message the greatest distance from the plane; (2) to the amateur who conducted two-way communication by telephone or telegraph over the greatest distance; and (3) to the amateur who rendered the most valuable

Air Service and Amateur Co-operation.—

service to the flight. By these means each city was notified in advance, by radio, of the exact time of departure at the plane's take-off, and the expected hour of arrival, so that provision was made for the reception at the landing field.

The radio equipment weighs under 117lb. all told, and has a power rating of 100 watts. Each unit is extremely compact and rugged, and is housed in an aluminium cabinet. The transmitter, which is designed for combined telephone and telegraph operation, weighs only 18lb., including valves, and measures 16in. wide and 12in. high by 8in. deep. Its call letters are 2XBK, and it is equipped to transmit on 120 metres.

The mechanism is mounted on the back of a vertical duralumin panel. In front of this panel are mounted two transmitting valves, one functioning as a master oscillator and the other as a speech amplifier. There are also two other medium power valves, one serving as an output amplifier, the other as a modulator. All the valves are mounted on sponge rubber cushions. The top and lower half of the panel are perforated for ventilation, and hinged so that when opened there is easy access to the parts.



The radio receiver employed.

The transmitter is operated from a control box weighing 8lb. and measuring 6in. wide by 12in. high by 8in. deep. This unit is placed in the rear of the passenger cabin convenient to the operator. This box contains the aerial tuning variometer and switches for changing from "send" to "receive" and from continuous wave transmission to telephone work; it encloses as well telephone jacks, interphone transformer, and all other equipment necessary for the control of the entire set.

By means of an interchangeable coil system the receiver has three wavelength ranges, from 85 to 150 metres for amateur reception, from 550 to 850 metres for ship and coastal station reception, and from 850 to 1,100 metres for weather reports and beacon signals from Government stations. It weighs approximately 12lb., including valves, and measures 14⅜in. wide by 10in. high by 2⅝in. deep. Five small valves of low power consumption and mounted on sponge rubber cushions function as follows: The first two valves are high-frequency amplifiers followed by a detector and two stages of audiofrequency amplification. The tuning is uni-controlled.

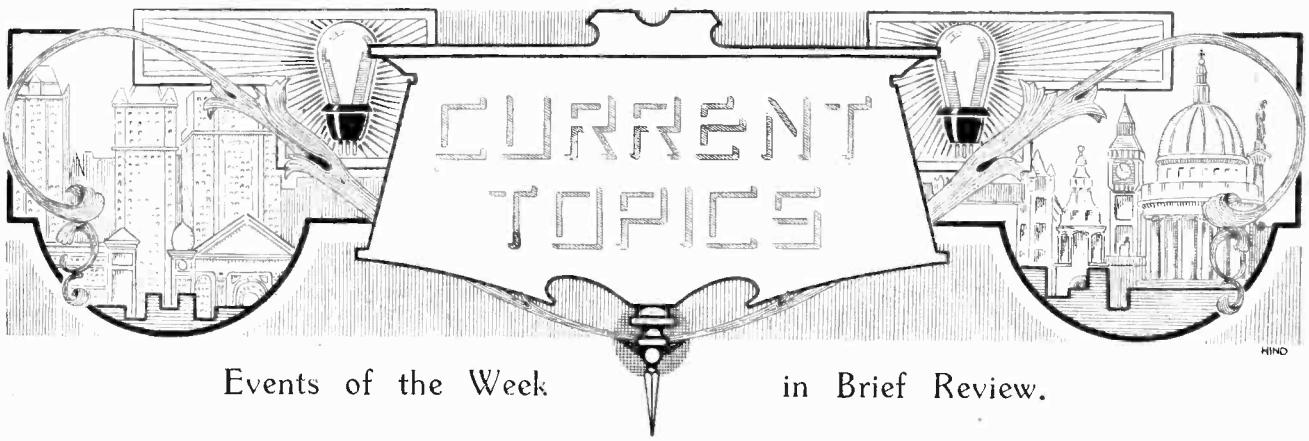
The power supply for the equipment is obtained from a wind-driven generator with a constant speed self-regulating air fan. Its weight is about 50lb., including 5½lb. for the air fan. The maximum output of the generator is 700 watts. The torpedo-shaped generator is attached to the struts of the left wing on the plane to reduce wind resistance while the plane is in flight. A cable leading into the cabin and under the flooring connects the generator to the transmitter, after passing through a filter box which permits the operation of both the transmitter and the receiver from the wind-driven generator without batteries.

To permit operation of the set by either the pilot or the operator, and for communication between them, there is installed a small jack box weighing half a pound and measuring 3¾in. by 3¾in. by 1½in.

The aerial wire is reeled out through an insulated tubing fair-lead with metal end flange. A clamping device locks the reel against rotation when the desired length of antenna has been let out.

Conveniently near the operator is an aerial ammeter, weighting a quarter of a pound, of the remote control type for checking the operation of the receiver. To complete the equipment are two standard aviators leather helmets with earphones, cords and plugs, and a receiving helmet with headphones, all practically sound proof. An anti-noise microphone arranged for breast mounting is also provided for telephone communication.

An interesting feature about the first flight were the arrangements made with certain broadcasting stations located in towns over which the aeroplane flew, which enabled some of the distinguished passengers carried on this flight to speak from the plane, all the speeches being picked up and relayed from the individual broadcasting stations.



Events of the Week in Brief Review.

WIRELESS VALVES EXEMPTED.

Wireless valves are specifically excluded from the list of imported articles which the Standard Committee of the Board of Trade recommend should bear marks of origin under the Merchandise Marks Act.

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SENATORE MARCONI'S ATLANTIC TRIP.

We understand that Senatore Marconi is about to take a four months' cruise in the Atlantic on his yacht "Electra," and will devote a considerable amount of his time to the measurement of signal strength from various parts of the world. It is believed that new measuring apparatus of an experimental nature will be employed.

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NATIONAL RADIO EXHIBITION.

As in previous years, the Radio Manufacturers' Association have decided not to permit actual demonstration of receivers and loud-speakers at Olympia during the National Radio Exhibition in September next. The selling of apparatus to the public will again be allowed, but demonstrations must be confined to areas outside a quarter of a mile radius of the exhibition building.

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INTERFERENCE BY ELECTRIC TRAMS.

Mr. Walter Baker, M.P. for East Bristol, who has complained of the interference with broadcast reception caused by electric tramways, has received a letter from the British Broadcasting Corporation, in which it is pointed out that a change in the present trolley-wheel system of overhead collections would be an extremely costly step for local tramways. A system must therefore be searched for which will be attractive from the point of view of maintenance costs as well as likely to improve broadcast reception conditions.

The letter expresses the opinion that no useful purpose can at present be served by additional experiments at Bristol until such time as the conversion to a new system of overhead collection has been completed in other towns, when further experiments will take place in an endeavour to confirm the results which have already been obtained experimentally.

BROADCASTING IN KENYA.

The first broadcasting station in British East Africa—at Nairobi, Kenya Colony—will, we understand, be officially opened on June 1st.

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POOR MICROPHONE.

A defenceless microphone was dashed to the floor by a Dutch Fascist at a Socialist meeting in Amsterdam last week. The speeches were to be broadcast by the Socialist Workers' Radio Society, and the interruption occurred as the meeting was about to begin. This is believed to be the first occasion on which a microphone has suffered such an indignity.

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EPISCOPAL INSTRUCTIONS BY WIRELESS.

Isolated priests in the wilds of Eastern Ecuador, South America, are kept in touch with headquarters by means of daily broadcasts. Every evening from 8.30 to 9, writes a correspondent of *The Universe*, the administrator of the Napo Vicariate, Father Emilio Cecco, transmits wireless telephonic instructions for the ministrations of the scattered clergy. A large number of the outposts of the vicariate are almost entirely cut off from civilisation.

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CABLES AND WIRELESS.

Mr. F. J. Brown, C.B., C.B.E., whose recent article in this journal on the wireless and cable position aroused considerable interest, will deliver a special lecture on "The Relations of Cables and Wireless" in the Fyvie Hall of the Polytechnic, 307-311, Regent Street, London, W.1, on Friday next, May 11th, at 6.30 p.m. The chair will be taken by Sir Geoffrey Clarke, C.S.I. Admission will be free.

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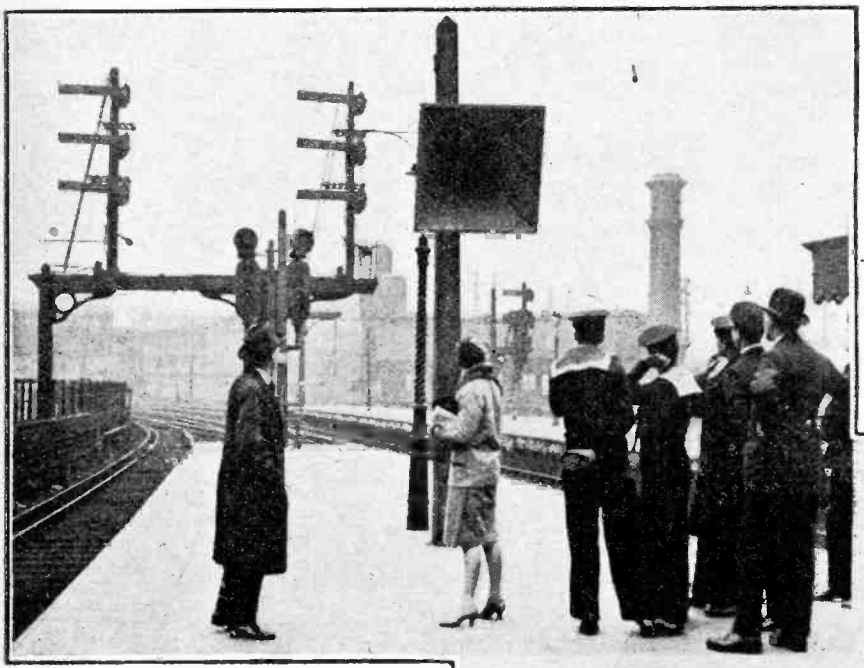
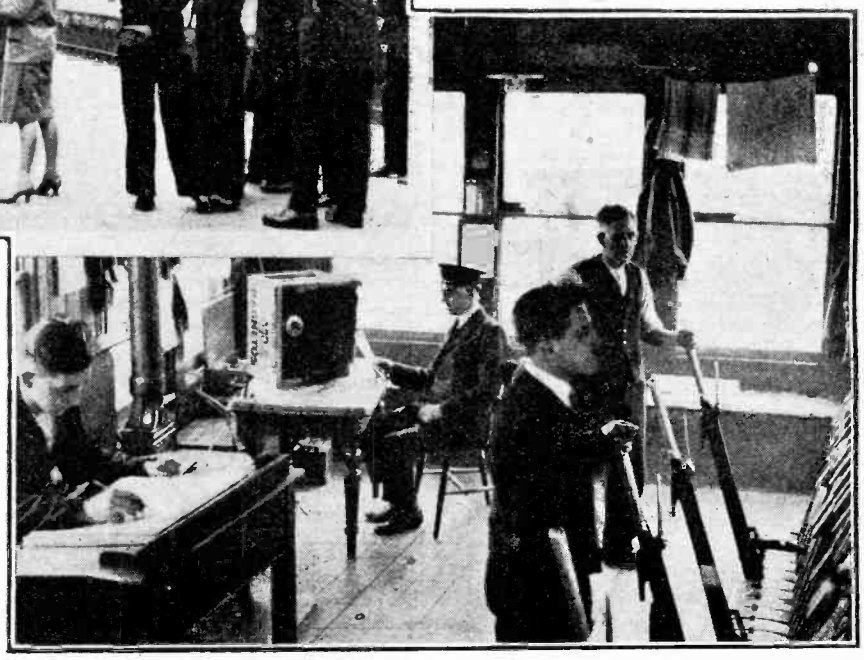
YORK'S LOUD-SPEAKERS.

The city of York has discovered that one can have too much of a good thing. The Watch Committee, in the fulfilment of its functions, has turned its eyes, or

WIRELESS FIRE ALARM. An interesting device now being tested by the New York Harbour Fire Department. By its use firemen on shore are able to keep in telephonic communication with their colleagues in the harbour and give notification of fires.





MOVING COIL LOUD-SPEAKERS ON THE RAILWAY. Successful experiments were carried out at London Bridge Station last week with British Brunswick public address equipment, which included ten R-K moving coil loud-speakers. In the upper photograph intending passengers are seen receiving their "marching orders," while in the lower, taken in the signal box, an official is directing the travellers *via* the microphone. Note the amplifier in the background.

rather its ears, on loud-speakers. The result is a recommendation that the City Council pass this by-law :—

(1) No person shall in any street or public place or in any place which adjoins any street or public place and to which the public are admitted, operate or cause or suffer to be operated any wireless loud-speaker in such a manner as to cause annoyance or disturbance.

(2) Any person offending against the foregoing by-law shall be liable to a penalty not exceeding five pounds.

No one welcomes legislation of this kind more heartily than the genuine wireless enthusiast, who realises that the travesties of speech and music so often heard in public loud-speakers can only bring wireless into disrepute.

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SHORT WAVES FROM DENMARK.

Special test transmissions on 42.12 metres will be made to-morrow and the day following from 7RL, the station of "Radiolytteren," Copenhagen. The following schedule will be observed :—

MAY 10TH.

23.00 to 23.05 ..... Calibration.
23.05 ,, 23.35 ..... Morse course.
23.35 ,, 1.00 ..... Telephony.

MAY 11TH.

23.00 to 23.05 ..... Calibration.
24.00 ,, 2.00 ..... Telephony.

We understand that the times given are B.S.T. Reports will be warmly welcomed at Raadhusplads, 55, Copenhagen V.

FORTHCOMING EVENTS.

WEDNESDAY, MAY 9th.

North Middlesex Radio Society.—At 8 p.m. At Shaftesbury Hall, Bowes Park, N. Sale of Surplus Apparatus.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove, N.17. Sale and Exchange. To be followed by discussion on "Grid and Anode Bend Rectification."

THURSDAY, MAY 10th.

Kensington Radio Society.—Lecture: "Modern Developments in the Reproduction of Sound," by Prof. Wilson (Technical Adviser to "The Gramophone").

Leyton and Leytonstone Radio Society.—Discussion on "Simple Transmitting Circuits."

Slade Radio (Birmingham). Lecture: "Neutro-Regenerative Receivers and Short Wave Reception," by Mr. W. K. Alford, of the Igranic Electric Co., Ltd.

MONDAY, MAY 14th.

Croydon Wireless and Physical Society.—At 8 p.m. At 5, Altyre Road, East Croydon. Lecture by Mr. F. W. Smurthwaite.

Holloway Literary Institute Wireless Society.—At 7.30 p.m. At Holloway School, Camden Road, N.7. Lecture on a Marconiphone set.

Hackney and District Radio Society.—At the Electricity Showrooms, Lower Clapton Road, E.5. Junk Sale.

TRANSATLANTIC AIRSHIP WIRELESS.

The new German "Atlantic" airship L.Z.127, now nearing completion in the Zeppelin works at Friedrichshaven, will carry the most up-to-date aircraft wireless installation, writes a Berlin correspondent.

The main transmitter will work on wavelengths between 500 and 2,100 metres. The current can be derived either from motor generators charging an accumulator battery, or from an external generator driven by a propeller.

The antenna system embodies the latest Telefunken practice and consists of two wires, each 100 metres in length, suspended by weights. The whole of the wireless equipment is housed in the front cabin of the airship.

The L.Z.127 has been designed for a regular Transatlantic service. Every possible luxury has been included, and it is already being described as the "Airship Hotel."

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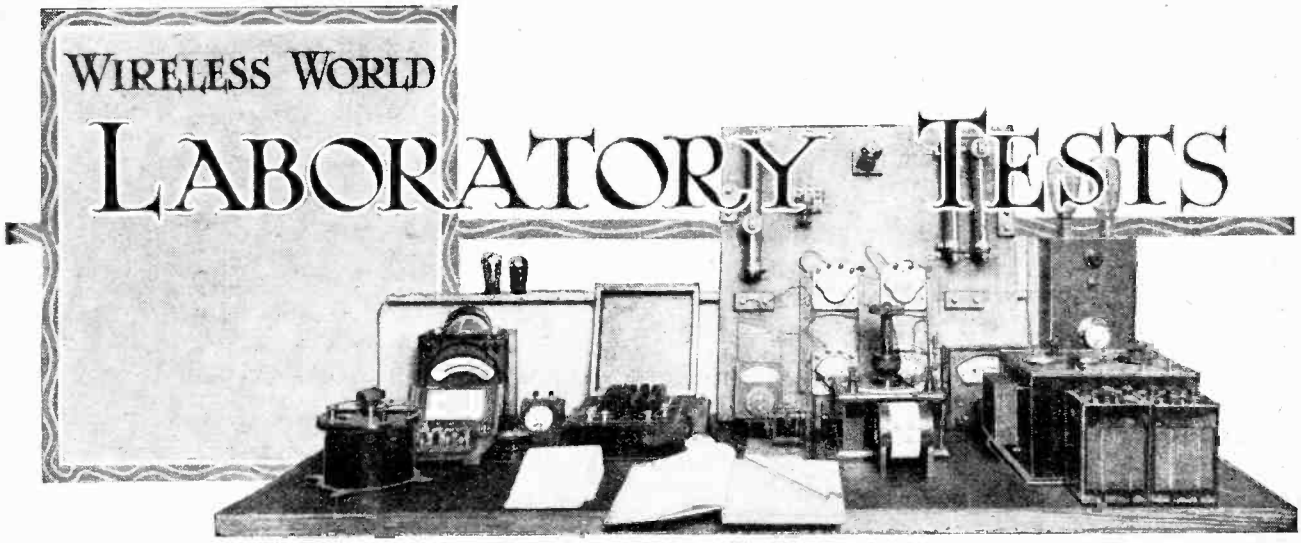
WIRELESS AT WESTMINSTER.

(From Our Parliamentary Correspondent)

Report of Wireless and Cable Conference.

In the House of Commons last week Mr. Baldwin informed Mr. Walter Baker that no report had as yet been submitted by the Wireless and Cable Conference. It was not therefore possible for him to say anything with regard to its publication. No offer had been made direct to His Majesty's Government in Great Britain in regard to the purchase of the whole means of Imperial telegraphic communication. He understood that certain suggestions in this connection had been laid before the Conference and were still under consideration. Until the report of the Conference was available it was obviously impossible for him to make any statement.



A Review of Manufacturers' Recent Products.

THE CLAROSTAT.

This is a continuously variable resistance of the compression type in which the resistance element is a mixture of graphite and pulverised mica particles. In the model illustrated a change of resistance from practically zero up to 5 megohms is obtained with four complete turns of the micrometer adjusting

"Clarostat" variable resistance and base-board mounting bracket.

screw; the first two turns increase the resistance to 5,000 ohms and the remainder of the resistance is distributed over the third and fourth turns. The general-purpose model is rated at 20 watts, but a "Power Clarostat" is available which is capable of dissipating 40 watts. Other models include the "Midget," rated at 8 watts, and the "Volume Control Clarostat," also rated at 8 watts, with a resistance variation from 200 to 500,000 ohms. These resistances are of American manufacture, and may be obtained in this country through Messrs. Claude Lyons, Ltd., 76, Old Hall Street, Liverpool.

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BURNDEPT CONDENSERS.

The 1928 Burndept variable condenser is a fine example of electrical and mechanical design executed with perfect workmanship.

Perhaps the most noteworthy innovation in the design is the use of a hollow spindle into which a bakelite extension rod of ¼in. diameter is fitted by means of two grub screws. This feature, in conjunction with moulded bakelite end plates, leaves both fixed and moving plates insulated, so that the condenser is universally adaptable to any type of circuit, and is quite free from hand capacity effects when used with the screening plate provided. The latter also serves as a template when fitting to a panel. A metal dust cover is supplied with the 0.0003 and 0.0005 mfd. models.

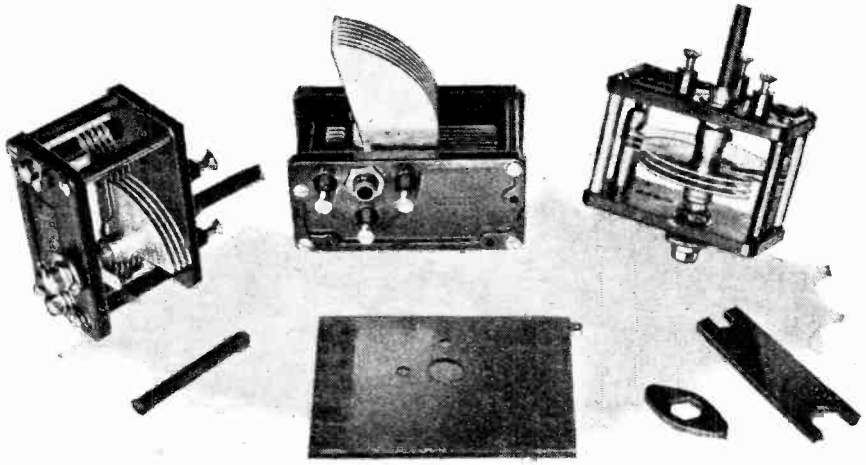
The moving vanes are adjustable both for centring and tension, the two adjustments being independent. Centring is accomplished by moving the bottom bush bodily, the top bearing is plain, and the spindle slides freely without any shoulder to restrict its motion. The tensioning device consists of a thin phosphor-bronze disc contained in the bottom bush. Thus both adjustments are controlled by the bottom bearing bush, which may be regarded as the "anchor" point.

The condenser is made with two types of plate. There is the "Square Law" in capacities of 0.00007 and 0.0001 mfd., the former for capacity reaction and the latter for short-wave tuning. Then there is the "Log Law," which, when connected in a circuit of specified self-capacity, may be used with a calculated wavelength scale. Two capacities are available in this type—0.0003 mfd. (0.00033 mfd. actual) and 0.0005 mfd. Special wavelength scales for these condensers are supplied by Messrs. Burndept to fit their Ethulog dials.

Check measurements of capacity on some specimen condensers submitted are given in the table below.

Type.	Maximum.		Minimum.	
	Nominal.	Measured.	Nominal.	Measured.
	(mfd.).	(mfd.).	(micro-mfd.).	(micro-mfd.).
Square Law	0.00007	0.000068	4	3
"	0.0001	0.00011	4	3
Log Law	0.00033	0.00033	8	9
"	0.0005	0.00052	10	13

These figures agree very well with nominal values.



The new 1928 Burndept variable condensers.

"BESCO" JUNIOR HYDROMETER.

Acid is drawn into the float chamber through an ebonite tube of only 5-32in. diameter, so that the hydrometer is specially fitted for testing the acid density of H.T. accumulators with small vent holes. It is marketed in this country by Messrs. F. J. Gordon and Co., Ltd., 92, Charlotte Street, London, W.1, and the price is 2s. 6d. The range is from 1.150 to 1.300, and a square washer is provided to protect the glass from damage through rolling on the bench.

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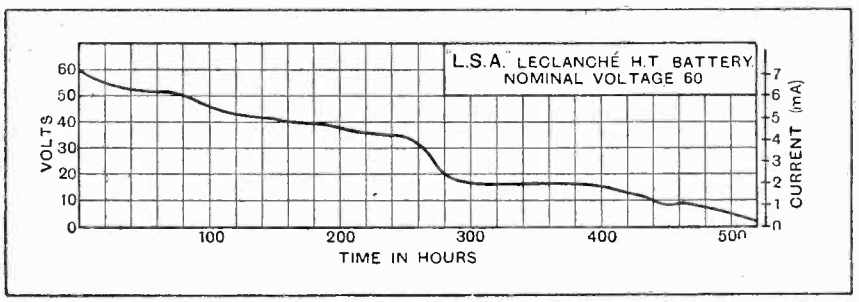
L.S.A. DRY H.T. BATTERIES.

These batteries are produced in the Swiss factories of the Leclanché, S.A., Yverdon, and are marketed in this country by Messrs. Thompson and Co., 1-3, Old Swan Lane, London, E.C.4. They are available in three capacities, "Normal," "Large Capacity," and "Giant," all types being supplied with numerous tapping points.

A specimen 60-volt battery of the "Normal" type was submitted for test and discharged for 3-hour periods with 3 hours between each for recovery. The result is shown in the accompanying curve, which indicates that a useful life of about 260 hours' working may be expected with an initial current of 7 milliamps. During this period the voltage falls steadily to 30 volts, after which there is a sudden drop to 16 volts. Although this is maintained for a considerable period, it is hardly sufficient to give satisfactory results even with a single valve set, so that it is wisest to set the limit of useful life at 260 hours.



Discharge curve of the L.S.A. battery; the time base represents consecutive working hours, but regular recovery periods were allowed during the tests at 3 hour intervals.

L.S.A. Leclanché dry-cell H.T. battery.

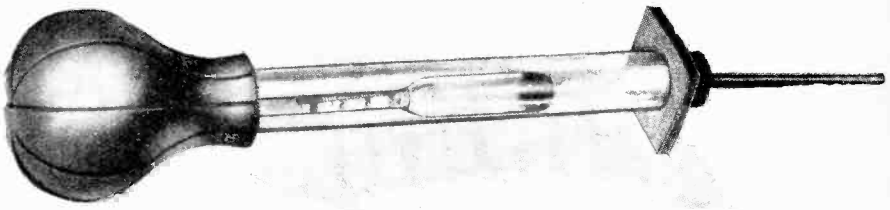
The current taken from the battery during the test is equivalent to that normally required by a two-valve set, which would function for a period of 2½ months if used for 3 hours per diem. For sets with more than two valves one of the larger types should be used in the interests of economy.

A NEW VACUUM THERMOCOUPLE.

To the serious experimenter a vacuum thermocouple is an indispensable measuring instrument. Its great advantage lies in the fact that it can be calibrated with direct current and then used to measure the R.M.S. value of alternating currents up to frequencies as high as a million cycles per second.

A new design of thermojunction suitable for work in connection with receiver design is made by Messrs. Collier and Stephenson, 102, High Street, Hornsey, London, N.8. It is intended for a maximum current of 10 mA., but will take a 50 per cent. overload without damage. This is due to the spot-welded junction, a great improvement over the usual soldered junction, which is liable to change permanently if overheated.

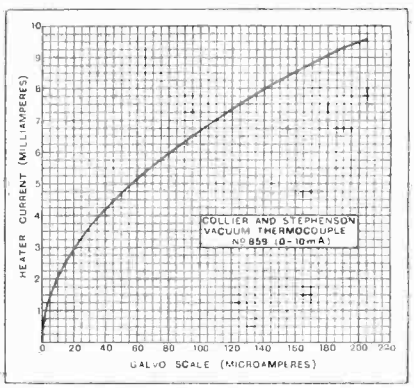
A calibration curve of the 10 mA. thermocouple is given. This holds for both directions of the direct current through the heater—another good point in favour of the spot-welded junctions; some soldered couples show a different calibration when the current is reversed and the mean of the two sets of readings has to be taken with a corresponding loss of accuracy when A.C. is applied.



"Besco" Junior hydrometer.

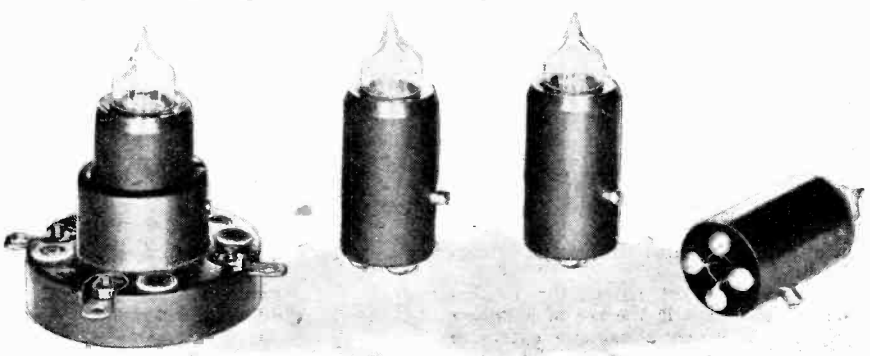
In addition to the 10 mA. model three other ranges are available for currents up to 25 mA., 50 mA., and 1 amp.; the latter should prove of interest to transmitting amateurs, and will give far more accurate results than the conventional hot-wire aerial ammeter on short waves.

All four models are mounted in ebonite bases which fit the standard "Weco-valve" holder. The price of each junction is £1.



Calibration curve of 10 mA range thermocouple. The microammeter resistance was 31.4 ohms; the couple generates an E.M.F. of about 6 mV and the current through the indicating instrument naturally depends on its internal resistance.

The heater resistances of the various models are as follows: 10 mA. range, 52 ohms; 25 mA. range, 29 ohms; 50 mA. range, 11 ohms; 1 amp. range, 0.1 ohm. The heaters are constructed of constantan, platinum or nichrome wire according to the range, and the couple is of iron and constantan. The vacuum within each unit is reduced to 0.0001 mm. of mercury.



Collier and Stephenson vacuum thermocouples with spot-welded junctions.

WIRELESS MASTS AND SCREENING.

Some Considerations in Erecting a Broadcast Receiving Aerial.

By R. L. SMITH ROSE, D.Sc., Ph.D., A.M.I.E.E.

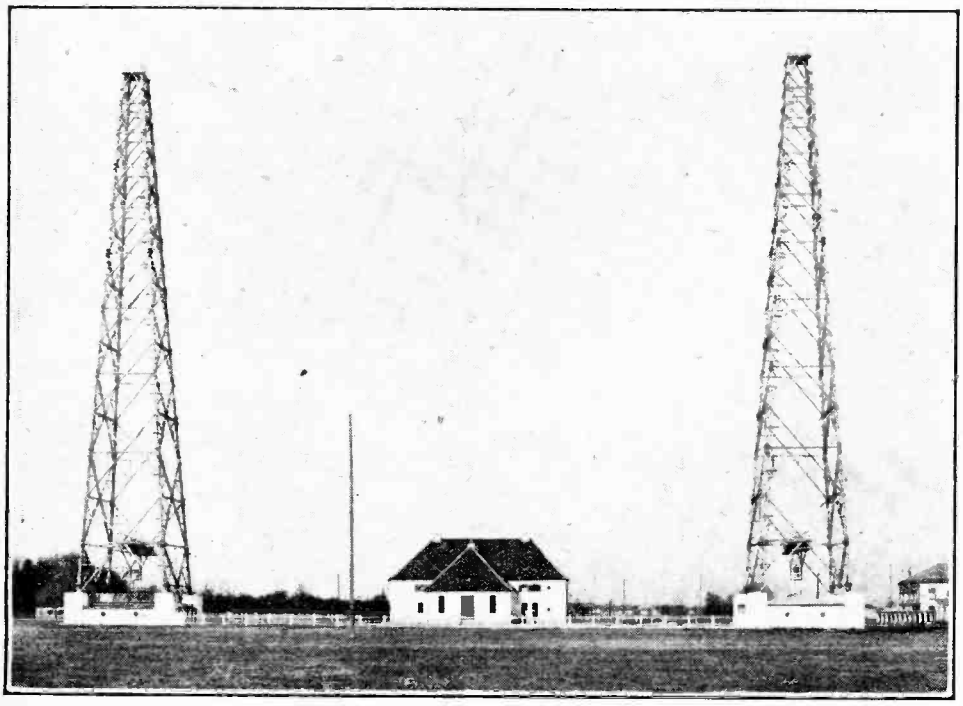
(*Concluded from page 462 of previous issue.*)

WHEN the height of a steel mast becomes so great that its natural wavelength is comparable with that of the wireless waves employed, the state of affairs in the resultant electromagnetic field is considerably modified. The condition is one which is not often likely to arise in the case of receiving aerials, but it is one which has already been encountered in connection with the high-power, medium-wave broadcasting stations. In the first case the condition required in connection with Fig. 2 for the secondary and primary fields to oppose each other will not be fulfilled, and there will thus be no direct screening action as such due to the presence of the masts. On the other hand, if a resonance condition obtains, the current flowing in the mast, which will have a moderately low resistance, may be very considerable, and it will, therefore, re-radiate wireless waves in the manner of a vertical transmitting aerial. This re-radiated field will be superimposed upon the main field from the aerial in producing a resultant effect at a distant receiving station.

Now, in most cases, a transmitting aerial will be supported by two masts, and probably placed midway between them. The currents induced in the two masts by the transmitting aerial will, therefore, be in phase with each other, and the radiated fields will combine to give a resultant distribution of radiation in a manner similar to that of two component aerials of an antenna array as employed at beam stations. The actual shape of the diagram will depend upon the distance between the masts, and Fig. 4 shows the polar radiation curves for two masts or aerials situated at four distances apart—from a quarter to five-eighths of a wavelength.

Shadow Effect from Masts.

Such a distribution of the radiation from the mast system must be combined with that obtained from the aerial alone, which will usually be the same in all directions; in other words, its polar radiation diagram will be a circle. The radiated fields from the aerial and from the masts may differ in phase to a varying extent depending upon the wavelength employed and upon the distance from aerial to masts. Thus the calculation of the resultant distribution of the radiated field may be a rather laborious process which it is necessary to carry out for each individual case. The general effect, however, of the location of tuned masts in the neighbourhood of a transmitting aerial can be seen to be a redistribution of the radiation in such a manner that the normal field strength received from the aerial alone is increased in some directions and reduced in others. The latter occurrence accounts for the mast shadow effect which is nowadays becoming familiar in connection with certain broadcasting stations.



The two wooden masts of the Munich broadcasting station.

Application to Receiving Aerials.

As a concluding section to this article it will be interesting to understand in what way the principles outlined above apply to the typical broadcasting receiving aerial slung between some convenient point near the top of the house and a mast at the far end of the garden. In such circumstances the gas and water pipe systems and the electric light wiring of the house can be regarded as untuned earthed conductors, having a height comparable with that of the aerial and a natural wavelength well below that for which the aerial is employed. It will be

Wireless Masts and Screening.—

gathered from what has gone before that, provided the aerial is kept at a distance of three or four feet away from the walls of the house, the existence of such conductors will produce little or no effect on the strength of the received signals. Where the house is one of a number in a row having similar metallic systems, the combined screening effect may become very appreciable. Alternatively, if the height of the screen is several times the height of the aerial, as may easily be the case in a block of flats or mansions, the reduction

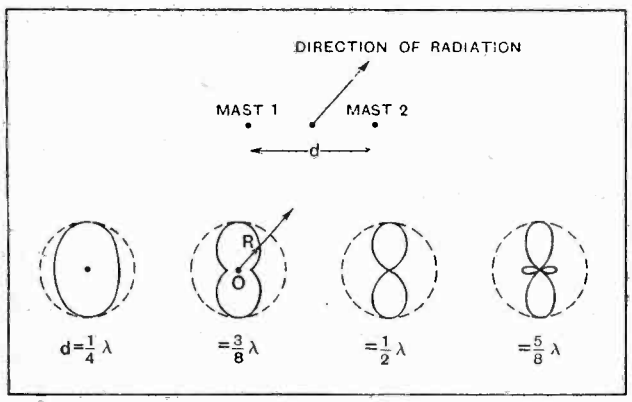


Fig. 4.—Polar diagrams of radiation for two vertical aerials or masts at various distances apart. The currents are assumed to be in phase in the two aerials. The length of the vector OR equals the combined radiation from both masts in the direction indicated.

of signal strength received on a vertical aerial may become very marked indeed, since a vertical untuned aerial reduces the incoming field strength to a small fraction of its original value at points close to its base, where it is connected to earth. Many readers may think that this is contrary to their general experience, and the explanation of this difference lies in the fact that most receiving aerials have a horizontal portion which is at least as long as the vertical portion, and that under such conditions the screening of the aerial by the metal-work in buildings is materially modified.

The state of affairs which prevails when an attempt is made to shield an inverted L-type aerial by a vertical screen may be understood by referring to Fig. 5, which illustrates a further experiment carried out with the wire cage already mentioned. A straight vertical

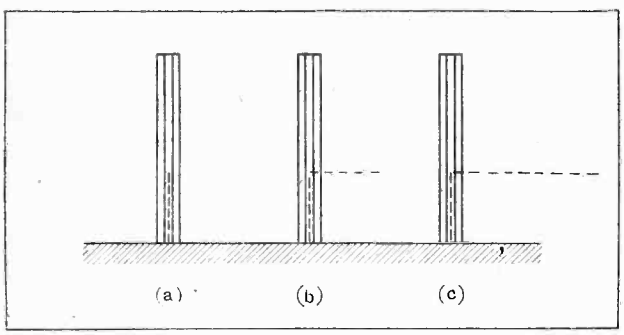


Fig. 5.—Experimental screening apparatus to determine the effect of a vertical wire screen on inverted L aerials of equal height and varying horizontal length.

aerial about 15ft. high was erected inside the vertical cage, 40ft. high, as depicted in Fig. 5 (a). When so arranged, the aerial was found to be completely screened for all practical purposes. A horizontal portion was now added to the aerial in successive stages, as shown in Fig. 5 (b) and (c), and a test was made of the signal strength received on the aerial. It was found that, with even a length of only 10ft. protruding, the effective screening action was considerably reduced, and that it diminished steadily as each successive stage was added. In general, it was found that the screening of the vertical lead was only effective when the horizontal length was less than the height of the screening cage.

The Horizontal Part of the Aerial.

To understand the action of the horizontal part of the aerial it is necessary to consider in a little more detail the secondary field set up by the currents in the vertical screen, as depicted in Fig. 6. A study of this diagram will show that at the base of the aerial the secondary field E_2 is vertical, and is opposing the primary field E_1, due to the arriving waves. At points half-way up the screen, however, the secondary field has an appreciable horizontal component, and this component will induce an E.M.F. in the horizontal portion of the aerial, increasing with its length and in the same direction as that which would be caused by the primary wave field in the vertical portion of the aerial.

It thus appears that for practical radio reception purposes there is no need to take excessive precautions to try and prevent the vertical down lead of an aerial

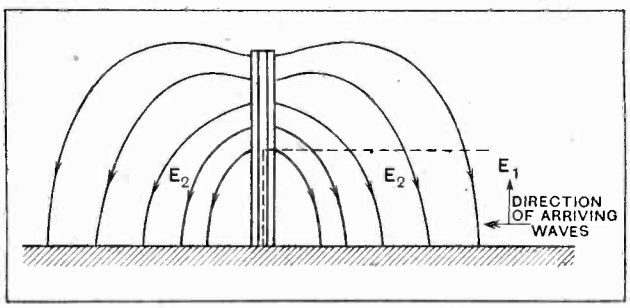


Fig. 6.—Currents induced in the screen wires cause a secondary field E_2 around the inverted L aerial.

from being screened, provided that there is a sufficient horizontal portion attached to the top of the aerial. In the same way the down lead of such an aerial would not be appreciably screened by the presence of a metallic supporting mast or the metal wire stays of a mast. It must be understood that we are not advocating experimenters to be careless in the arrangement of their aerials. What may be very serious in the above cases is the shunt capacity effect of neighbouring objects in diverting the aerial current away from the receiving instrument. Another point of importance also is that serious eddy current and dielectric losses may be introduced into the aerial circuit if the down lead is close to other objects, whether earthed or not. Both of these disadvantages can be overcome, however, by allowing as great a spacing as possible between the aerial lead and the surrounding objects.

Hints on Following a Specification.

By "RADIOPHARE."

THE fact that there is still so much uncertainty as to when and where it is permissible to use parts other than those actually used by the designer is probably a legacy from the bad old days immediately following the inception of broadcasting. There seems to be a prevalent idea in less well-informed quarters that to substitute a single component with one of different make is to court disaster. This is wrong, and the purpose of the present article is to offer some suggestions which may be helpful to those who wish for any reason to include in their receivers parts not actually incorporated by the designer. In view of the wide choice at present available, the writer often wonders why "lists of parts" are given at all, but imagines that their omission would be unpopular in certain cases, because without them it would be impossible to publish dimensioned panel-drilling diagrams, base-board layouts, etc., which relieve the constructor of a certain amount of trouble. Each manufacturer's products vary in dimensions and method of attachment; no reasonable being would attempt to restrict the free development of improvements in design by insisting on standardised components.

Before dealing in detail with the question of substitution it would seem advisable to touch on a point which is often not properly appreciated, namely, that of price. Every conscientious designer must take this into account when choosing his parts; very properly, some sets are designed with economy in view, while with others expense is almost completely ignored. Components for the cheap set are chosen as offering the best possible value for their cost, but, as we generally get what we pay for, it is quite possible that better results—and almost certainly greater pleasure in operating the set—will be obtained from more expensive components.

Capacity and Inductance.

In many modern sets, and particularly in those with H.F. amplification, the coils and high-frequency transformers are probably the most important components, and the substitution of others of lower efficiency, or what amounts to the same thing, of less suitability for the circuit, should only be made if the constructor has a good fundamental knowledge of the subject. The matter is too complex for treatment in these notes, and in cases of doubt the reader is advised to avail himself of the services of *The Wireless World* Information Department, although it may be pointed out that the kind of coil used in, say, a heavily damped aerial circuit is not of very great importance, substitution of a winding having about the right inductance being generally permissible.

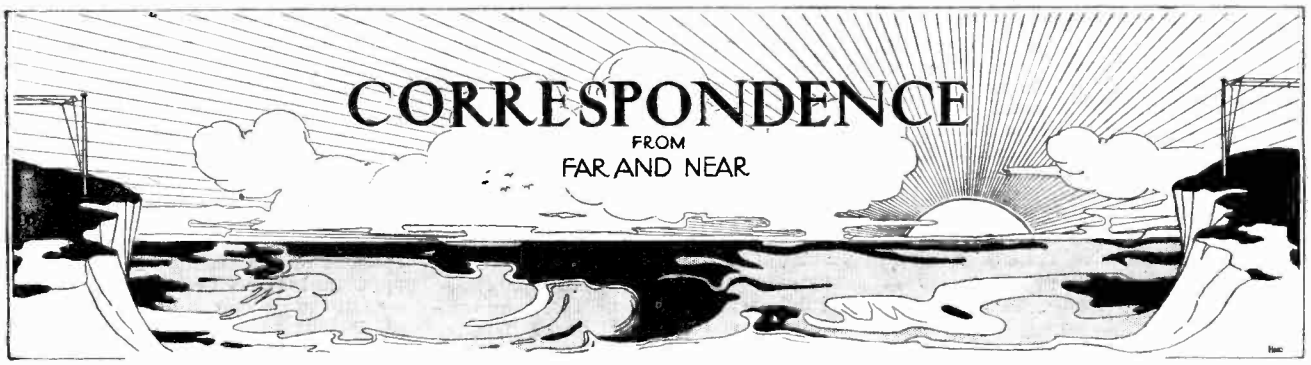
It is possible to cover the normal broadcast waveband with a fixed inductance and a condenser of either 0.0003 or 0.0005 mfd. capacity, and both these sizes are used in various designs. It will almost invariably be permissible to replace the smaller capacity by the larger, but tuning difficulties will be increased unless a slow-motion device is included. The converse does not, however, hold good; in the first place, if a fixed inductance designed to cover the desired waveband with a 0.0005 mfd. condenser is included, the wavelength range of the set will be insufficient with a smaller capacity, and if inductance is increased, selectivity will not be that intended by the designer. Some care should be taken not to use a variable condenser considerably larger in physical dimensions than that specified, particularly if it is near the high potential end of the tuning coils.

Insufficient Neutralising Capacity.

The position regarding low-frequency transformers is a simple one as far as most up-to-date circuits are concerned, as the use of one *slightly* inferior to that included in the specification will have little noticeable effect on the performance of the receiver, except from the point of view of quality. On the other hand, an instrument which can only be described as thoroughly bad (when judged by modern standards) will provide such a considerably decreased overall amplification that the resultant weakening of signals will be plainly apparent.

There is a possibility of going astray in the choice of neutralising condensers. The great majority of these components have a maximum capacity of some 30 micro-microfarads or slightly less, which is quite sufficient to balance the most popular types of circuits, but occasionally an arrangement is used in which there are a comparatively small number of turns in the neutralising windings, with the result that the capacity required for balancing is considerably greater than the capacity to be "balanced out," in which case a specially large condenser must be used.

Although valves are not, strictly speaking, a part of the design, one cannot leave the subject without referring to the importance of adhering strictly to the designer's advice, not so much as to the actual make used, but as to impedance value. Care should be taken to see that a given impedance is accompanied by an amplification factor not widely differing from that suggested.



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.

THE EVERYMAN PORTABLE.

Sir,—One can hardly quarrel with *The Wireless World's* conservative policy regarding the performance of receivers, but I think you have erred towards under-statement in the case of the "Everyman Portable." There was great doubt in my mind whether this set would be sufficiently sensitive for my needs, and so it was almost against my better judgment that I made it up and have now had an opportunity of testing it during a long journey by car. Without exaggeration, the daylight range might certainly have been put at 85 miles on 5GB and 50 miles on 2LO—about 75 per cent. greater than that suggested in the descriptive article. Moreover, at night time it is generally possible to hear a few Continental stations at fair strength on the frame aerial alone. G. B. MONRO.

London, W.

[It is intentional that when describing the probable performance of *Wireless World* receivers we err on the side of under-estimating their range, but our correspondent's report is interesting as showing what the "Everyman Portable" will do with careful tuning and under favourable conditions.—ED.]

5GB.

Sir,—Referring to the two recent letters on 5GB in your issues of April 4th and 11th, it may be of interest to say that here—at Leeds—the night distortion experienced from 5GB is of such a nature as to make this station absolutely worthless as an alternative evening programme.

I am afraid that until the excessive centralised control by London is modified for alternative stations, and listeners have the right to allot or proportion their licence fee according to the station and type of programme preferred, very little real improvement or satisfaction will be obtained in these matters.

Leeds. April 15th, 1928. G. H. H.

Sir,—I have read with interest the letters you have recently published on the subject of the transmissions from 5GB; perhaps the following would be of interest in connection with this matter.

I have recently had an opportunity of hearing the transmissions at (i) Aberystwyth, (ii) in a Welsh valley town near Bridgend, Glamorgan, (iii) in a village outside Newport, Monmouthshire, and (iv) here in Essex, all on efficient receivers.

Reception, even on a modern multi-valve set, is impossible in Aberystwyth, owing to very bad fading, the signals being very strong at one minute and almost inaudible the next. The reception of 5XX is, on the contrary, very good.

As regards (ii), which is not so far west as Aberystwyth, and considerably nearer Daventry, the fading is of a slower period, and, as would be expected, not so violent. Still, even on a super heterodyne, satisfactory reception is not obtained owing to the continual change from soft to loud and *vice versa*. Again 5XX is very good.

In Monmouthshire, reception is much better, and the fading not very pronounced, but it is still present. Here again the receiving station is situated more to the east and nearer to Daventry than (ii). 5XX shows no variability.

Lastly, in Essex, reception appears to be quite satisfactory from both stations.

It appears, then, that strong fading occurs as one goes to the north and west, and that there is a continuous improvement as one goes south and east. It would be of interest to know if this is true generally, and of even greater interest to know if the B.B.C. engineers have any theory to account for it.

O. G. SUTTON.

Shoeburyness, Essex. April 14th, 1928.

CONTINENTAL BROADCASTS.

Sir,—It just happens that, while receiving Cologne through 2LO, I tried the difference of reception by tuning in to Cologne direct, and I was certainly surprised to find that direct reception was far better. I do not decry the B.B.C. giving these land-line efforts for the benefit of those with crystal or small valve sets incapable of reaching out cleanly. But to those who can afford a five- or four-valve set and keep it under control I should certainly advise reaching out.

Many a time have I tired of both 5GB and London (2LO) and searched the wavelengths for something more congenial, and found Langenberg, Cologne, Frankfurt, Radio Paris, or some other powerful station quite up to, if not equal to, 2LO standard.

Of course, one must admit that on some of the less powerful stations abroad there is occasionally annoying interference, but one can generally dodge these by switching over to a relay.

(Set, 3H.F.-D.-one or two L.F.) H. E. HULL.

Kensington, W.

April 11th, 1928.

ACCUMULATOR CHARGING—AN EXPERIENCE.

Sir,—I charge my accumulators by means of a charging board connected to the D.C. house supply main.

Recently, owing to an increase of current consumption due to the installation of an electric cooker and other household electrical apparatus, the supply company found it necessary to put in a larger meter.

I put my accumulators on charge as usual, and at the end of about thirty-six hours made a hydrometer test. To my consternation the float would not rise at all, and further investigation proved the cells to be fully discharged.

The cause of the trouble, although simple, did not strike me at once.

The fitting of the new meter had resulted in the polarity of the house wiring being reversed, so that my accumulator had been connected up to the board backwards. So far as I can see, it has sustained no damage, but I thought this note of warning might be the means of putting your readers on their guard. They might not all be so lucky. POLE-FINDER.

Birmingham.

April 20th, 1928.

DISTORTION.

Sir,—There has been some correspondence in your columns regarding the distortion in 2LO's transmission. I should like to mention that it appears impossible to tune in that station after dark in this district without the trouble. Curiously enough the transmission is quite clear during daylight, and I have enjoyed many afternoon programmes. But as soon as darkness falls the peculiar distortion occurs. It is intermittent: at one moment the speech is "snarling" and nasal—just as if the receiver were oscillating—and at the next it will suddenly become clear. There are considerable alterations in volume as well.

Now, to anticipate the usual replies of the technical gentlemen who will advise me to "look at my set," I would say that the said set is an "Everyman Four," and properly adjusted. If the set is at fault, how is it that at any time undistorted music and speech can be received from German and Spanish stations only a few condenser degrees from London, and even from London in daylight? And again, how is it that numerous others report exactly the same trouble? The theory of a silent point oscillator (or oscillators) causing the trouble is scarcely tenable, as the complaints come from a fairly wide area, and it is hardly conceivable that such oscillators would be working every evening without intermission for several months.

One is forced to the conclusion that there is some kind of interference with 2LO's wave, or some peculiarity in the transmission itself, that spoils distant reception of the station. The former notion receives assistance from the fact that the trouble is less noticeable, although still existent, in the case of receivers without high frequency amplification: these may be able to pick up a strong distant transmission like 2LO and ignore a weaker interfering signal. Anyhow, whatever the true cause may be, it is a pity if something cannot be done to improve matters, for one would fain tune in London at times when talented artists from 5GB are caterwauling in imitation American to an accompaniment of saxophones and tea-trays. But alas! one is driven to the continent, for at present there is not a distant British station that can be received without interference after dark. Manchester used to be a stand-by, but now even that is overlapped by Stuttgart, and I doubt if a superhet. could separate them thoroughly.

Cannot the B.B.C. look into this 2LO trouble, or is the anti-distant-reception attitude of Captain Eckersley too dominant? There is sufficient evidence to show that the fault is not in the receivers of those who complain.

Moseley, Birmingham. "F. S."
April 20th, 1928.

TRANSMISSIONS OF OUTSIDE BROADCASTS.

Sir,—May I be allowed to call attention to a peculiar effect noticeable in the broadcasts from the Royal Hotel, Eastbourne?

For over two years the Sunday evening programmes given by Albert Sandler and his company have been conspicuous for the excellent quality of the transmission; there has always been a fullness of tone about these transmissions which was most exhilarating.

Now, in my opinion, this quality was entirely absent from transmissions relayed from the Park Lane Hotel last night. Why?

Another outside broadcast which has a noticeable feature is the Monday lunch-time transmission from St. Michael's Church, Cornhill. The announcements made by the Vicar are, I believe, the best reproduction of speech which emanates from 2LO, not even excepting that of the regular B.B.C. announcer.

It would be interesting to learn if this observation regarding the Albert Sandler concerts is confirmed by many listeners besides myself.

Should it be established that the fine quality of Albert Sandler concerts has, in the past, been due, even in some small part, to the acoustics of the Grand Hotel, or the peculiar characteristics of the land line from Eastbourne, then these factors will merit thorough investigation by the technical experts of the B.B.C.

I may say that the set used for these observations has received careful attention; it is a 2-v-1, very similar in design to the 2H.F. Everyman, except that it has an anode bend detector and R.C. coupling. It has been in regular use, with a 7ft. exponential horn, for nearly twelve months. It is not quite faultless, but I am so familiar with the sound of it that it makes a reasonably trustworthy standard for comparisons between different transmissions.

I do not pose as one of the giant amateurs who possess sets capable of reproducing better music than the B.B.C. are able to transmit, yet I venture to suggest that such claims are not necessarily as absurd as some of your correspondents appear to think.

Some of these amateurs may well possess technical knowledge at least equal to that of the B.B.C. staff, and while the whole energy of the B.B.C. experts has been absorbed by their efforts to improve transmissions, the enthusiastic research of the amateur has been directed to the perfecting of receivers.

As this is a somewhat simpler problem, it is reasonable to assume that they may have come nearer to the achievement of ideal reception than the B.B.C. staff have to the achievement of perfect transmission. H. LEE.

Isle of Sheppy. April 16th, 1923.

MORSE INTERFERENCE.

Sir,—With reference to the letter of Mr. W. Muir on Morse interference, as an operator of some experience, may I be allowed to comment upon parts of his letter?

In the first case, Mr. Muir states that GLQ was right on 26 metres, instead of his proper wave of 24.5 metres. Regarding this, I would like to say that in all my experience I have never known a P.O. long wave station to be more than a fraction of a metre off his proper wave. Tuning is very close on C.W., and I have no doubt that on the short waves the P.O. are just as careful.

Then Mr. Muir says that Ongar sent for nearly two hours "GLQ GLQ GLQ de LPZ LPZ LPZ." As any operator knows, if Mr. Muir heard this as he has it, then it was not GLQ he heard at all! If my memory serves me right, LPZ is a South American station, and was obviously calling GLQ. Small wonder that the power "seemed to be tremendous" in West Africa!

Regarding GLQ interfering with 5SW, does Mr. Muir remember that there is only .5 of a metre difference in the waves?

One other point is his reference to the "wash-out" signal, and says that he hears it in most messages to which he listens. Here again I have no hesitation in asserting that the South American stations are the worst offenders. Any operator will tell you that Spanish stations generally do not maintain a high standard in Morse. In my experience, the erase signal is very seldom used; personally, I could almost count the number of times I have had this signal on my fingers! And that in over four years' sea service.

Finally, may I suggest that commercial working between ship and shore, and shore and shore, is rather more important than a listeners' entertainment, and until a more satisfactory method of communication is introduced we must "grin and bear it"?

London, S.E.24. April 18th 1928. A LISTENER.

SCHOOL WIRELESS RECEPTION.

Sir,—In your issue for April 4th, under "Broadcast Brevities," you applaud the standard of wireless reception attained by schools in Kent. Your readers, no doubt, will be interested to know that the special sets supplied to the Kent Education Committee for their schools are manufactured by us. These sets were supplied under a scheme inaugurated by the Kent Education Committee with the assistance of the Carnegie Fund, and were designed specially for use in schools with a view to perfect reception. A. J. DEW AND CO.

April 17th, 1928.

L.S.5 BRIGADE.

Sir,—With reference to your reply in the issue dated April 18th, to "C. T. E.," regarding the rattle experienced in installing a moving-coil speaker, the writer may, perchance, by recounting his own experience, be able to render some assistance, and at the same time assure the gentleman who was

enquiring as to the practicability of working a speaker of this type from one super power valve in the output stage.

Experiments were conducted to ascertain the lowest possible anode voltage which could be used without introducing distortion. The writer can now definitely state that the trouble which "C. T. E." experiences is in all probability due to valve overload. Actually, when running one 256 in the output stage with a voltage of 120, distortion is noticed on the speaker before the milliameter can register a deflection. The distortion is apparent as a buzz or comb and paper effect on some of the upper frequencies. such as, for instance, the upper notes of a soprano voice, and no amount of juggling with components or the speaker will rectify it.

By increasing the overall intensity, *i.e.*, by loading the last valve to a greater extent, the kick on the meter is pronounced, and the rattling effect increased. Gradually increasing the H.T. voltage from 120 to 160 improves the quality of reception, and entirely eliminates the rattling effect noticed.

It is essential, of course, that the grid bias is increased accordingly, and the addition of this last 40 volts actually doubles the total H.T. consumption of the set. The improved results, however, fully justify the extra current taken. Working on these voltages, the power delivered by the single output valve is ample for even a large room, assuming that the volume of sound required to fall upon the ear is roughly the same as would be experienced if one were listening to the original, say at the back of a concert hall, or at a reasonable distance from the source. One cannot pretend, of course, that the volume of sound emitted by the speaker under these conditions is equal in intensity to a full military band, but then one does not normally listen to a military band within a distance of 20 ft. or so, and, therefore, to attempt to reproduce with a volume such as this is entirely unnecessary.

In conclusion, then, I would say to the owner of *The Wireless World* Five, who wishes to use an M.C. speaker on a single super power valve, by all means do so, as once having installed one, he will never revert even to the best of other cone speakers, and to "C. T. E." I would suggest increasing the high-tension voltage on the output valve as far as possible, as he is almost certainly over-running the straight portion of this valve's characteristic.

L. C. HILL.

London, N.19.
April 18th, 1928.

SCIENTIFIC WIRING.

Sir,—Mr. Medlam's article is of great practical interest to all constructors. I have already partly proved the advantages of such a system in a compact screened grid two-valve set, in which great pains were taken to avoid induction loops, stray capacity and battery couplings. The result is a set, extremely stable, with a minimum of screening, free from hand capacity effects and smooth reaction.

The point, however, arises as to the practical limits of the section A—B. If the common negative bus bar is eliminated, separate leads are needed right back to the generator, which is, of course, impracticable, therefore earth must be taken as the common meeting place or junction. The modern tendency is toward an all-metal chassis or else screening boxes at earth potential. Connections thereto give the advantage of short leads and large area. A multitude of negative leads is redundant, and is more likely to be harmful than beneficial. Greater care than is usual should be taken with the earth lead, which must be of ample section, preferably copper strip, the negative battery leads, also of large section, being taken direct to the strip.

BM/BLDN.

Beaulieu, Hants.
April 28th, 1928.

SHORT-WAVE RECEPTION.

Sir,—It would be interesting to know how many of your readers picked up the short wave transmission of 2XAL in the early hours of this morning, and heard the news of the safe arrival of the German aeroplane, "Bremen," off the coast of Labrador.

As reported in to-night's "Birmingham Mail," I had the good luck to be listening when this interesting report came through.

The set in use is similar to the short wave set described in your journal a short time ago, except that it has two L.F. instead of one R.C. and one L.F.

Although the aerial is badly screened, reception was at good loud-speaker strength, and remarkably clear.

April 14th, 1928. H. COHEN.

Sir,—As a short-wave enthusiast, and having achieved very considerable success in the reception of distant stations, I can only say to Mr. W. H. Chipperfield that I am amazed that the B.B.C. do not relay 2XAD and 2XAF, as, for the last two months these stations have been coming through consistently well (vide "The Searcher" in "World Radio" for confirmation). In direct contrast, 2XAD has often announced how 5SW has been relayed by WGY for as long a period as two hours on end and three times a week. Your correspondent says ". . have they (short-wave writers) found out that the B.B.C. engineers know the best policy to follow?" The answer is, "Yes, they have no policy except to religiously stick to 24 metres."

E. T. SOMERSET.

Sussex.
April 11th, 1928.

TALKS.

Sir,—Your correspondent, Miss Margaret House, takes for granted, as do almost all those who dislike talks, that those who like them are seeking information or education. But that is not the case invariably, and, perhaps, not genetally.

Many of us are interested and amused by hearing about various things,—natural history, travel, dramatic criticism, speeches, etc.—just as your correspondent is interested or amused by listening to music. Just as most of us like conversation, not because we wish it to educate us (though, of course, it may, if it is good), but because the healthy curiosity of the mind wishes to be exercised.

Herr Feuchtwanger surely gave good reasons for his opinion, which, if I remember rightly, were that the music as it comes to us on the wireless is a less complete or satisfactory rendering of the original as played than speech is of its original. Surely that is so. Whether listening to music or speech, we lose the pleasure of seeing the performer; that operates equally against both types of entertainment; but, whereas the music is not quite so good as the original, the speech may be much better than we should get in some parts of an audience, if we were hearing the speech in a room.

After all, it is a matter of taste. Strange to say, the kind of "talk" I most dislike—in fact, the item I find most boring of all, music or talks, is the reading of stories—which your correspondent commends.

C. D. ROCHESTER.

Kettering. April 26th, 1928.

BALANCED ARMATURE UNITS.

Sir,—I notice in your current issue that a reader enquires where a balanced armature unit can be purchased for use with horn speakers.

I have constructed the folded exponential, and I was up against the same difficulty, but, not to be beaten, I purchased a four-pole balanced armature unit for use with cone speakers, and, after reducing the weight and stiffness of the mechanism and closing the air gaps slightly, I fitted this with a 2½in. paper cone mounted on a ring by means of suède leather in much the same way as the larger cones are mounted.

This was then fitted with a cap which followed the contour of the cone and terminated with a boss bored to suit the horn tube, allowing clearance for a rubber bush.

I think the resultant unit justifies the trouble involved, as it shows a decided improvement on the lower notes when compared with two or three other ordinary units of good make.

The necessary alterations were not very difficult, and should be easily carried out by anyone possessing a little patience, a little knowledge of loud-speaker mechanism, and access to a lathe.

I thought this might interest some of your readers, and perhaps encourage one or two of them to try their luck at unit making, and—who knows?—a manufacturer may do something for us.

A. H. LAWRENCE.

Grantham.
April 26th, 1928.

READERS' PROBLEMS

The "Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interests of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

Doubling the Scale of a Meter.

I have a moving coil type milliammeter reading 0-20, and having recently adopted parallel output valves I find that this meter is now inadequate for my requirements. Is it possible to extend the scope of the meter so that it will read up to 40 milliamperes, please? K. C.

The usefulness of a milliammeter can be extended by connecting a resistance of suitable value across its terminals. By this means the meter can be made to read up to any desired value over 20 milliamps., and to double the scale of the instrument the shunt resistance should have the same value as that of the meter. Perhaps the most convenient method of determining the value of the resistance required is by trial, and the procedure would be as follows: Connect the meter in circuit with a source of E.M.F. and a series resistance, the value of which has been adjusted to allow a current of 15 milliamperes to pass. Now shunt the terminals of the meter by a variable or semi-variable resistance and adjust this so that the indicating needle coincides with the 7.5 millampere mark. The instrument will now be capable of measuring currents up to 40 milliamperes, but it must not be forgotten that as the full scale reading is now double the former value the amount indicated by the needle must be multiplied by two to obtain the correct current flowing in the circuit.

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Setting a Potentiometer.

A friend tells me that my anode bend detector requires two volts negative on its grid. The bias arrangements are those which have been suggested from time to time in your journal; a potentiometer is connected between L.T.— and L.T.+, its slider being joined to the low potential end of the detector grid circuit through a 3-volt bias battery; 6-volt valves are used. I should be glad to know where the potentiometer slider should be set in order to obtain the desired voltage. T. G. D.

We think that a consideration of Fig. 1 will make this matter clear to you. With the arrangement you have adopted, it is possible to vary the grid voltage between 3 volts negative and 3 volts positive. When the slider is at the extreme negative end of the potentiometer winding

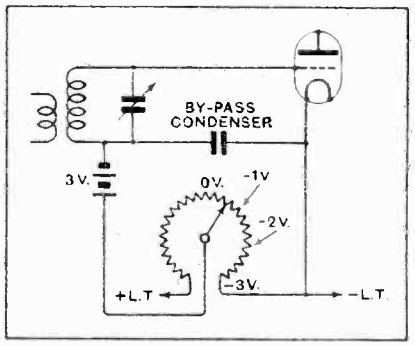

Fig 1.—Adjusting detector grid voltage.

(that end connected to L.T. negative) the applied voltage will be minus 3 volts, while the grid will be at zero when the slider is at the middle of its travel. Positions corresponding to intermediate voltages are indicated on the diagram. You will see that the change in voltage is in proportion to the movement of the slider.

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An Accidental Counterpoise.

A puzzling effect has recently come to my notice. I have observed that the removal of the earth connection makes absolutely no difference to signal strength. This has been checked very carefully by observing weak signals, and I am confident that there is no possibility of error.

My H.T. supply is from the house lighting plant, which consists of sixty large accumulators, and I had thought at first that one side of this would be earthed. However, I find that this is not the case, and assume that the reason for the effect noticed is not associated with the particular form of H.T. supply. Can you offer any suggestions as to its cause? W. L. C.

Although your house lighting system is not earthed, we expect that it is acting as a moderately effective counterpoise, and we consider that this is the explanation of the effect you have noticed. Even though the disposition of the wiring may not be ideal with respect to the aerial, it is quite possible that it works as well or better than a direct earth connection of the ordinary type.

○○○○

The "Everyman Four" on Long Waves.

I am thinking of modifying my "Everyman Four" receiver by substituting plug-in H.F. transformers, in order that the high-frequency amplifying valve may be used on the long wavelengths. Have you described coils for this purpose in any back number of "The Wireless World?

G. B. T.

Plug-in coils specifically intended for the "Everyman Four" have not been described, but we suggest that you might use those specified for the "Regional" and "Standard Four" receivers, the former in our issues of August 17th and 24th, 1927, and the latter in those for November 30th and December 7th, 1927.

RULES

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

Locating H.F. Resistance.

Although the performance of my "Everyman Four" is good when compared with my previous set, which had the same number of valves, I am not altogether satisfied with it after having made a direct comparison with a similar receiver constructed by a friend. The set was tested on his aerial. Faults in valves, batteries, etc., have been ruled out by a process of elimination, and I have come to the conclusion that the trouble is due to damping in one of the H.F. circuits, although the source of this cannot be located by a phone-and-battery test.

I have considered rewinding both the aerial-grid and H.F. transformers, but before doing this should like to know if there is any simple method whereby H.F. resistance may be traced definitely to one of the tuned circuits. W. B. G.

It is not an easy matter to test for H.F. resistance without an extensive equipment of instruments, but we suggest that the following method, although admittedly somewhat crude, will be helpful in your case.

In order to locate the circuit in which damping exists, you should try the effect of inserting a non-inductive resistance in each circuit in turn in the manner shown in Fig. 2 at R_1 and R_2. A suitable value for the resistance would be from 5 to 10 ohms, and we suggest you might use 2in. (or slightly more) of No. 45 Eureka wire. This should be placed in the aerial grid transformer secondary circuit, in the position shown, after you have tuned to a station whose signals are weak, and you should notice carefully if the addition of the resistance has a considerable effect in reducing intensity. If it has not, then you may assume with some confidence that there is already excessive resistance in the circuit itself, and thus the trouble is more or less localised. If, on the other hand, the added resistance has a noticeable effect in reducing signal strength, it is probable that this circuit is free from blame, and the resistance should be accordingly transferred to the H.F. transformer secondary (in the position marked R_2 in the diagram) and the same experiment repeated. As far as this last test is concerned, it will be convenient to mount the length of resistance wire on a coil plug, and to insert it into the long-wave loading coil socket. This will enable you to make a quick comparison by operating the short-circuiting switch.

We should add that the test can best be carried out in daylight, when the signals from a distant station are not likely to be affected by fading. Moreover, it is recommended that the set should be completely neutralised for the test; you should not attempt to increase sensitivity by partial deneutralisation.

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Long and Short Waves.

I am trying to design an "all-wave" receiver which will be suitable for wavelengths of about 30 metres, as well as for the upper and lower broadcast wavebands. In order to obviate the need for a multiplicity of tuning coils, I should like to use a 0.0005 mfd. tuning condenser for all the wavebands, but experience shows me that such a large capacity is not convenient on the extremely short waves, as tuning becomes unduly difficult. I believe it has been recommended that a fixed condenser may be connected in series with the variable, and in this case it would seem possible to use a switch for short-circuiting it. Your comments on this matter would be appreciated. W. M.

Your proposed arrangement is quite practicable, and we show in Fig. 3 how it may be put into effect. This diagram is prepared on the assumption that you are using capacity-controlled reaction. As far as the reaction condenser (R.C.) is concerned, we think that the same value will be satisfactory on all the wave-

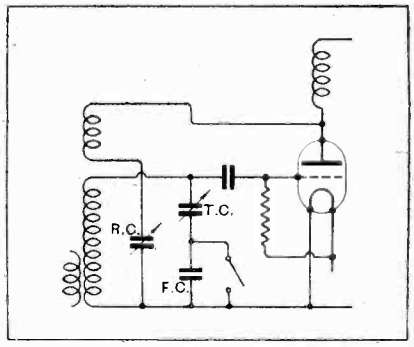

Fig. 3.—For short-wave work, the tuning condenser may be reduced in value by connecting a fixed capacity in series with it.

lengths to be covered, but it may be necessary for you to use fewer reaction turns in the short-wave coils than are generally specified. We suggest that you add a fixed condenser (shown at F.C.) in the manner indicated; this may have a value of 0.0003 mfd., and it might with advantage have an air dielectric.

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Shocks from the Receiver.

The quality of reproduction from my receiver (H.F.-det.-2 L.F.) is far from good, and I am at a loss to know what I can do to improve matters. Perhaps the following symptoms will help you to locate the fault. The output super-power valve has a choke filter output arrangement in its anode circuit, by means of which the loud-speaker is isolated from the H.T. battery. I find, however, that if I tune in to the local station, and place my fingers across the loud-speaker terminals, a distinct shock is perceptible. T. E. F.

We are afraid that the information you give does not help us to trace your trouble; it is quite natural that the output from a super-power valve will create sufficiently high L.F. voltages across an anode choke to give quite an appreciable shock. If you will supply us with further details, it is possible that we may be able to help you.

○○○○

On the Short Waves.

Is it possible to add another L.F. stage to my Empire Short Wave Receiver, in order that the majority of the stations at present heard on two valves may be amplified to sufficient strength for operating a loud-speaker? S. H. T.

Yes, there is no reason why this set should not operate with two L.F. amplifying valves. We suggest that you follow the detector by resistance coupling, and you might well adopt the L.F. portion of the "Short-Wave Three" described in the issue of this journal dated September 14th, 1927.

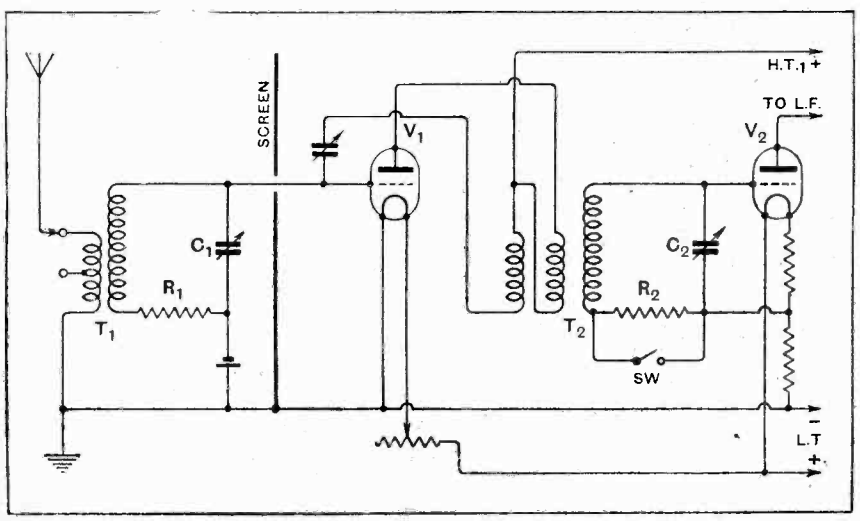

Fig. 2.—Artificial resistances may be inserted at R_1 and R_2 as an aid to the tracing of damping in an "Everyman Four" receiver. The remaining lettering refers to the original circuit diagram.

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As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

CONTENTS OF THIS ISSUE.

PORTABLE WIRELESS.

EACH succeeding year since broadcasting has been with us has seen a pronounced improvement in the design of portable and transportable receivers, until to-day there are very many portable sets on the market which will give a truly satisfactory performance and yet keep down bulk and weight to within limits quite reasonably consistent with portability. The portable set, moreover, has some distinct advantages over sets where an outdoor aerial is employed because of the enhanced selectivity which it is possible to obtain by the use of a frame. The smallness of the collector, however, requires that more stages of amplification should be used than are necessary where an efficient aerial of adequate proportions is available, and, therefore, viewed from this angle, portable sets are more costly when compared with simpler receivers for permanent installation.

Importance of the Collector.

Outside aerials, as we all know, are an all-important factor in deciding upon the performance of the average receiver, and when what would appear to be two identical receivers used in different localities give very different performances, the reason can almost always be traced to the aerial. With the portable receiver, however, operating from a frame as a collector, all the sets start more or less level, so to speak, and it is, therefore, much easier to compare their performances and draw conclusions as to the relative sensitivity of different types; but even so, we are somewhat up against a difficulty because so far no unit of sensitivity has come into general use in connection with wireless receivers to enable one to make rapid comparisons.

Efficiency in Terms of Stations Received.

Instead, the manufacturer, in stating the case for his set, has no choice but to resort to describing its sensitivity in terms of the number of stations which the receiver will get and, possibly, the distance that these stations are from the receiver. This method of stating the sensitivity of a receiver is a compromise and, we think, a perfectly legitimate compromise so long as no more scientific system has been worked out.

Day and Night Ranges.

But the system is apt to be very misleading to the public which may not recognise the great differences between daylight and night ranges, and therefore, in referring to the number of stations which a set will receive, in order to clear up the possibility or, we may even say, probability of misunderstanding, it would be well that it should be clearly indicated whether day or night performance is referred to. Then, again, during the hours of darkness receivers with any pretentions whatsoever to sensitivity will, at some time or other, under favourable conditions receive a very large proportion of the stations of Europe if one is sufficiently patient to try for them; but, except in the case of the more powerful transmitters, one can seldom be sure of repeating the reception night after night. If it is found possible to allot a guaranteed rating in units of sensitivity to any receiver, then it will be a comparatively easy matter, with the aid of our present knowledge of field strengths developed at varying distances, to decide, with some degree of certainty, what stations would be received consistently, and approximately at what strength.

It is not only with portable sets, of course, that some rating of this character is desirable. With all types of receivers it would be an advantage to have this information, though, of course, for the reasons given above, the performance of sets using outdoor aerials would vary very much on either side of what would be implied by the guaranteed rating in units of sensitivity, which, in the case of ordinary receivers, would assume the use of an average aerial.

The PORTABLE SET

A Review of Current Commercial Practice.

"SHE shall have music wherever she goes"; thus runs an advertisement for a well-known portable receiver. That there is truth in spirit in this statement is evinced by handling one of the *really portable* attaché case sets now on the market at a distance of, say, 70 miles from the nearest broadcasting station, when it will be at once evident that not only is the "local" transmission satisfactorily received, but that five or six other stations will be heard on the loud-speaker at good strength and with excellent quality. There should be, indeed, few points in England where good entertainment from alternative stations cannot be obtained; the word entertainment is used advisedly, for it may be possible to heterodyne some 30 stations, but beyond the few transmissions already mentioned the rest can only be resolved into weak music and almost unintelligible speech by the excessive use of reaction with its quality destroying properties.

Those people to whom such fare appeals need not hesitate to obtain one of these receivers, for improvement in the efficiency of valves, unspillable accumulators, and components in general, has caused the portable set to emerge from the experimental stage and become a serious rival to the orthodox receiver for use with an outdoor aerial.

This year a demand has undoubtedly been created for the attaché case receiver, an example of which is shown in Fig. 1; there is more or less a line of demarcation between this and the transportable receiver which was much in evidence at the last Olympia exhibition, and a typical example of which is shown in Fig. 2. The portable scores on the question of weight, while the bigger dimensions of the transportable provide room for a much larger frame aerial (an external plug-in frame would not be inadmissible), larger H.T. battery, and it generally suffers less from the components being cramped. Being somewhat heavier than the portable type, it is usually provided with a turntable to facilitate tuning-in different stations. The amenities of broadcasting can be enjoyed out-of-doors in comfort with either receiver, but there is a growing preference for the lighter type.

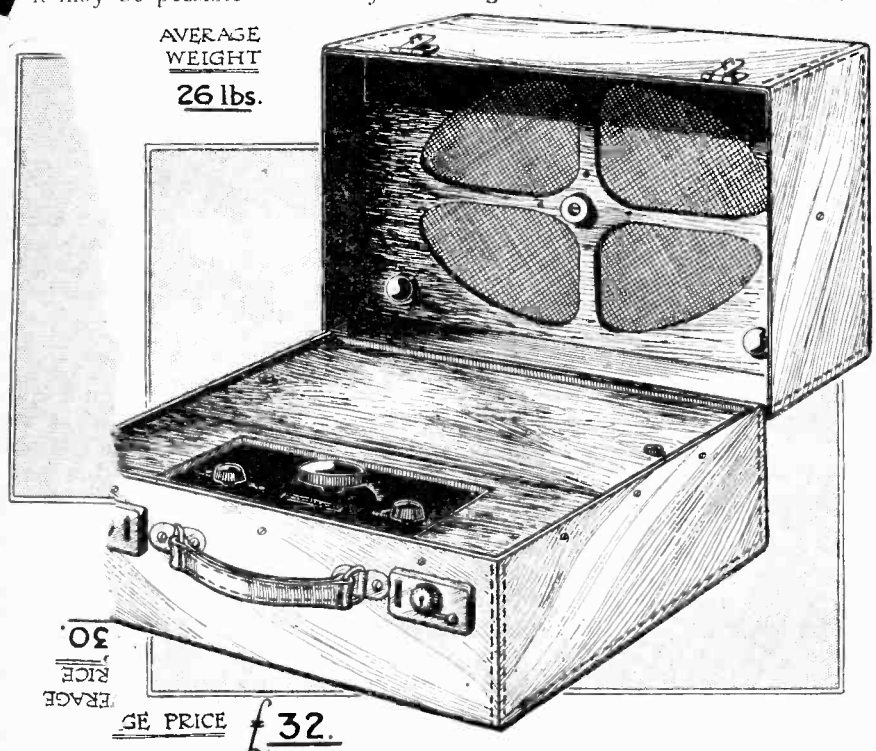


Fig. 1.—A typical suitcase portable receiver. The frame aerial and cone loud speaker are usually built into the lid. The average price and weight apply to the popular five-valve set.

A Question of Patents.

It is proposed in this article to consider in general the trend of design of portable and transportable receivers; a critical examination in detail of six of these sets will be found elsewhere in this issue. In Fig. 3 percentages are given for the most important components and controls; although a suit-

The Portable Set.—

case receiver is depicted, the percentages apply to both portable and transportable receivers, a total of 70 of which are reviewed.

The wireless student who closely follows current practice would be surprised were you to ask him to evolve a five-valve set of maximum efficiency and proceeded to suggest his using a two-stage high-frequency amplifier, employing small slotted aperiodic transformers or chokes together with provision for liberal reaction. Such, however, are the limitations imposed in commercial practice that one readily congratulates the manufacturers on obtaining such excellent results with such handicaps.

In the first place, the position with regard to patents relating to neutralisation is sufficiently obscure to prevent their general adoption, and while many would be prepared to pay a reasonable royalty there appears to be some difficulty in obtaining a licence to use. To tune two stages of H.F. amplification without neutralisation would be hopeless unless screened grid valves were employed. The latter, however, do not seem to enjoy much popularity, as will be seen from the percentage tables (5 per cent.).

One Dial Control Essential.

In the hands of the uninitiated, more than one tuning control appears to have an adverse psychological effect. It has been freely stated by those concerns which distribute portable sets that the inclusion of two tuning controls is unpopular, for the time has long since passed when the value of a set is assessed by the number of dials that it contains.

A frame aerial is more efficient and immune from electrostatic pick-up when it is centre-tapped, but here again the manufacturer finds he has to pay royalty for Hartley patents, and although quite a nominal figure is demanded, the question of competitive price of receiver has to be considered.

From these remarks it will be seen that the manufacturer is in the unenviable position of having to avoid neutralisation and more than one dial control, and is thus bound to use aperiodic H.F. couplings until such time as the patent position is cleared up, or until better use can be made of the screened grid valve.

Readers will remember that about three years ago a stabilised tuned anode circuit, as shown in Fig. 4, was in vogue. Provided the direction of the windings of the two inductances L_1 and L_2 was correct, a capacity of the small condenser N.C. could be found such that the circuit was stable over the greater part of the tuning range.

We have already shown that development lies in the direction of reducing the number of tuning controls to one, with the result that included in a number of sets are to be found small *iron-cored* high-frequency transformers with flat-top resonance curves which are wired up with their primaries as stabilising coils, and their secondaries as untuned anode coils or chokes coupled to the next valve by a condenser and leak in a similar way to Fig. 4. The majority (63 per cent.) of portable sets have five valves (two H.F. det., 2 L.F.), and in quite a number we find incorporated the circuit of Fig. 5 (*b*). The second H.F. coupling will be seen to contain an iron-cored transformer similar to that in the first stage, but the connections are of an orthodox nature. The condenser C_1 tends to stabilise the H.F.

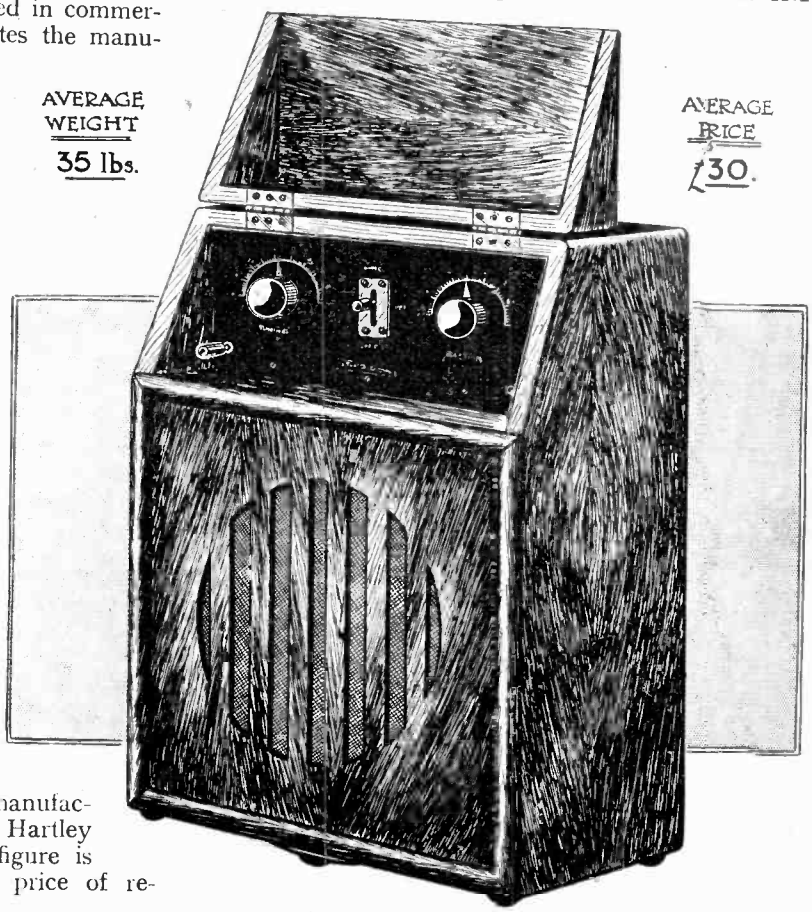


Fig. 2.—A typical transportable set of greater weight and of more liberal dimensions than the portable set. A bigger frame aerial and larger H.T. battery are usually incorporated. The price and weight apply to the five-valve set.

amplifier and provides a means of introducing reaction. Sets thus designed are surprisingly sensitive, but the transformers must be changed over by a switch or by plugging-in when the waveband is altered.

Another popular circuit is given in Fig. 5 (*a*), in which aperiodic chokes are used instead of H.F. iron-core transformers; this again gives one-dial tuning, and reaction is controlled by a variable condenser connected between the plate of the detector valve and a few extra turns added to the low-potential end of the frame aerial. The chokes are a little more selective than the transformers, and it is not usually necessary to change them over when making a waveband change.

Practically all the sets examined (94 per cent.) have provision for changing over from short to long waves,

The Portable Set.—

necessitating an alteration of inductance in the frame aerial. Now, theoretically a small frame aerial is inefficient on long waves, but it should give reasonably good results on short waves; actually in practice we find that the majority of portable sets bring in the long-wave stations with greater volume and with greater certainty than the short. This suggests that, should the manufacturer be able to improve short-wave performance in its proper relation to that of the long waves, then reception at *full* loud-speaker strength on a five-valve portable could be claimed for fifteen or more stations. The superiority of reception on the long waves may be attributable to the fact that the type of H.F. inductances used are intrinsically better suited to such waves.

Frame Aerial Difficulties.

When a frame aerial is being used for short waves the unwanted turns necessary for the long waves are inclined to absorb energy and cause "blind spots" at various points on the tuning range, unless it is arranged to break these turns at two or three points or to short-circuit them. A few makers employ one or other of these expedients, but the majority use a frame built up of three sections, which are thrown into parallel for the short, and in series for the long, waves; thus every turn is used for either waveband. One manufacturer at least, to avoid interaction, winds two separate frames at right angles, but this is only possible in a transportable set which is housed in a deep containing cabinet.

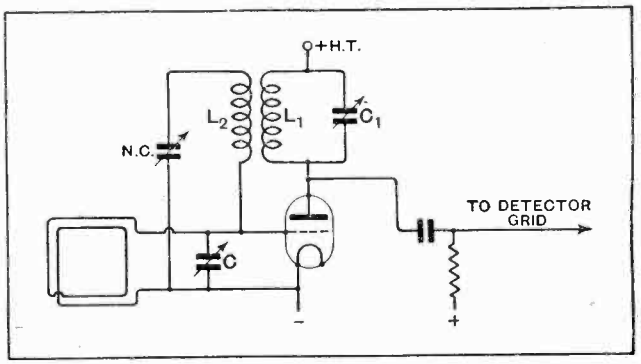


Fig. 4.—A stabilised tuned-anode circuit using plug-in coils. This circuit is the forerunner of that shown in Fig. 5(b).

The loading of a frame should be avoided if possible, and there are only a few instances of its use. The inductive coupling of a frame with the H.F. chokes or transformers is a difficulty that should be overcome by

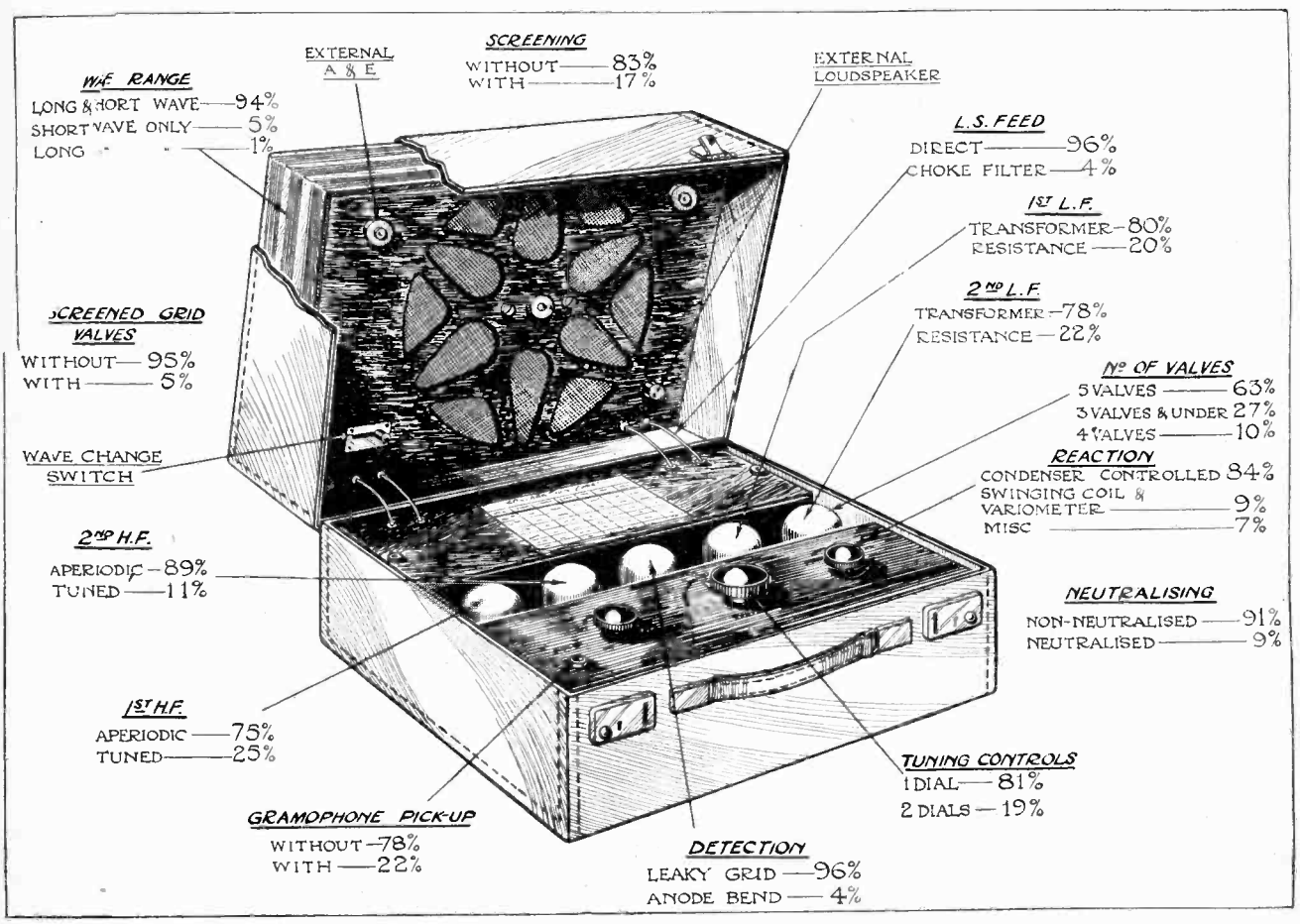


Fig. 3.—Although a suitcase portable is shown as an example, the percentages apply to the typical transportable set as well

The Portable Set.—

screening; it is regrettable to note that the percentage of sets (17 per cent.) incorporating this feature is so small.

When a loud-speaker is operated within a few inches of the valves of a receiver their electrodes (especially those of the detector valve) are liable to be set into vibration, causing a characteristic howl which builds up to a roar. This acoustic reaction effect, as it is known, has diminished with the advent of the 0.1 amp. valve with its more robust filament, but, now that sets have an increased overall efficiency, the volume obtainable from the loud-speaker is greater, and some instances of howl were encountered which could only be mitigated by switching off for a moment and reducing signal strength. A palliative for this trouble is the shrouding of the detector valve with cotton-wool.

The filament current supply in portable sets needs careful attention. Dry cells, with their inconvenient discharge curve, have become practically obsolete, and 2-volt unspillable accumulators have taken their place. In the transportable set the position for carrying and that for reception are the same, but in the majority of suitcase portables the listening position, as far as the accumulator compartment is concerned, is at right angles to the carrying position, with the result that the accumulator may spend most of its life on its side. Glass wool filling, which is used by a number of manufacturers, prevents creeping of the acid, but at the same time reduces the ampere-hour capacity considerably. One is inclined to advocate the type of suitcase portable in which the lid and case open out laterally from a vertical hinge and in which, therefore, the carrying and listening positions are in the same plane. Such sets are on the market and do not necessitate the use of glass wool, as acid is not likely to ooze through the accumulator vents.

An Interesting New Valve.

The average L.T. consumption of a five-valve portable set is a little over ½ ampere, and the average actual ampere-hour capacity of the accumulator provided is thirty; the number of hours' listening that can be enjoyed on one charge is, therefore, about fifty (with cells *not* containing glass wool).

The plate current battery provides most of the weight in a portable set and has to be cut down to a size consistent with the current demand made upon it. With a few outstanding exceptions, valves have been chosen so that the total anode current is not more than 6 or 7 mA, which is well within the normal discharge rate of the smaller type of batteries, whose life (with fifty hours per month use) should be about four months.

From experience one has become accustomed to associate a certain volume of signals with an approximate grid swing on the last valve, and it can be safely said that the 9 volts bias which is provided as standard in

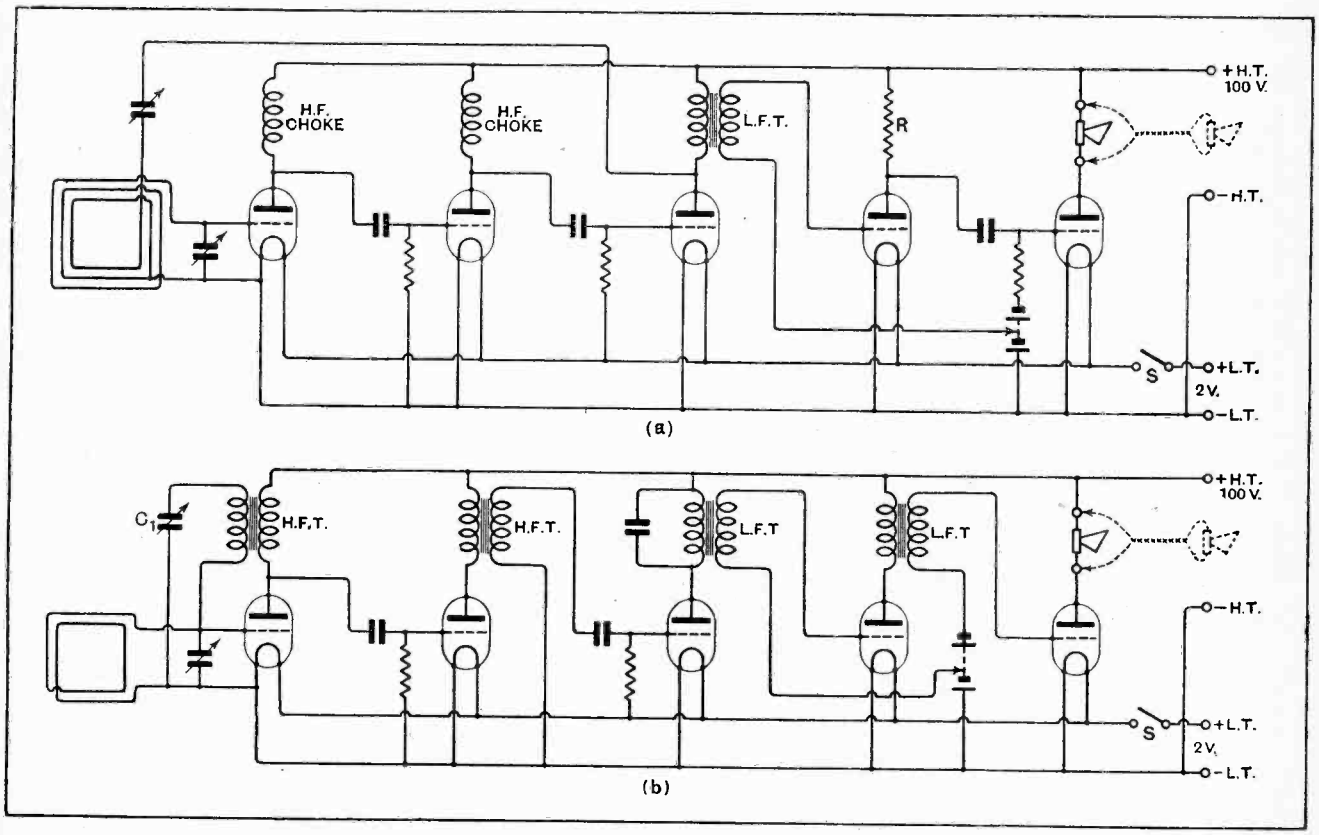


Fig. 5.—(a) A popular five-valve circuit used in many portable sets. Aperiodic H.F. chokes are employed. (b) An interesting circuit employing iron-cored high frequency transformers. In dotted lines provision for an external loudspeaker is shown.

The Portable Set.—

nearly all the sets reviewed tends to show that overloading takes place on local station reception unless the set is detuned.

An innovation which may prove of great assistance to the manufacturer is the five-electrode valve. Its mutual conductance is extremely high, and its employment may effect a reduction of one valve without impairing the efficiency of the receiver in the slightest and without unduly increasing the current consumption. We hope to be in a position soon to test this valve and give further details of its potentialities.

As regards detection, an examination of the percentage tables will reveal that 90 per cent. of the sets contain the leaky grid method, due to the fact that it is more sensitive to weak signals and will give a good, undistorted output if the input is not much over 1 volt R.M.S. Another point in its favour is that the associated anode impedance need not be very high, and resistance coupling, with its small stage gain, is not necessary. If the plate current of the detector valve is small, as would be the case with lower bend anode detection, ample regeneration, which is relied on in all sets to bring up the signal strength, would be difficult, especially on the long waves. With increasing sensitivity of receivers and increasing strength of transmissions from broadcasting stations, it may soon become necessary to use anode bend detection as standard practice, and if a lower plate impedance is necessary, so that transformer coupling may follow, *upper* bend anode rectification may be found satisfactory and is already being employed in one receiver.

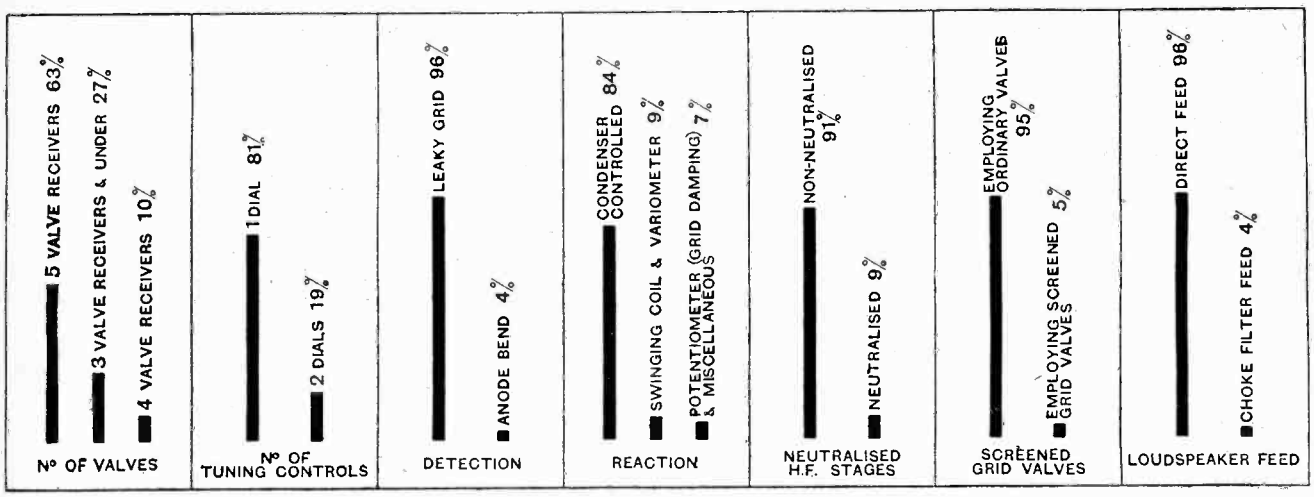


Fig. 6.—The more important couplings, controls and components are here shown according to the relative extent to which they are used.

Distortion due to L.F. Oscillation.

On the low-frequency side the percentage tables will show that by far the most popular combination is two transformers, presumably to obtain the greatest step-up possible with a minimum of components. With a common source of H.T. the two transformers are prone to give trouble with L.F. oscillation or incipient oscillation accompanied by distortion. On testing some of the sets it was found that the addition of a very small resistance to the H.T. battery produced instability, showing that unnecessary distortion from incipient oscillation was present. The incorporation of anode feed resistances as lately described in this journal would be an advantage.[1]

Volume Control by Reaction.

We have become accustomed to consider a volume control as a means whereby excessive signal strength can be cut down without detuning and without introducing distortion, but the practice among portable set makers is to call their reaction condenser a volume control. Except in cases where the circuit of Fig. 5 (*b*) is used, this volume control invariably consists of a capacity control of reaction from the plate circuit of the detector to a number of extra turns on the frame, as shown in Fig. 5 (*a*). The primary of the first L.F. transformer acts as a choke of sufficient inductance to deflect the H.F. impulses without the addition of a separate H.F. choke.

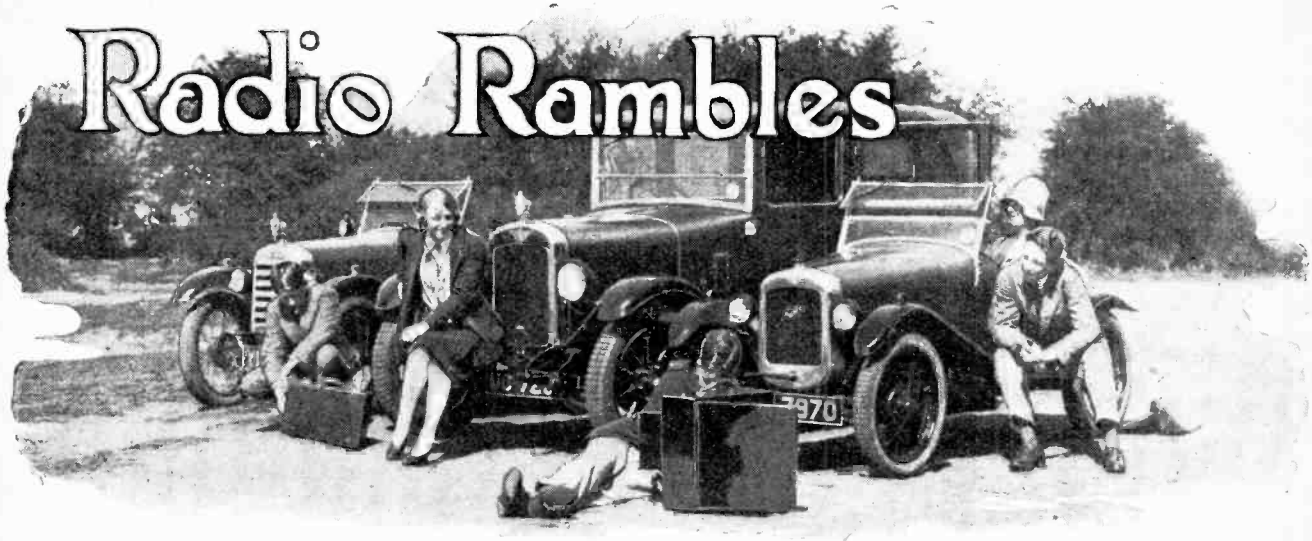
The following refinements are incorporated in a number of sets: Gramophone pick-up terminals, provision for outside aerial and earth and external loudspeaker; connections for trickle charger, so that it is unnecessary to remove the L.T. battery for charging; indicator lamp to show that the valve filaments are alight, and various miniature meters to read the state of both H.T. and L.T. batteries on load. There is a growing tendency to make provision for the use of A.C. and D.C. eliminators in the case where portable sets are used in houses wired for electric light.

In conclusion, it may justly be stated that vast strides have lately been made with the portable set, and should some of the shortcomings already referred to be overcome, it is perhaps safe to predict that, where the user's demands are not too exacting, it will eventually oust the outside aerial set.

W. I. G. P.

[1] "Battery Resistance and Distortion," *The Wireless World*, April 25th, 1928.

Radio Rambles



Reflections on the Subject of Portable Receivers, Particularly for Use on a Car.

By "WANDERPLUG."

MANY a weary year ago—I suppose it must have been soon after the war—I was invited by the Marconi Company to join a party they were organising for the purpose of demonstrating how the wireless receiver and the motor car might be linked together. I remember vividly how bitterly cold it was, and how, even in the back of a lordly Daimler saloon, I envied Capt. Eckersley, who, snugly ensconced (at least, I expected so) in the "studio" at Writtle, gave us alternately comic back-chat and Big Ben's chimes on ginger beer bottles.

The "programme," neatly bisected by a dinner at Chelmsford, where the great ones prophesied a rosy future for "Radio and the Car," was somewhat marred by the electric trams in the East End, but the demonstration, for all that, was a decided eye-opener in those early days.

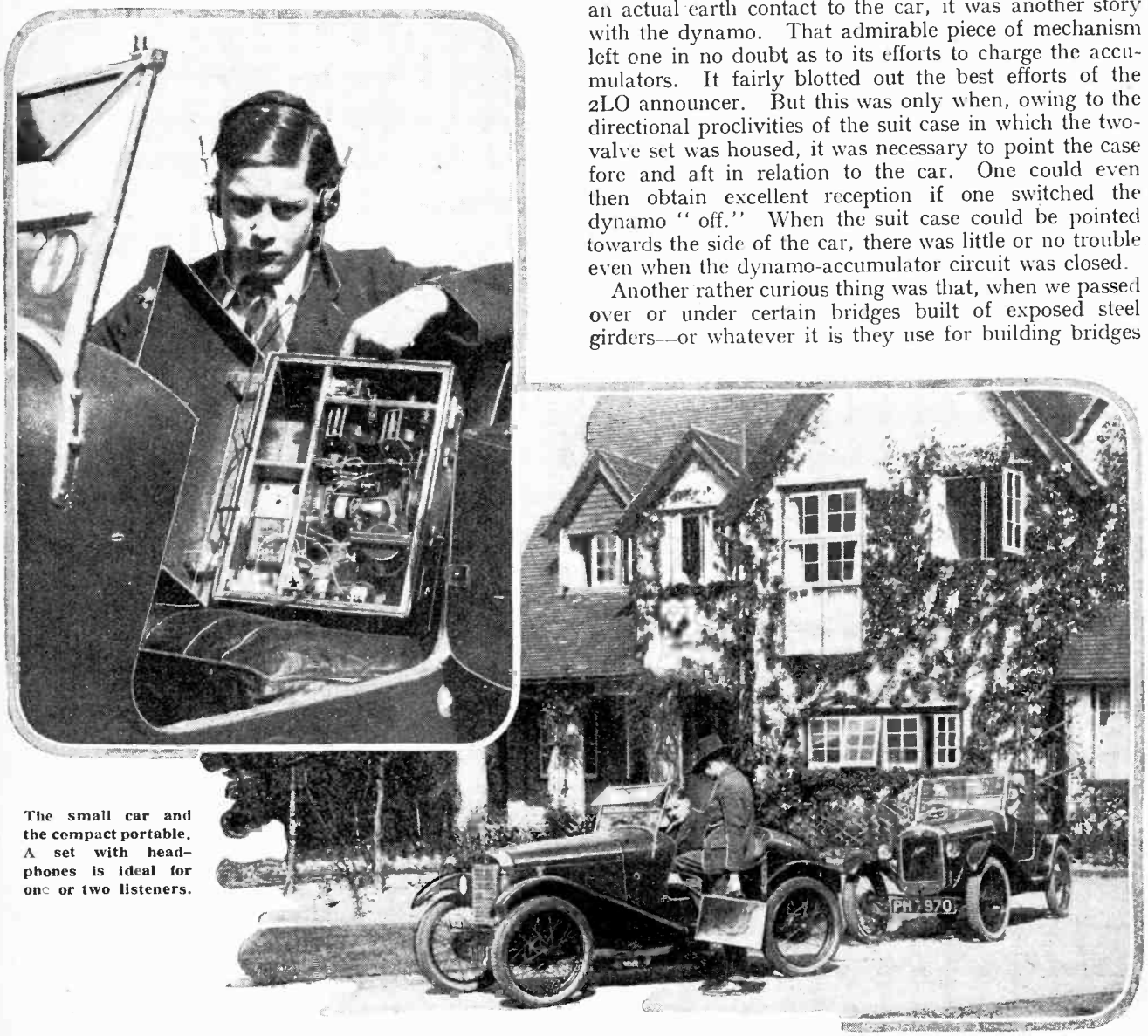
The receiver was a fearsome weapon. I don't think I am exaggerating when I say that it had nine valves, including six high-frequency amplifying stages, and I seem to recollect a frame aerial of generous dimensions that decorated the roof of the car. Only the greatest of experts could produce the "doings"—in a word, the outfit was not quite the kind of thing to put in the hands of the average motorist who thought he would like to "have a little music" to while away the tedium of a long drive.

What a Change To-day!

A few weeks ago I contracted an urge to do a little "portable" work, and I procured a couple of sets—one a seven-valve superheterodyne, and the other the most modest of small two-valve sets. With them, three cars and a party of enthusiastic young friends I sallied forth. It was one of those days for which an Arctic explorer in the middle of a blizzard would willingly sacrifice the Pole and everything else—I mean one of those almost mythical rarities, a cloudless, warm, English day. And we thoroughly enjoyed our trip.

Radio Rambles.—

The superheterodyne, as befitted its dignity, rode majestically in the back of my saloon. It was not called upon to perform actually *en route,* but that, if asked to do so, it could have " lifted the roof " I have no doubt whatever, judging by the volume of sound it produced during halts and the enthusiasm of the two-valve set, which was cavalierly hurled from one member of the party to another, what time we glided to and buck-



The small car and the compact portable. A set with head-phones is ideal for one or two listeners.

jumped along the grass road at Newlands Corner, erroneously called the Pilgrim's Way.

One thing struck me as very remarkable. Whereas some ten years ago it was deemed necessary to swathe the magneto in a strait-waistcoat of copper gauze, or the like, to reduce " Q. R. Emma " (in other words, vociferous interference) from it, to-day the " mag." seems almost inaudible. So far as I am aware, the magneto of 1928 does not differ radically from its ancestor of 1918, so I can only suppose that the muteness of our magneto—of which the motto evidently was " Thou shalt be Seen, but not Heard "—was due rather to improvement in receivers by way of their compactness giving freedom from induction, than to any inherent excellence in the magneto itself.

Reception En Route.

But, in spite of the limited pick-up and presence of an actual earth contact to the car, it was another story with the dynamo. That admirable piece of mechanism left one in no doubt as to its efforts to charge the accumulators. It fairly blotted out the best efforts of the 2LO announcer. But this was only when, owing to the directional proclivities of the suit case in which the two-valve set was housed, it was necessary to point the case fore and aft in relation to the car. One could even then obtain excellent reception if one switched the dynamo " off." When the suit case could be pointed towards the side of the car, there was little or no trouble even when the dynamo-accumulator circuit was closed.

Another rather curious thing was that, when we passed over or under certain bridges built of exposed steel girders—or whatever it is they use for building bridges —the signals faded right out while we were just arriving at or departing from the bridge. When we were over or under the centre of the bridge, the signals came up to quite reasonable strength. Perhaps some enthusiast can suggest why; I confess that it defeats me.

The suit-case of the two-valve set was so small that it might almost be called an attaché case; anyway, it was so diminutive, and light, that it could be carried

Radio Rambles.—

comfortably on the knee, in which position it could, of course, be moved round with the greatest ease so as to get the best results when we were following the twists and curves and right-angle corners of a cross-country route. Even our youngest and least-experienced companion had no difficulty in holding the London station transmission anywhere within thirty-five miles of the transmitting aerial.

Loud-speaker Reception for Many Stations.

So far I have been dealing almost entirely with the little two-valve set; by the way, its D.E. valves received their nourishment from an ordinary sixpenny pocket lamp dry battery!—but I must say something also about the superheterodyne. So beautiful was its mahogany case that we all treated it with reverent respect.

The first time I attempted to use it I was twenty miles from London. I read the directions carefully—"Put this to maximum and that to zero," and so on—and thought that, with luck, I might hear faint signals. Instead of which (as the saying is) I was very nearly knocked over backwards by the blare of sound that hit me from the loud-speaker. These modern portables are certainly "it," so far as collecting the stations is concerned. On the chart there were about thirty logged, and I'm sure there were a dozen others easily audible.

Such concessions to weakness as headphones are neither necessary nor desirable; in fact, with phones no ordinary ear drum could bear up against the signals received. I don't know where this particular superheterodyne keeps its aerial—presumably it has one somewhere—but with no outward evidence of one it rakes in, on the self-contained loud-speaker, the most impossible places without turning a hair.

For picnic parties, where several people simultaneously want to listen to broadcasting, I should say that the powerful portable set is absolutely ideal. It certainly need not be a superheterodyne, though, obviously, this gives one an almost bewildering choice of stations. But a far less elaborate outfit will serve. For example, my little two-valve receiver, with its aerial wound round between the baseboard and the leather of the suit-case, can give reasonable volume on a loud-speaker up to, say, ten or twelve miles from a main station. With another L.F. stage it would probably do all that most people would want up to twenty-five miles.

The Car and the Portable.

Between this simple little affair and the much-to-be-desired superheterodyne I have no doubt there are many alternative possibilities. The really important point is that portable sets of widely varying capabilities and prices are unquestionably now available for car owners who want them.

I don't say, for a moment, that the driver of a car should be encouraged to wear headphones while he is threading the mazes of urban or suburban traffic, but there is no earthly reason why his passengers should not. (Incidentally, it might keep them from the dangerous practice of talking to the man at the wheel.) In any case, the portable takes up little room in the back of a car, and it might well prove a godsend during those dreary evenings after dinner in country hotels, when one wonders if bed-time will ever come.

General Notes.

Mr. J. W. Wroth (2WT), 21, Henningham Road, Tottenham, N.17, is transmitting on 23, 44-46, 90, and 150-200 metres, and will welcome reports.

Mr. A. B. Whatman (6BW) has temporarily closed down his station at Twyford, but hopes shortly to resume his transmissions in the neighbourhood of Brockenhurst.

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Melbourne Heard on a Transportable Set.

An experiment was carried out on April 22nd by the Australian Press Association, assisted by Mr. C. G. Allen, of Belvedere, Kent. A six-valve Supersonic receiver was placed in a car with an aerial of about eight feet of copper wire rigged on the top. The car was driven from Salisbury Square to Australia House, where difficulty was experienced owing to magneto interference from passing buses. In the shadow of the Temple Church an Australian voice was faintly heard, but in Lincoln's Inn Fields, farther away from traffic, Melbourne, 3LO, was picked up with surprising success at about 8.55 p.m. and the sound of Melbourne's city clock striking 6.0 a.m. came in just after the London clocks had chimed 9.0 p.m. British Summer Time. The Melbourne programme was heard at full loud-speaker strength with comparatively little atmospheric interference.

TRANSMITTERS' NOTES

Short-wave Transmissions.

U 2XAL, the short-wave station of WRNY, at the Roosevelt Hotel, New York, broadcasts on 30.9 metres on Tuesdays, Wednesdays, Fridays, and Saturdays, at 7.0 p.m. onwards, Eastern Standard Time (1.0 a.m. the following day B.S.T.), and on Sundays from 4.0 p.m. to 6.0 p.m. Eastern S.T. Reports will be cordially welcomed and should be sent to station WRNY, The Roosevelt, 45th Street, and Madison Avenue, New York City.

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We are able to give particulars of a few more short-wave stations in America and the Philippine Islands, to which call-signs have recently been allotted.

U 2XAR Rocky Point, N.Y. (R.C. of A.), 80 kW., transmitting on 16, 80, 25.75, and 33.59 metres.

U 2X[illegible] Rocky Point, N.Y. (R.C. of A.), 80 kW., transmitting on 16.[illegible], 21.02, and 43.23 metres.

U 2XB[illegible] Water Mill, N.Y. (Western Electric). 5 kW., transmitting on 7.2, 10.7, 22.06, 30.1, 40.3, 79.3, and 85.3 metres.

U 6XB Bolinas, California (R.C. of A.), 80 kW., transmitting on 16.67, 21.91, and 33.33 metres.

U 6XU Bolinas, California (R.C. of A.), 80 kW., transmitting on 14.55, 21.82, and 43.64 metres

Philippine Insular Government Stations.

KZBT Buteran, P. I., 42.9 metres.
KZCM Pasay, P.I., 46.5 metres.
KZTL Tolong, P.I., 42.8 metres.

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New Call-signs Allotted (Additional).

2ML (ex 2BNR), Leslie Marshall, 58, Pernau St., Belfast. Transmits on 45 metres, generally from 20.00 G.M.T. on week-days and from 12.00 G.M.T. on Sundays, and will welcome reports.

5SJ Stanley N. Johnson, 191, Holywood Rd., Strandtown, Belfast. Transmits on 8, 23, 45, and 90 metres.

6CN G. A. Corden, Outwood Grange, Nr. Wakefield, Yorks.

6GD (ex 2BKF) S. H. Goodwin, 93, Grant Road, London, S.W.11.

6HK J. H. Harker, 31, Ruskin Avenue, St. Giles, Lincoln. Transmits on 23 and 45 metres, and welcomes reports from any distance particularly with reference to fading and quality of tone. He will also be glad to hear from other amateurs interested in low-power tests.

6LR L. A. C. Lawler, 3, Ouselev Road, Wandsworth Common. (Change of address.)

6SC S. H. Chapple, 28, Duke's Avenue, N.10. (Change of address.)

6TC T. S. Craig, 43, Southwell Rd., Bangor, Co. Down, N. Ireland.

6UU T. W. Readshaw, 69, High St., Bonnyrigg, Midlothian, Transmits on 200 metres and would like to co-operate with other experimenters on that wavelength; generally works between 11.0 and 12.0 B.S.T. on Sundays.

2[illegible]RV R. L. Varney, "Fairview," The Avenue, Sunbury-on-Thames.

2BUW[illegible] W. C. and J. N. Roe, Minydon, Ridgway Rd., Farnham, Surrey.

ATZ S[illegible] V. Smith, 110, Clonmell Rd., London, N.15.

HINTS ON PORTABLES.

Getting Best Results from Self-contained Receivers.

By "RADIOPHARE."

FRAME aerial sets are inherently more selective than others, but are by no means totally immune from interference in the "wipe-out" area surrounding a powerful station. However, a good deal may be done towards minimising this kind of interference by making proper use of the directional properties of the frame. Interference troubles will be most prevalent when the set includes aperiodic H.F. amplifiers, which in themselves do not confer any real selectivity.

Instead of adopting the obvious procedure of turning the frame so that signals from the desired stations are at a maximum, it is almost always better to set it in such a position that interfering signals are at a minimum before searching for distant transmissions. This method is clearly inapplicable when distant and local stations are in the same plane.

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Frame Orientation as Volume Control.

As far as local reception is concerned, swinging of the frame provides a most excellent control of volume, which, unlike many others, is almost entirely free from objectionable features, although admittedly there is a slight possibility of introducing interference from another station when the frame is set nearly at minimum with relation to the local transmitter.

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Signals are of maximum strength when the plane of the frame points towards the transmitting station. This statement, however, requires some qualification, and it is not always safe to set one's frame in what is assumed to be the correct direction with relation to the position of the transmitter. Where the receiver is surrounded by such objects as earthed metallic conductors, steel frame buildings, electric power circuits, etc., there is often considerable distortion of the incoming wave front, and the actual setting of the frame for loudest signals may differ widely from that expected.

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Re-radiation from Neighbouring Conductors.

The signal strength obtainable from a frame aerial receiver will often vary noticeably in different rooms of the same house, or even in different positions in the same room, due partly to the effects of screening. When attempting long-distance reception, it is always worth while trying several positions for the set; contrary to expectations, it will sometimes be found that the proximity of metallic objects, such as girders, piping, or electric light wires, will increase, rather than decrease, signal strength. This is due to re-radiation.

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When self-contained sets are used in the home as well as outside, it is worth while considering the advisability of providing a heavier set of batteries of large capacity for use when portability is not required. As is now well known, large capacity batteries are cheaper in the long run when the current consumption is heavy.

It must be remembered that H.T. dry batteries are discharged very much more quickly than are grid bias cells, from which no current is taken. As the H.T. voltage decreases, it is advisable to make corresponding reductions in negative bias, and although this will not make good deterioration in quality consequent on the use of a partially exhausted H.T. battery, it will improve results.

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It is often of advantage to include provision for headphone reception in the design of a portable receiver; occasions often arise where it is impossible to avoid disturbing others when using a loud-speaker.

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Limitations of the Frame Aerial.

Although a frame aerial scores heavily in point of portability, it is but an indifferent collector of energy. The range of every type of portable set including this kind of aerial may be increased by adding an "open" aerial and earth. Even if the design of the set does not provide for these additions, it is by no means difficult to introduce the necessary modifications; the aerial should be joined through a fixed condenser of about 0.0001 mfd. to that end of the frame winding which connects to the grid of the first valve; the earth lead can conveniently be connected to the negative terminal of the L.T. battery, which is always accessible.

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A Ready-made Aerial.

When the occasional use of an improvised open aerial is proposed, it is worth while preparing a length of light flexible rubber-covered wire with a spring clip at the far end for easy attachment to any convenient support which may offer itself.

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Greatly improved loud-speakers are now available in a form suitable for inclusion in portable receivers, and thus more attention is paid nowadays to the quality of reproduction. In order to prevent the unpleasant form of distortion brought about by incipient L.F. oscillation due to battery resistance, it should be realised that the anode feed resistance scheme, discussed in *The Wireless World* for April 25th, is applicable to sets of this kind. The fact that the H.T. batteries in these receivers are seldom of the largest capacity is an argument in favour of this plan, as the internal resistance of small cells increases very rapidly with use.

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The Question of Weight.

Generally speaking, if a portable set is to be carried any distance without fatigue, it should not weigh more than twelve or fifteen pounds. The writer expresses this opinion advisedly, and as the result of experience; an addition of four or five pounds in weight makes itself more than evident after walking a mile or so.

Abridged Specifications of Commercial Portable and Self-contained Receivers.

UNLIKE an ordinary receiver, which is usually designed to work under a fixed set of conditions, and to meet certain requirements, a portable set (if it is to fulfil its purpose) should be capable, as far as possible, of functioning anywhere. Nevertheless, as wireless design is essentially a matter of compromise, the prospective purchaser should be at some pains to decide in his own mind the principal use to which his receiver is to be put, as it is probable that his needs will best be met by one particular type of instrument. This point being settled, a careful consideration of the specifications given below will be helpful as an aid to reaching a final decision. The particulars given are, of necessity, brief, but all essential information is included, and manufacturers will always supply further details.

Self-contained receivers fall into two main classifications: first, the real portable, generally contained in an attaché case and weighing some 25 lb.—sometimes considerably less—and intended principally as an adjunct to the main set; and, secondly, the "transportable" receiver, in which the need for light weight and compactness is not so vital. This type of instrument is generally, but not exclusively, used at home; as no external aerial is required, and as the set may be readily moved from room to room, it appeals to a large number of listeners.

In the following pages, which constitute an index to sets, except where stated to the contrary (1) the receiver covers the normal broadcast waveband of from about 200-550 metres, and also the long wavelengths (from about 1,000-2,000 metres); (2) a frame aerial is contained in the case; (3) the price quoted includes the complete receiver, with batteries, valves, loud-speaker, and royalties.

ADEY (LATE ALPHIAN) PORTABLE.

Circuit. Four valves; tuned H.F. amplifier, leaky grid detector, and two transformer-coupled L.F. stages.

Controls. Two tuning dials.

Weight. 30 lb.

Remarks. A dry cell L.T. battery is fitted, and a voltmeter is mounted on the panel. A Celestion loud-speaker is enclosed in the lid.

Price. £35.

Makers' Name. Adey Wireless, Ltd. (late Alphian), 99, Mortimer Street, London, W.1.

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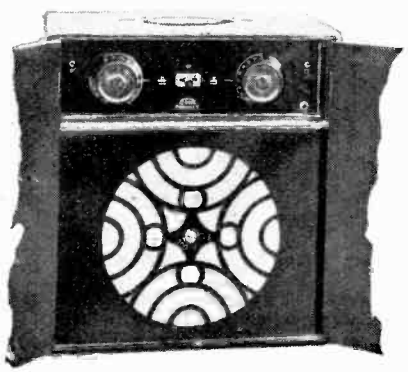
ÆONIC PORTABLE V.

Circuit. Five valves; 2 aperiodic H.F. stages, leaky grid detector, 2 transformer-coupled L.F. amplifiers.

Controls. Single tuning dial, with capacity-controlled reaction.

Dimensions. $16\frac{1}{2} \times 17\frac{1}{2} \times 8\frac{1}{2}$in. Weight complete 29 lb.



Æonic cabinet portable.

Remarks. Volume control by reaction adjustment. Cone loud-speaker built in.

Price. In oak case, £23 2s. 6d.; in mahogany case (weight 1 lb. less), £25 4s. 6d.

Makers' Name. Æonic Wireless Co., Ltd., Coventry House, South Place, Moorgate, London, E.C.2.

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ARMITAGE "WESTMINSTER MARK 1 TRANSPORTABLE."

Circuit. Four valves; two aperiodic H.F. amplifiers, detector, and one transformer-coupled L.F. stage.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 20×16×9in. Weight complete, 35 lb.

Remarks. A self-contained set with loud-speaker in a walnut cabinet. The Mullard Pentode valve is used in the L.F.

Buyers' Guide 1928.—position. Large capacity H.T. batteries are fitted.
Price. £36 15s.

ARMITAGE "WESTMINSTER MARK 2 TRANSPORTABLE."

Circuit. As in the Mark 1 receiver described above.
Remarks. This set is 5 lb. heavier than the "Mark 1" receiver, but its dimensions are the same. It includes the very unusual feature of a detachable gramophone turntable with electrical pick-up, a speed control for the clockwork motor being mounted on the instrument panel. There is also a volume control.
Price. £42.
Makers' Name. Armitage Mfg. Co., 9, St. Stephen's House, Westminster, London, S.W.1.

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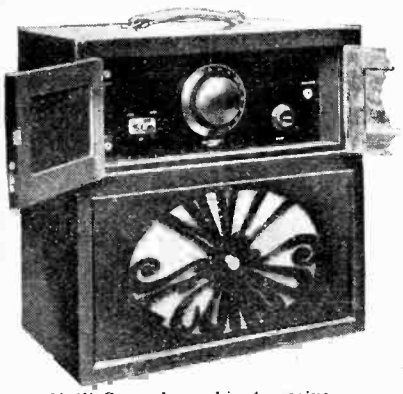
ATKINSON "NULLI SECUNDUS."

Circuit. Five valves; 2 aperiodic H.F. stages, leaky grid detector, and two transformer-coupled L.F. amplifiers.
Controls. Single tuning dial with capacity-controlled reaction.



Nulli Secundus cabinet receiver.

Remarks. Volume control by reaction adjustment. Balanced armature-driven loud-speaker built in. Provision is made for connection of a gramophone pick-up.
Price. £33 12s.
Makers' Name. C. Creswick Atkinson, M.I.R.E, 35b, High Street, Bedford.

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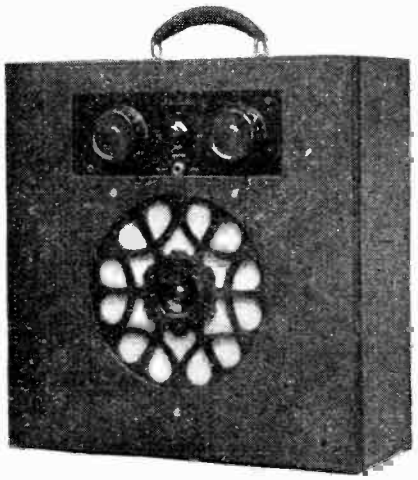
AUTOMOBILE ACCESSORIES "P.D. DUAL."

Circuit. Five valves; 2 aperiodic H.F. stages, leaky grid detector, two transformer-coupled L.F. amplifiers.
Controls. Single tuning dial with capacity-controlled reaction.
Weight. 32 lb. complete.
Remarks. Cone loud-speaker built in; this set is fitted with terminals for use of an optional external aerial-earth system and also for an external loud-speaker. Switching of filaments and wavelength change is controlled by a single knob. An adaptor can be supplied for operating the set from external batteries or from an eliminator.
Price. £26 5s.
Makers' Name. Automobile Accessories (Bristol), Ltd., P.D. Works, Sion Street and Clifton Terrace, Bedminster, Bristol.



P. D. Dual Portable.

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BURNE-JONES "MAGNUM ROAD-SIDE FOUR."

Circuit. Four valves; aperiodic H.F. amplifier, leaky grid detector with resistance and transformer-coupled L.F. amplifiers (in that order).
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 17×17×8in. Weight 27 lb.
Remarks. This set covers a waveband of from 250 to 550 metres. The built-in loud-speaker is an Amplion cone.
Price. £19.
Makers' Name. Burne-Jones and Co., Ltd., Magnum House, 288, Borough High Street, London, S.E.1.

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B. & J. "QUALITONE" PORTABLE.

Circuit. Four valves; tuned transformer H.F. amplifier, leaky grid detector, and two transformer-coupled L.F. amplifiers.

The B. and J. Qualitone.

Controls. Two tuning dials with capacity-controlled reaction.
Dimensions. 15×15×8in. Weight complete, 30 lb.
Remarks. A horn loud-speaker with a Blue Spot unit is included in this set.
Price. £22 10s.
Makers' Name. B. and J. Wireless Co., 2 and 3, Athelstane Mews, Stroud Green Road, London, N.4.

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BURNDEPT PORTABLE FIVE.

Circuit. Five valves; two aperiodic H.F. stages, leaky grid detector, with resistance- and transformer-coupled L.F. amplifiers (in that order).
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 18×17×8in. Weight complete, 30 lb.
Remarks. Built-in Celestion cone loud-speaker. An adaptor for gramophone reproduction can be supplied.
Price. In oak cabinet, £31 10s.; in mahogany cabinet, £33 10s.
Makers' Name. Burndept Wireless, Ltd., Eastnor House, Blackheath, London, S.E.3.

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CAYDON APERIODIC.

Circuit. Five valves; two aperiodic H.F. stages, leaky grid detector, and two transformer-coupled L.F. amplifiers.

Burndept cabinet portable.

Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 11½×11½×9in. Weight, 23 lb.
Remarks. Celestion loud-speaker built into lid.
Price. In pigskin, lizard or blue morocco-covered case, £36 15s.; in hide case, £34 13s.

CAYDON SEMI-TUNED.

Circuit. Five valves, the first semi-tuned anode, and the second semi-tuned transformer. Leaky grid detector, and two transformer-coupled L.F. stages.
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 16 × 13 × 8½in. Weight, 29 lb.
Remarks. Celestion loud-speaker built into lid.
Price. £36 15s.

Buyers' Guide 1928.—
Makers' Name. Campbell and Addison, 40, Howland Street, London, W.1.

COOK'S "C.W.C."

Circuit. Five valves, two choke-coupled H.F. stages, leaky grid detector, and two transformer-coupled L.F. amplifiers.
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 17×16×8in. Weight, 26 lb.
Remarks. G.E.C. built-in cone loud-speaker; polished mahogany containing case with a flap at the top covering the horizontally mounted control knobs. A turntable is fitted.
Price. £24.
Makers' Name. Cook's Wireless Co., Ltd., 23, St. Helen's Street, Ipswich, Suffolk.

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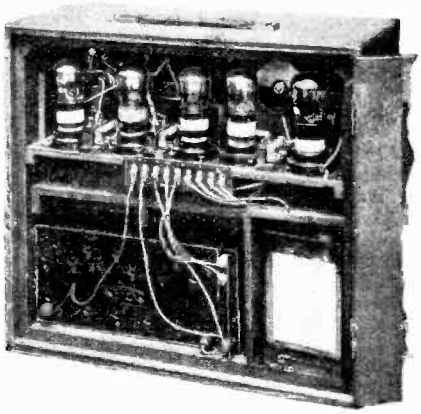
CANTOPHONE PORTABLE TWO.

Circuit. Two valves; leaky grid detector with one transformer-coupled L.F. stage.
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 12×9×5in. Weight, 10 lb.
Remarks. A lightweight set for headphone reception, contained in a leather attaché case of small dimensions.
Price. £11.

CANTOPHONE PORTABLE THREE.

Circuit. Three valves; leaky grid detector with two transformer-coupled L.F. stages.
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 16×11×8in. Weight, complete, 22 lb.
Remarks. A Mullard cone loud-speaker is built into the leather attaché case in which this receiver is contained. Provision is made for the use of a gramophone pick-up.
Price. £20 15s. 6d.



Interior of Burndept receiver.

CANTOPHONE PORTABLE FOUR.

Circuit. Four valves; tuned anode H.F. amplifier, leaky grid detector, and two transformer-coupled L.F. stages.
Controls. Two tuning dials, with reaction controlled by means of a potentiometer.
Dimensions. 16×11×6in. Weight, complete, 22 lb.

Remarks. A Mullard cone loud-speaker is built into the leather attaché case in which this set is contained. Provision is made for the use of a gramophone pick-up.
Price. £26 5s.

Caydon suitcase portable.

CANTOPHONE CABINET PORTABLE THREE.

Circuit. Three valves; leaky grid detector with two transformer-coupled L.F. stages.
Controls. One tuning dial with capacity-controlled reaction.
Dimensions. 18×15×8in.
Remarks. A self-contained portable receiver for home use, with built-in Mullard cone loud-speaker. This set can also be supplied for operation from A.C. or D.C. mains at an extra cost. Provision is made for the use of a gramophone pick-up.
Price. £23 5s. 6d.

CANTOPHONE CABINET PORTABLE FOUR.

Circuit. Four valves; tuned anode H.F. amplifier, leaky grid detector, and two transformer-coupled L.F. stages.
Controls. Two tuning dials with potentiometer control of reaction.
Dimensions. 18×15×8in.
Remarks. A self-contained portable set for home use, with a built-in Mullard cone loud-speaker. It is also supplied in a form suitable for direct operation from A.C. or D.C. mains at an extra cost. Provision is made for the use of a gramophone pick-up.
Price. £28 15s.

CANTOPHONE CABINET PORTABLE FIVE.

Circuit. Five valves; two tuned anode H.F. amplifiers, leaky grid detector, and two transformer-coupled L.F. amplifiers.
Controls. Two tuning dials with potentiometer-controlled reaction.
Dimensions. 18×15×8in.

Remarks. A self-contained portable for home use, which is also supplied in a form suitable for operation direct from A.C. or D.C. mains. A Mullard cone loud-speaker is built into the cabinet, and provision is made for the use of a gramophone pick-up. The two H.F. stages are screened.
Makers' Name. Cantophone Wireless Co., Remo House, 310-312, Regent Street, London, W.1.

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CELESTAPHONE PORTABLE FOUR.

Circuit. Four valves; tuned transformer-coupled H.F. amplifier, leaky grid detector, and two transformer-coupled L.F. stages.
Controls. Two tuning dials with capacity-controlled reaction.
Dimensions. 15×14×10in. Weight, complete, 21 lb.
Remarks. Screening is employed in the H.F. amplifier, and a cone loud-speaker is built into the case. The set is also supplied with fittings for an external power feed at £2 extra.
Price. £29.

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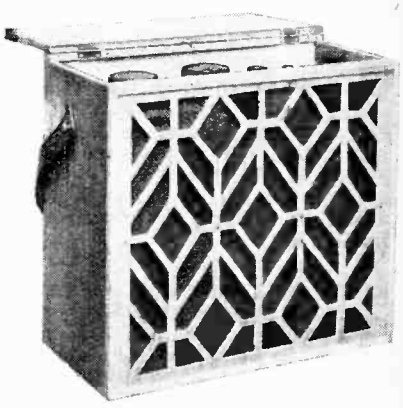
CELESTAPHONE PORTABLE FIVE.

Circuit. Five valves; one untuned H.F. amplifier, leaky grid detector, and resistance-coupled, choke-coupled, and transformer-coupled L.F. amplifiers (in that order).
Controls. Two tuning dials with special reaction coupler.
Dimensions.—18×15×10in. Weight, complete, 32 lb.
Remarks. Arranged for home use with external power feed. Provision is made for four alternative aerial circuits of any type. The H.F. amplifier is screened, and a cone loud-speaker is built into the case.
Price. £32 10s.
Makers' Name. Denison Bros., Stonecliffe Works, Wakefield Gate, Halifax.



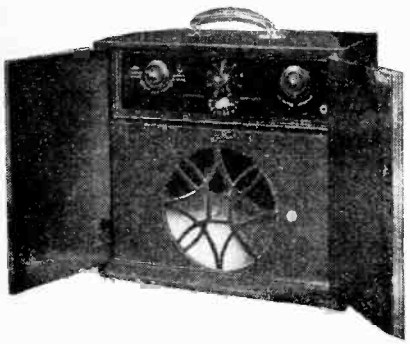
C.W.C. cabinet receiver.

DYSON'S "GODWINEX PORTABLE."

Circuit. Five valves; two tuned transformer-coupled H.F. stages, and leaky grid detector, with resistance- and transformer-coupled L.F. amplifiers (in that order).
Controls. One tuning dial with capacity-controlled reaction.
Dimensions. 16×17×8in. Weight complete, 30 lb.

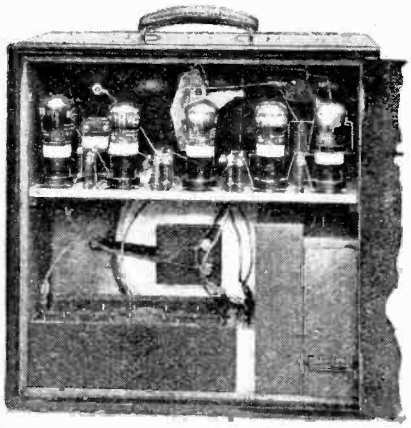
Buyers' Guide 1928.—

Remarks. Fitted with Brown loud-speaker unit and built-in horn. There is a switch for changing over from short to long waves, and provision is



Godwinex cone portable

made for connecting an external aerial when required; a plug is fitted so that an external loud-speaker may be connected, at the same time switching off that contained in the set.



Interior of Godwinex receiver.

Price. With horn loud-speaker, £26 2s. 6d. With cone loud-speaker, £28 2s. 6d.

Makers' Name. J. Dyson and Co., Ltd., St. Stephen's House, 2, Coleman Street, London, E.C.2.

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EAGLE "CHAKOPHONE TRANSPORTABLE THREE."

Circuit. Three valves; one H.F. amplifier, detector, and one L.F. stage, incorporating the Mullard Pentode valve.

Controls. Two tuning dials with reaction coupler.

Dimensions. 17×17×11½in. Weight complete, 30 lb

Remarks. A novel receiver, with a screened grid H.F. valve. The detector valve and its grid coil is completely screened. A G.E.C. loud-speaker is built into the lid.

Price. £26 5s.

Makers' Name. Eagle Engineering Co., Ltd., Saltisford, Warwick.

EMPIRE FAERIE FIVE.

Circuit. Two-screened grid Mullard valves with a special form of reaction, designed to give uniformity over the whole tuning scale; leaky grid detector, and two resistance-coupled L.F. stages.

Controls. Two tuning dials with reaction.

Dimensions. 13×12×8in. Weight complete, 18½ lb.

Remarks. An extraordinarily compact and light set of interesting design, contained in a leather-covered case, with cone loud-speaker built into the lid. The waveband covered is from approximately 200 to 550 metres. A miniature voltmeter is mounted on the metal panel.

Price. £26 5s.

EMPIRE THREE.

Circuit. Three valves; leaky grid detector with two resistance-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 19×16×5in. Weight complete, 15 lb.

Remarks. Light weight and extreme simplicity are the outstanding features of this set, which has a built-in loud-speaker. Filaments automatically switched on by opening the lid.

Price. £12 7s. 6d.

EMPIRE FOUR.

Circuit. Four valves; leaky grid detector, with three resistance-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 19×16×5in. Weight complete, 16 lb.

Remarks. Similar to the Empire Three

Chakophone self-contained receiver

described above; both these sets cover the 300-500-metre waveband.

Price. £15 2s.

Makers' Name. Empire Electric Co., 303, Euston Road, London, N.W.1.

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EMPRESS PORTABLE.

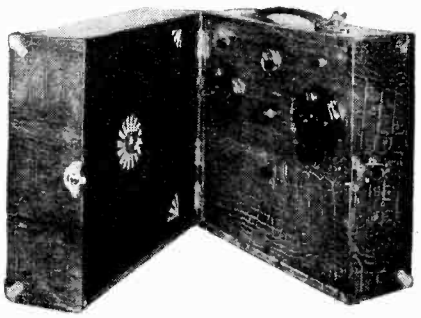
Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector, and two transformer-coupled L.F. stages.

Controls. A single tuning dial with capacity-controlled reaction.

Weight. 26 lb. complete.

Remarks. A suit-case receiver with a built-in Amplion loud-speaker.

Price. £26 5s.



Faerie Five portable.

EMPRESS "ALBANY FIVE D."

Circuit. Five valves; two H.F. amplifiers, the first with a tuned transformer coupling and the second aperiodic; leaky grid detector and two transformer-coupled L.F. stages.

Controls. Two tuning dials with capacity-controlled reaction.

Remarks. A transportable receiver with a built-in Amplion loud-speaker. The H.F. stages are screened.

Price. £31 10s.

Makers' Name. Empress Radio and Electrical Co., Manor Works, Stonehouse, Plymouth.

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EUREKA "ORTHODYNE FIVE PORTABLE."

Circuit. Five valves; 2 aperiodic H.F. amplifiers, leaky grid detector, and 2 transformer-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 15×12×10in. Weight complete, 28 lb.

Remarks. Contained in a leather suit-case, with Celestion or Amplion loud-speaker mounted in the lid.

Price. £35.

EUREKA "ORTHODYNE FIVE TRANSPORTABLE."

Circuit. Five valves; 2 aperiodic H.F. amplifiers, leaky grid detector, and 2 transformer-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 16½×13½×10½in. Weight, 33 lb.

Remarks. A home receiver contained in a polished wooden cabinet (various finishes are available) which is similar in appearance to a table gramophone. An Amplion or Celestion loud-speaker is built into the lid.

Price. £35.

Makers' Name. The Portable Utilities Co., Ltd., 8, Fisher Street, Holborn, London, W.C.1.

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FORSTER "ADVANCE PORTABLE THREE."

Circuit. Three valves; leaky grid detector with 2 transformer-coupled L.F. stages.

Buyers' Guide 1928.—
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 17×16×8in. Weight, 30 lb.
Remarks. A cone loud-speaker is built into the case. A waveband of 280 to 550 metres is covered.
Price. £18 18s.

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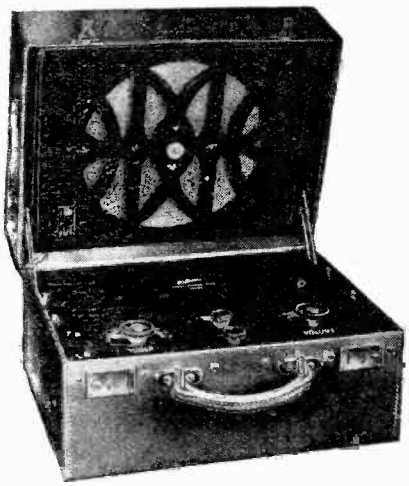
FORSTER "ADVANCE TRANSPORTABLE FOUR."

Circuit. Four valves; screened grid H.F. amplifier with tuned anode coupling, leaky grid detector, and 2 transformer-coupled L.F. amplifiers
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 18×17×8in. Weight, 35 lb.
Remarks. Metallic screening is employed in the H.F. amplifier. A cone loud-speaker is built into the case. Interchangeable coils are provided for long-wave reception.
Price. £26.



Eureka Orthodyne portable.

FORSTER "ADVANCE TRANSPORTABLE FIVE."

Circuit. Five valves; 2 screened grid H.F. amplifiers with tuned anode couplings, leaky grid detector, and 2 transformer-coupled L.F. stages.
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 18×17×8in. Weight complete, 35 lb.
Remarks. Similar to the four-valve set described above, but with 2 screened H.F. stages.
Price. £31.
Maker's Name. G. Forster, Carlton House, Lower Regent Street, London, S.W.1.

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FRANKLYN "PEGASUS ROVER."

Circuit. A nine-valve superheterodyne with first detector followed by 3 I.F. amplifiers, anode bend second detector, and 3 resistance-coupled L.F. stages; there is a separate oscillator.
Controls. Two tuning dials with capacity-controlled reaction.
Dimensions. 16¾×20×7in. Weight, complete, 32 lb.
Remarks. A compact lightweight superheterodyne. In spite of the fact that 9 valves are used, the H.T. consumption averages no more than about 10 milliamps. A Celestion cone loud-speaker is built into the case, which is of mahogany or oak, as desired.
Price. £60, complete with waterproof cover.
Maker's Name. A. G. Franklyn, 3, Boar Lane, and 3b, Camden Terrace, Leeds.

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GALLOWAY.

Circuit. An eight-valve superheterodyne with first detector, 3 I.F. stages, separate oscillator, anode bend second detector, and resistance- and transformer-coupled L.F. amplifiers.
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 19×10×9in. Weight 18 lb. exclusive of separate battery container.
Remarks. A special volume control is provided. The loud-speaker is supplied separately in accordance with the buyer's requirements, and is not included in the cabinet.
Price. £43 15s., complete with battery box.
Makers' Name. J. and L. Galloway, Ltd., 38, Mair Street, Plantation, Glasgow, S.W.1.

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GECOPHONE B.C. 2850.

Circuit. Five valves; aperiodic and tuned transformer H.F. amplifiers (in that order), leaky grid detector, and 2 transformer-coupled L.F. stages.
Controls. Two tuning dials with capacity-controlled reaction.
Dimensions. 20½×14½×8½in. Weight complete, 35 lb.
Remarks. The built-in cone loud-speaker is driven by a balanced armature unit. Provision is made for external aerial and earth.
Price. £30.

GECOPHONE B.C. 7000.

Circuit. A seven-valve supersonic heterodyne, with first detector, separate oscillator, two I.F. stages, second detector, and two transformer coupled L.F. amplifiers.
Controls. Two tuning dials with capacity-controlled reaction.
Dimensions. 15×21×9¼in. Weight complete, 35 lb.
Remarks. Fitted with an enclosed horn loud-speaker, and provision is made for connecting an external loud-speaker by means of a jack.
Price. £40.
Makers' Name. General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Gecophone cabinet receiver.

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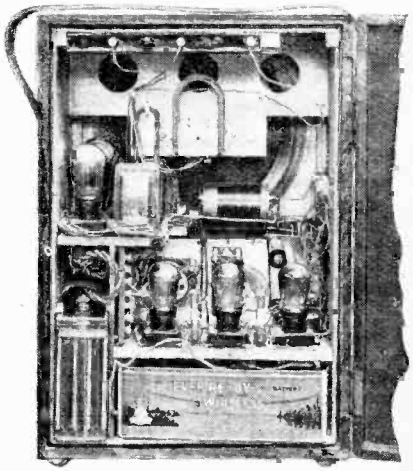
GOTTLIEB "R.S.V.P."

Circuit. Five valves; two aperiodic H.F. stages, leaky grid detector, and transformer- and resistance-coupled L.F. amplifiers (in that order).



Interior view of Gecophone portable.

Controls. Single tuning dial with capacity-controlled reaction.
Weight. 28 lb. complete.
Remarks. Supplied in oak, mahogany or leatherette covered cases, in which a cone loud-speaker is included.
Price. In leatherette, £22 0s. 6d.; in oak, £23 1s. 6d.; in mahogany, £25 3s. 6d.
Makers' Name. J. L. Gottlieb and Co., Ltd., 15, Cromer Street, London, W.C.1.

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HALCYON DE LUXE.

Circuit. Two aperiodic H.F. amplifiers, leaky grid detector, and two transformer-coupled L.F. stages.
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 18½×14×8in. Weight, 40 lb.
Remarks. This receiver is fitted with a turntable in order that full advantage may be taken of the directional properties of the frame aerial. A red pilot light shows if the batteries are switched on, and also serves as an indication of the stage of the charge of the L.T. battery. There are two separate frames, the change-over from long to short

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R.S.V.P. Portable Five.

waves being made by means of a switch.
Price. £36 15s.
Makers' Name. Halcyon Wireless Co., Ltd., Canberra House, 313-319, Regent Street, London, S.W.1.

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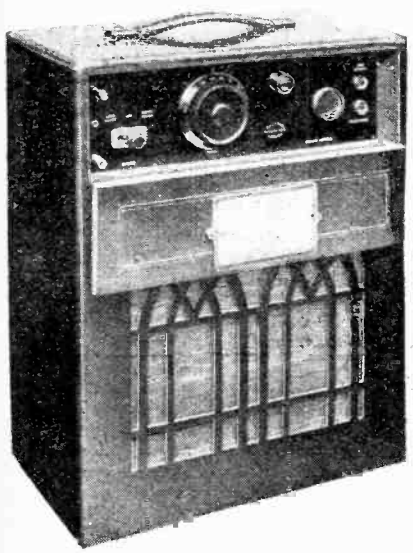
HART COLLINS FIVE-VALVE PORTABLE.

Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector, and two transformer-coupled L.F. amplifiers.
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 16×16½×6½in. Weight, complete, 30 lb.
Remarks. This receiver is of the cabinet type with an Amplion "Radiolux" loud-speaker included.
Price. £30.



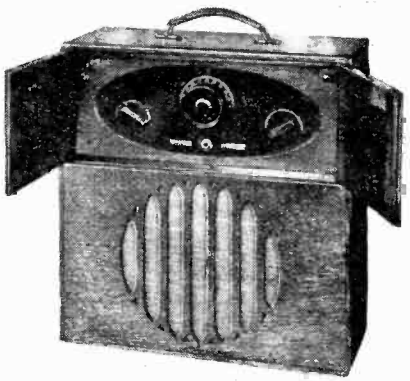
Halcyon cabinet receiver.

HART COLLINS FIVE-VALVE DE LUXE.

Circuit. Two aperiodic H.F. amplifiers, leaky grid detector, and two transformer-coupled L.F. stages.
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 16×16×6½in. Weight, complete, 28 lb.
Remarks. In common with other Hart Collins portables, wave changing is effected by a switch. A cone loud-speaker is included in this model.
Price. £32 11s.

HART COLLINS TOURIST MODEL.

Circuit. Five valves; two aperiodic H.F. amplifiers, anode bend detector, and two transformer-coupled L.F. stages.
Controls. Single tuning dial with capacity-controlled reaction.



Hart-Collins cabinet receiver.

Dimensions. 14½×11¾×8in. Weight, complete, 25 lb.
Remarks. An exceptionally compact and light set. The Brown cone loud-speaker is mounted in the lid.
Price. £33 12s.
Makers' Name. Hart Collins, Ltd., 38a, Bessborough Street, London, S.W.1.

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HENDERSON Type "N."

Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector, with transformer and resistance-coupled L.F. stages (in that order).
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 17½×15×8in. Weight complete, 25 lb.
Remarks. The Amplion loud-speaker is built into the cabinet. Access to the control panel is obtained by lifting a flap.
Price. £25.

HENDERSON Type "S."

Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector with transformer and resistance-coupled L.F. stages (in that order).
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 17×12½×9½in. Weight complete, 30 lb.
Remarks. This receiver is obtainable with a pedestal table at the extra cost of £5; it includes a built-in Celestion loud-speaker.
Price. £30.
Makers' Name. W. J. Henderson and Co., Ltd., 351, Fulham Road, London, S.W.10.

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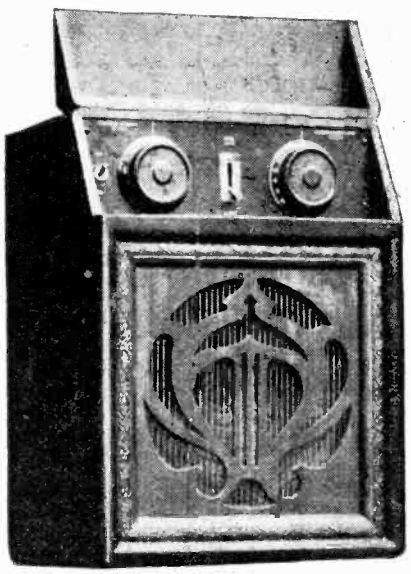
H.P.L. THREE.

Circuit. Leaky grid detector with two transformer-coupled L.F. stages.
Controls. Single tuning dial with moving coil reaction.
Dimensions. 12×12×9in. Weight complete, 22 lb.
Remarks. A cone loud-speaker is built into the lid; the set is designed for the reception of the local station and 5GB, and thus covers a waveband of 250 to 550 metres. Provision is made for connecting an external aerial.
Price. £16.

H.P.L. FOUR.

Circuit. Four valves; one aperiodic H.F. amplifier, leaky grid detector, and two transformer-coupled L.F. amplifiers.
Controls. Single tuning dial and moving coil reaction.
Dimensions. 12×14×9in. Weight complete, 27 lb.



Henderson self-contained receiver.

Remarks. This receiver covers both medium and long broadcast bands; otherwise the remarks concerning the H.P.L. Three are applicable.
Price. £24.
Makers' Name. Heath Plugs, Ltd., Kennington Cross, London, S.E.11.

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IGRANIC NEUTROSONIC SEVEN.

Circuit. Seven-valve superheterodyne, with signal-frequency tuned transformer H.F. amplifier, two I.F. stages, and single choke-coupled L.F. amplifier, 2 anode bend detectors.
Controls. Three tuning dials, no reaction.
Dimensions. 16¾×12×10in. Weight complete, 24 lb.
Remarks. The frame aerial is wound in

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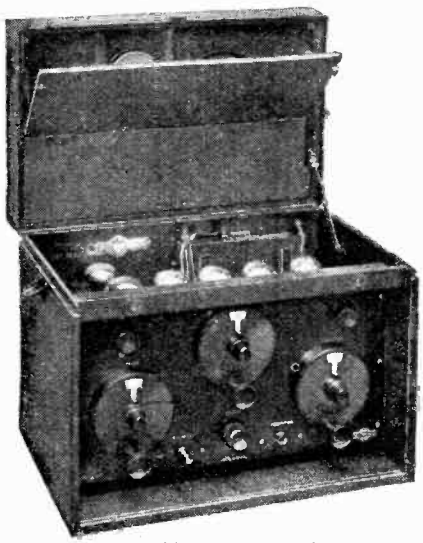
the lid of the battery box, which is a separate unit. A special battery box containing a cone loud-speaker can be supplied.
Price. £44 11s. 6d. Battery box complete with frame, £13 5s. Ditto, with loud-speaker, £21 extra.

IGRANIC FIVE-VALVE PORTABLE.

Circuit. Five valves; two H.F. amplifiers, detector, and two L.F. stages. A new receiver; details not available.



Igranic portable superheterodyne.

Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 17¼ × 17¼ × 9¼in. Weight under 40 lb.
Remarks. A Brown cone loud-speaker is built into the lid.
Makers' Name. Igranic Electric Co., Ltd., 149, Queen Victoria Street, London, E.C.4.

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LEVER "TRIX PORTABLE FOUR."

Circuit. Leaky grid detector with three resistance-coupled L.F. stages.

The new Igranic portable.

Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 18 × 16 × 9in. Weight complete, 30 lb.
Remarks. A cone loud-speaker is built into the set.
Price. £21 8s.

LEVER "TRIX PORTABLE FIVE."

Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector, with resistance and transformer-coupled L.F. stages (in that order).
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 18 × 16 × 9in. Weight complete, 30 lb.
Remarks. Sockets are fitted for the optional connection of an external aerial-earth system; also jacks for an external loud-speaker. Provision is made for the use of a gramophone pick-up.
Price. £30.
Makers' Name. Eric J. Lever (Trix), Ltd., 8-9, Clerkenwell Green, London, E.C.1.

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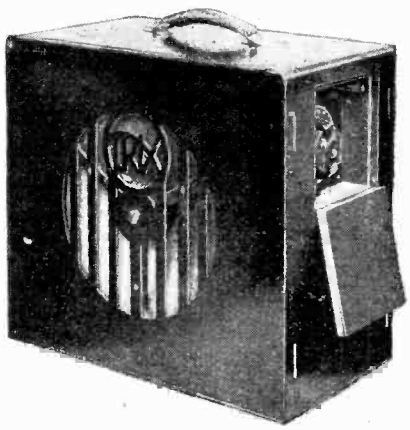
LINDLEY FIVE.

Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector, with resistance- and transformer-coupled L.F. amplifiers.



Trix cabinet receiver.

Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 17½ × 17½ × 8in. Weight, 32 lb.
Remarks. An Amplion cone loud-speaker is mounted in the mahogany cabinet, which is fitted with a turntable and a removable canvas cover.
Price. £30.
Makers' Name. Lindley and Co., 14, Great Queen Street, Kingsway, London, W.C.2.

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LIVERPOOL RADIO SUPPLIES "UNI-FLEX."

Circuit. Five valves; two aperiodic H.F. amplifiers, and leaky grid detector, with transformer- and resistance-coupled L.F. stages (in that order).
Controls. Single tuning dial with capacity-controlled reaction.
Weight. 28 lb.
Price. £25.
Remarks. An M.P.A. cone is included in the case.
Makers' Name. Liverpool Radio Supplies, 64, Myrtle Street, corner of Grove Street, Liverpool.

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LANGHAM "TRANSATLANTIC."

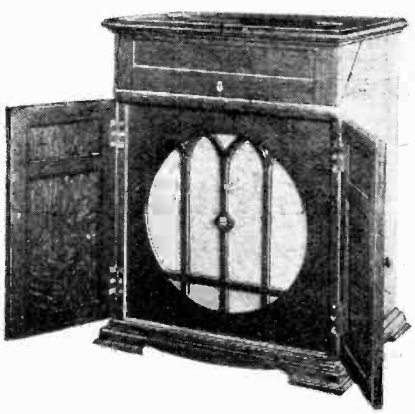
Circuit. Five valves; two aperiodic H.F. stages; leaky grid detector, and two transformer-coupled L.F. stages.

The Lindley Five.

Controls. Single tuning dial with capacity controlled reaction.
Dimensions. 15 × 15 × 9½in. Weight complete, 27 lb.
Remarks. A single three-position switch is arranged to control batteries and wavelength range. A Langham cone loud-speaker is built into the lid of the leather case. Medium and long wave-bands are covered by interchangeable transformers.
Price. £36 15s.

LANGHAM "TRANSPORTABLE."

Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector, and two transformer-coupled L.F. stages.
Controls. Single tuning dial with capacity-controlled reaction.
Dimensions. 21 × 16 × 12½in. Weight complete, 45 lb.
Remarks. A transportable receiver primarily intended for home use, with built-in Langham cone loud-speaker.
Price. In oak, £36 15s.; in mahogany or walnut, £37 16s.
Makers' Name. Langham Radio, 96, Regent Street, London, W.1.



Langham Transportable.

Buyers' Guide 1928.–

M.P.A. TRANSPORTABLE THREE.

Circuit. Three valves; leaky grid detector with transformer- and resistance-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 20×15×9in. Weight complete, 28 lb.

Remarks. Two separate frame aerials are mounted at right angles, and are thrown into circuit by a switch. An M.P.A. sprung-diaphragm loud-speaker is mounted in the case.

Price. £26 5s.

M.P.A. TRANSPORTABLE FIVE.

Circuit. Five valves; two tuned transformer-coupled H.F. amplifiers, leaky grid detector with resistance- and transformer-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 20×15×9in. Weight complete, 30 lb.

Remarks. Arrangement of frames and loud-speaker as in the M.P.A. three-valve set described above. The H.F. couplings, which are screened, are interchangeable for the two broadcast wavebands.

Price. £36 15s.

Makers' Name. M.P.A. Wireless, 62, Conduit Street, Regent Street, London, W.1.

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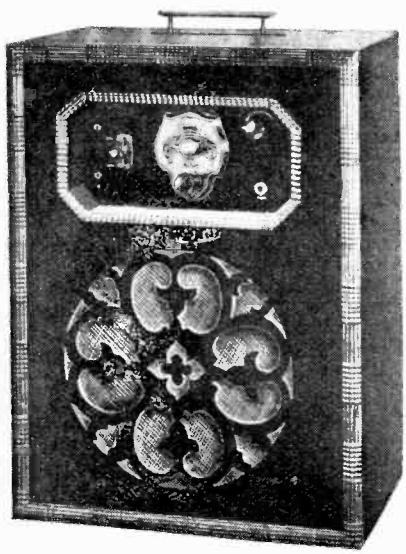
McMICHAEL PORTABLE FIVE.

Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector, two transformer-coupled L.F. stages.



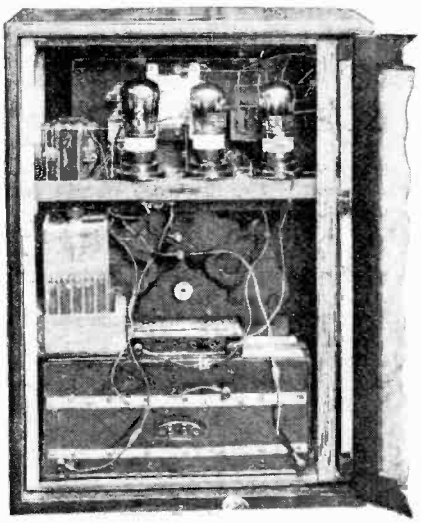
M.P.A. three-valve cabinet receiver.

Controls. Single tuning dial with variometer controlled reaction.

Dimensions. 15½×12¾×8¾in. Weight, 28 lb.

Remarks. A Celestion loud-speaker is built into the lid of the case, which is of leather. The appropriate McMichael aperiodic couplings are put into circuit for long or short waves by a switch, which also has a third position controlling filament lighting. A feature of the set is its high amplification on long waves.

Price. £31 10s.



Interior of M.P.A. receiver.

McMICHAEL TRANSPORTABLE FIVE.

Circuit. On the same lines as that of the portable set reviewed above.

Remarks. This is a receiver for the home, and can easily be moved from room to room. It is operated in conjunction with the well-known McMichael frame aerial, which is mounted on top of the cabinet; any type of loud-speaker can be used, as this is not included in the instrument.

Price. £30, exclusive of loud-speaker.

Makers' Name. L. McMichael, Ltd., Wexham Road, Slough, Bucks, and 179, Strand, London, W.C.2.

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NEOPHONE PORTABLE.

Circuit. Three valves; leaky grid detector with two transformer-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 18×18×9in. Weight complete, 30 lb.

Remarks. Neophone cone loud-speaker built into the case, which is of oak, with fail front. Another model, with mahogany cabinet and Blue Spot loud-speaker, is priced at £15. These sets cover the medium broadcast waveband.

Price. £10.

NEOPHONE EVERYMAN FOUR.

Circuit. Four valves; transformer-coupled H.F. amplifier, anode bend detector, with resistance- and transformer-coupled L.F. stages.

Controls. Two tuning dials.

Dimensions. 18×18×9in. Weight complete, 30 lb.

Remarks. A commercial version of the famous "Everyman Four" receiver, constructed in portable form, with frame aerial and optional open aerial. A Blue Spot loud-speaker is included in the case.

Price. £20.

Makers' Name. Neophone Engineering Co., 9 and 10, Little St. Andrew Street, St. Martin's Lane, London, W.C.2.

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ORMOND PORTABLE.

Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector, and two transformer-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 18×14×9in. Weight complete, 32 lb.

Remarks. In mahogany cabinet, with control panel protected by flap. Built-in Ormond cone loud-speaker.

Price. £27 12s. 6d.

Makers' Name. Ormond Engineering Co., Ltd., 199-205, Pentonville Road, King's Cross, London, N.1.

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PORTADYNE TYPE "C."

Circuit. Five valves; two H.F. amplifiers, detector, and two L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 15×13×8in. Weight complete, 30 lb.

Price. £30 9s.

Remarks. A horn of special design is built into the cabinet.

Makers' Name. Whittingham Smith and Co., 110, Kew Green, Kew, London.

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PYE TYPE 25.

Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector, and two transformer-coupled L.F. stages.

Controls. A single tuning dial with moving coil reaction.

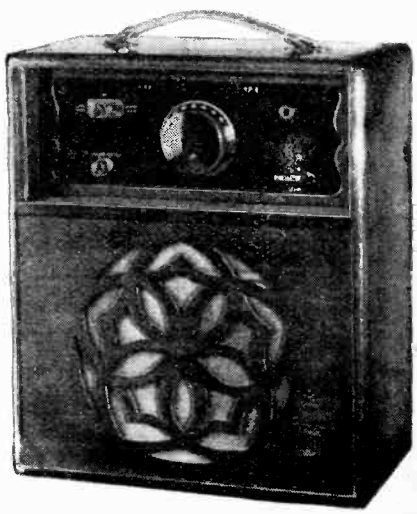
Dimensions. 16×16×7½in. Weight, 30 lb.

Remarks. Contained in an upright walnut cabinet with built-in loud-speaker.

Price. £30 12s. 6d.

PYE TYPE 555.

Circuit. Five valves; two tuned transformer H.F. amplifiers, leaky grid de-



Portadyne cabinet set.

Buyers' Guide 1928.—

tector, and two transformer-coupled L.F. stages.

Controls. Fixed tuned anode with corrector.

Dimensions. 16×16×7½in. Weight, 30 lb.

Remarks. An interesting receiver intended for the reception of Daventry long-wave station only, thus permitting of very high amplification on this wavelength without any complications. A cone loud-speaker is built into the cabinet (supplied in either oak or walnut), and a volume control is provided.

Price. £25 12s. 6d.

Makers' Name. W. G. Pye and Co., Granta Works, Montague Road, Cambridge.

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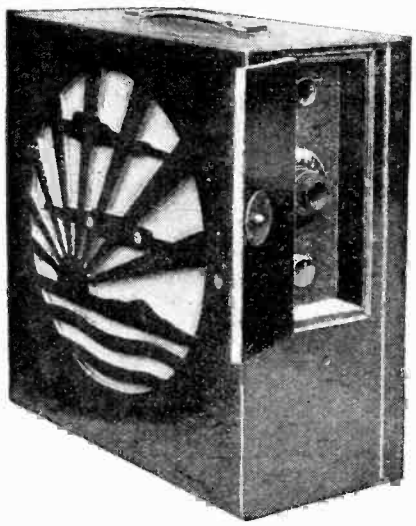
RADIOCRAFT CONSOLE.

Circuit. Three valves; screened grid H.F. amplifier, anode bend detector, and Mullard Pentode L.F. amplifier.



Pye all-wave receiver.

Controls. Two tuning dials; no reaction.

Dimensions. 34×16×16in.

Remarks. An interesting and unconventional receiver, contained in a rectangular cabinet with cover for control panel, mounted on short legs fitted with rubber-tyred wheels. A special loud-speaker is mounted in the lower part of the cabinet, and a volume control is included. The frames are in duplicate, and are non-directional.

Price. £26 5s.

Makers' Name. Radiocraft Supplies, Ltd., 9, The Arcade, Walsall.

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THE "REAL" PORTABLE.

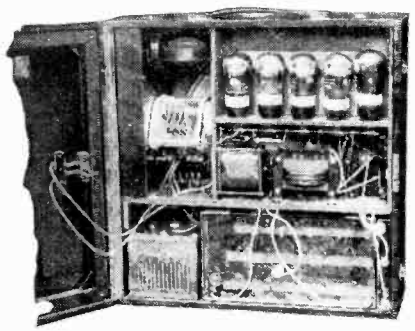
Circuit. Five valves; two aperiodic H.F. amplifiers, detector, and two L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 16×16×7in. Weight, 22 lb.

Remarks. A compact attaché case receiver. Controls are accessible through a hinged door at one end of the case. The enclosed loud-speaker is automatically disconnected if desired by the insertion of a plug connected to an external instrument.

Price. £27 2s. 6d.



Interior of Pye receiver.

THE "REAL" HOME RECEIVER.

Circuit. Five valves; 2 H.F. amplifiers, detector, and 2 L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 15×15×24in. Weight, 35 lb.

Remarks. A semi-portable home receiver, contained in an upright cabinet with fall flap covering the controls. The loud-speaker is mounted in the top section of the cabinet.

Price. £35 2s. 6d.

Makers' Name. Read Radio, Ltd., 67, Newman Street, Oxford Street, London, W.1.

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REES-MACE "ALL-IN TWO."

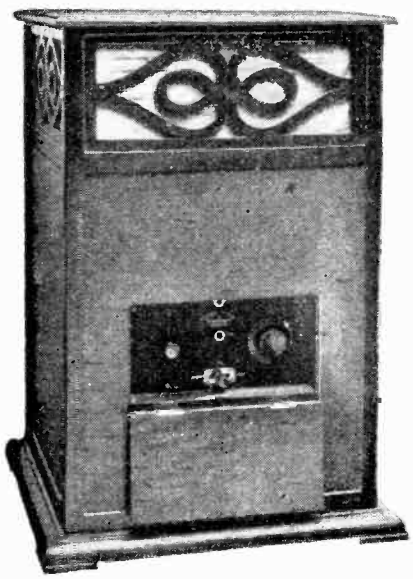
Circuit. Two valves; leaky grid detector, with transformer-coupled L.F. amplifier.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 15½×14½×7½in. Weight, complete, 25 lb.

Remarks. Covers a waveband of between 200 and 600 metres. A Rees-Mace cone loud-speaker is built into the cabinet, which is supplied in oak, mahogany, walnut, or with a leather cover. All Rees-Mace sets are fitted with a revolving turntable.

Price. £16 16s.



The "Real" self-contained receiver.

REES-MACE "ALL-IN THREE."

Circuit. Three valves; leaky grid dectector and 2 transformer-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 15½×14½×7½in. Weight, complete, 26½ lb.

Remarks. See above.

Price. £21.

REES-MACE "ALL-IN FOUR."

Circuit. Four valves; tuned transformer H.F. amplifier, leaky grid detector, and 2 transformer-coupled L.F. stages.

Controls. Two tuning dials, with a patented form of reaction.

Dimensions. 17½×16½×8in. Weight, complete, 33 lb.

Remarks. See above. This set covers both medium and long broadcasting wavelengths.

Price. £29 8s.

Rees-Mace four-valve portable.

REES-MACE "ALL-IN FIVE."

Circuit. Five valves; 2 aperiodic H.F. amplifiers, leaky grid detector, and 2 transformer-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 17½×16½×8in. Weight, complete, 30 lb.

Remarks. See above. This model also covers the medium and long broadcasting wavelengths, and, in addition, is wired for use with a gramophone pick-up.

Price. £30 2s. 6d.

Makers' Name. Rees-Mace Manufacturing Co., Ltd., 39A, Welbeck Street, London, W.1.

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ROLLS PHANTOM FIVE.

Circuit. Five valves; 2 aperiodic H.F. amplifiers, leaky grid detector, and 2 transformer-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 15×12×8in. Weight, complete, 28 lb.

Remarks. Contained in an attaché case of real hide, with turned edges. A

Buyers' Guide 1928.—

Celestion loud-speaker is mounted in the lid.

Price. £35.

Makers' Name. Hoare & Jagels, Ltd., 28-9, Great Sutton Street, London, E.C.1.

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RUNNYMEDE.

Circuit. Five valves; 2 aperiodic H.F. amplifiers, the first being choke-coupled, with leaky grid detector. The 2 L.F. stages are coupled by transformer and resistance.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 17×16½×10in. Weight, 36 lb.

Remarks. A 3ft. logarithmic loud-speaker horn is included in the case. Alternatively, a cone can be fitted if specially ordered.

Price. £28.

Makers' Name. Runnymede Engineering & Electrical Co., Dacre House, Victoria Street, London, S.W.1.

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SCIENTIFIC SUPER FIVE.

Circuit. Five valves; 2 aperiodic H.F. amplifiers and leaky grid detector, with resistance- and transformer-coupled L.F. amplifiers.

The Rolls suitcase receiver.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions 18×17×8in. Weight, complete, 30 lb.

Remarks. A transportable receiver in a leather-covered upright cabinet with built-in Brown cone loud-speaker.

Price. £25.

Makers' Name. Scientific Supply Stores, 126, Newington Causeway, London S.E.1.

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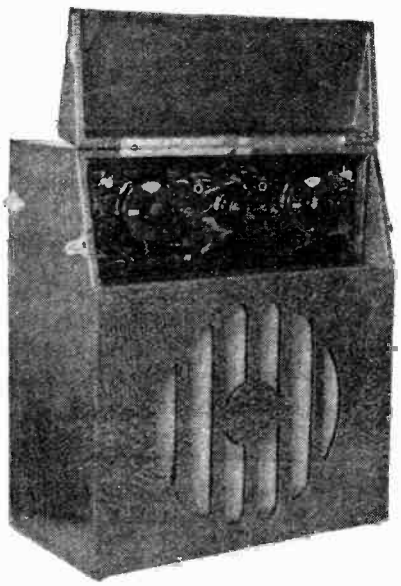
SELECTOR THREE.

Circuit. Three valves; leaky grid detector with 2 transformer-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.



Scientific cabinet set.

Dimensions. 16½×12½×7¼in. Weight, complete, 25 lb.

Remarks. Self-contained cabinet receiver with built-in Amplion cone loud-speaker. Covers a waveband of from 250 to 550 metres.

Price. In oak, £18 18s.; in mahogany, £19 19s.

SELECTOR PORTABLE FIVE.

Circuit. Five valves; 2 aperiodic H.F. amplifiers with leaky grid detector and 2 transformer-coupled L.F. stages.

Controls. Single tuning dial with capacity-controlled reaction.

Dimensions. 18×17×7in.

Remarks. Self-contained cabinet receiver with built-in Amplion cone. Provision is made for using a gramophone pick-up; the L.T. battery can be charged without removing it from the cabinet.

Price. £33 12s.

SELECTOR SUPER.

Circuit. A seven-valve superheterodyne with three I.F. stages and 2 detectors, followed by transformer- and choke-coupled L.F. amplifiers.

Controls. Two tuning dials; no reaction.

Dimensions. 18×18×7in. Weight, complete, 48 lb.

Remarks. Cabinet superheterodyne receiver with horn loud-speaker included. The H.T. accumulator battery can be charged without removing it from the cabinet.

Price. £57 15s.

Makers' Name. Selectors, Ltd., 1, Dover Street, Piccadilly, London, W.1.

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SHERWOOD SUPERB FIVE.

Circuit. Five valves; 2 aperiodic H.F. amplifiers and leaky grid detector, with transformer- and resistance-coupled L.F. amplifiers (in that order).

Controls. Single tuning dial with moving coil reaction.

Dimensions. 17×17×7in. Weight, complete, 23 lb.

Remarks. A cabinet receiver with an exceptionally wide wave range (300-2,850 metres). A special horn loud-speaker is included.

Price. In oak, £21; in mahogany, £22.

Maker's Name. A. M. E. Sherwood, 68, Hatton Garden, London, E.C.1.

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"S.R.S. PORTABLE THREE."

Circuit. Three valves; leaky grid detector and 2 transformer-coupled L.F. amplifiers.

Controls. Single tuning dial with moving coil reaction.

Dimensions. 13½×13½×6in. Weight, complete, 20 lb.

Remarks. A cabinet receiver with a door in front, the opening of which automatically switches on the filaments and discloses the flare of the horn.

Price. £17 17s.

Makers' Name. The Station Radio Stores, 38, Palmer Street, Victoria Street, London, S.W.1.

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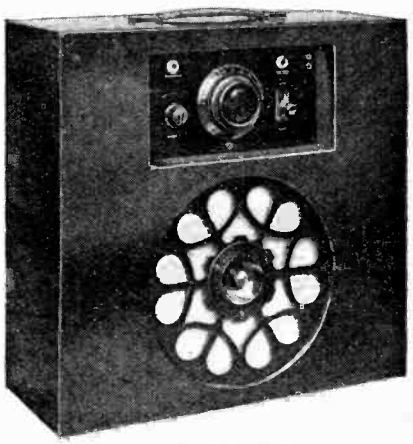
STANAPHONE.

Circuit. Three valves; leaky grid detector, with resistance- and transformer-coupled L.F. amplifiers (in that order).

Controls. Single tuning dial, with capacity-controlled reaction.

Dimensions. 12×12×10in. Weight complete, 18 lb.



The Selector Five.

Remarks. A cone loud-speaker is included

Price. £15 15s.

Makers' Name. M. Stanley and Co., 174, London Road, Liverpool.

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SYMPHONY PORTABLE FIVE.

Circuit. Five valves; two aperiodic H.F. amplifiers, leaky grid detector, and two transformer-coupled amplifiers.

Controls. Single tuning dial, with capacity-controlled reaction.

Dimensions. 16¼×13½×8½in. Weight complete, 35 lb.

Remarks. A self-contained receiver in a wooden case provided with a slip-on waterproof cover; a fall flap covers the control panel. A Symphony cone loud-speaker is included.

Price. £27 10s.

Makers' Name. A. J. Stevens and Co.

Buyers' Guide 1928.—

(1914), Ltd., Walsall Street, Wolverhampton.

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TRUPHONIC "SERAPHONE FIVE."

Circuit. Five valves; two aperiodic H.F. amplifiers and leaky grid detector, with transformer- and resistance-coupled L.F. amplifiers.

Controls. Two edgewise dials for tuning and reaction.

Weight. 30 lb.

Remarks. Self-contained cabinet receiver with sunk control panel. A Brown cone loud-speaker is fitted, with its grille below the controls. Provision is made for the use of a gramophone pick-up.

Price. £33 10s.

Makers' Name. Truphonic Trading Co., Triumph House, 189, Regent Street, London, W.1.

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W.B. CONSTRUCTIONAL PORTABLE.

Circuit. Five valves; two aperiodic H.F. amplifiers, and leaky grid detector, with two transformer-coupled L.F. amplifiers.

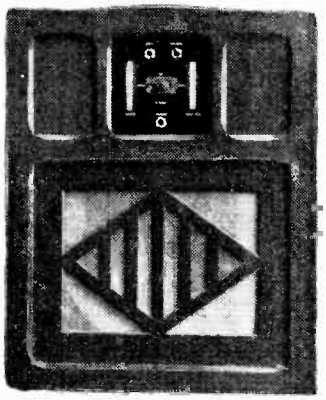
Controls. One variable condenser and one balancing condenser.

Dimensions. 18 × 16 × 7½in. Weight complete, 30 lb.

Remarks. This receiver is supplied in the form of a set of parts, including such well-known components as Mullard valves, Dubilier condensers, McMichael aperiodic transformers, and a Blue Spot balanced armature cone unit. A ready-made oak cabinet of conventional design is included.

Price. Approximately £15.

Makers' Name. Walker Bros. (Guildford), Ltd., St. Joseph's Works, Bramley, Guildford, Surrey.



Truphonic cabinet receiver.

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ZONE.

Circuit. Five valves; two aperiodic H.F. stages, and leaky grid detector, with transformer- and resistance-coupled L.F. stages.

Controls. Single tuning dial, with capacity-controlled reaction.

Dimensions. 11½ × 11¼ × 9½in. Weight complete, 25 lb.

Remarks. One of the smallest portable receivers of its class. The Celestion loud-speaker is mounted behind an ivorine grille. Separate frame aerials for the two wavebands are built in; that not in use is short-circuited by the change-over switch.

Price. £31 10s.

Makers' Name. Zone Wireless Co., Ltd., Poland House, 167, Oxford Street, London, W.1.

Six representative types of portable receivers are reviewed in greater detail on pages 533–538.

NEWS FROM THE CLUBS.

Golders Green Society's Summer Programme.

The growing interest in summer-time wireless is reflected in the decision of the Golders Green and Hendon Radio Society to hold meetings twice a month during the summer at the houses of various members. In addition to a field day once a month, the forthcoming programme includes a club dinner at the Comedy Restaurant on Friday next, May 18th, and a picnic field day on Sunday, May 20th, at Ashridge Park, Berkhamsted. A direction-finding field day will be held on June 17th.

An interesting side-line of the society's activities is the publication of a monthly bulletin which not only keeps members in touch with forthcoming arrangements, but provides a safety valve for humorous correspondents, thus:—

"'Puzzled' (Hendon).—'L.T. 1.20, H.T. 7.40,' probably refers to the tides. But why worry?"

Hon. secretary: Lt.-Col. H. Ashley Scarlett, 357a, Finchley Road, N.W.3.

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South Croydon Society's Dinner.

Capt. Derek McCulloch, the popular 2LO announcer, occupied the chair at the "end of the season" dinner of the South Croydon and District Radio Society on Wednesday, May 2nd. Mr. Vellacott, in welcoming Capt. McCulloch, gave a summary of the society's activities during the past session. In thanking the members who had loyally supported the society, he said that the future was bright when such excellent support could be relied upon. In his reply, Capt. McCulloch gave an entertaining account of the work behind the scenes at Savoy Hill. During the evening, thanks to the joint efforts of Mr. Remington and Mr. Fairweather, members listened to broadcast programmes received on a five-valve set operating a coil-driven loud-speaker.

The society will resume meetings early in September.

Hon. secretary: Mr. E. L. Cumbers, 14, Campden Road, South Croydon.

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Television: Mechanical Difficulties.

At the last meeting of the Dorset Wireless and Television Club, Mr. N. W. Wright dealt with the mechanical side of television, referring to its present limitations and other points of interest to the experimenter.

Hon. secretary: Mr. N. W. Wright, 13, Royal Arcade, Esplanade, Weymouth.

Electricity and the Gramophone.

The new popularity of the gramophone as a result of electrical reproduction was discussed by Mr. W. K. Alford, of the Igranic Electric Co., Ltd., in his lecture-demonstration before the Tottenham Wireless Society on Wednesday, May 2nd. The speaker demonstrated the Igranic Phonovox gramophone pick-up, using an Igranic three-valve resistance-capacity amplifier, the latter being so "portable" that it could be carried easily in an overcoat pocket. Several loud-speakers were used during the evening, including some commercial instruments, but in the opinion of the members present the loud-speakers of outstanding merit were the home-made moving coil instrument of Mr. S. Smith, and a permanent magnet cone instrument made by the Magnavox Co. Dealing with the development of electrical recording, Mr. Alford said that quite recently means were developed by which records could be analysed, and it was found that very little bass was recorded below 1,000 cycles and that the response cut off at 2,800 cycles to practically nil. Electrical recording revealed an extension of the record response curve to 40 and 5,000 cycles.

Hon. secretary: Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

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New Headquarters for North Middlesex Radio Society.

A comparison of condensers and resistances by means of a Neon tube was the subject of a lecture and demonstration by Mr. R. Kirlew at a recent meeting of the North Middlesex Radio Society. The lecturer described the way in which a musical note could be obtained by charging a condenser through a resistance up to the ignition voltage of a lamp, at which point the lamp discharged it back to the extinction voltage and the cycle recommenced. As the frequency of this operation was a direct function of the time-constant of the resistance-condenser circuit resistances could be compared by the aid of a calibrated condenser, since for a given frequency the resistance must be inversely proportional to the capacity. Mr. Kirlew concluded with an interesting demonstration.

This meeting was the first to be held in the new headquarters of the society at St. Paul's Institute, Winchmore Hill, N.21, and the improved accommodation was felt to be a great asset to the society. The transference of the headquarters to this popular hall, together with the modest subscription, should have the effect of rallying to the society's banner a largely increased membership recruited from Palmers Green, Winchmore Hill, and Enfield.

Hon. secretary: Mr. E. H. Laister, Endcliffe, Station Road, Winchmore Hill, N.21.

FORTHCOMING EVENTS.

WEDNESDAY, MAY 16th.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove, N.17. Demonstration of the Langham Portable Receiver, by Mr. McQueen.

Golders Green and Hendon Radio Society.—At 8 p.m. At "Wayside," Golders Green Road. Reception by Mr. Marshall, followed by informal discussion on "Stray Capacity in Wiring."

THURSDAY, MAY 17th.

Slade Radio (Birmingham).—Lecture: "Receiver Design with Special Reference to Short Wave Reception," by Mr. J. W. Walker.

Leyton and Leytonstone Radio Society.—Discussion on Electro-magnetic Waves.

FRIDAY, MAY 18th.

Golders Green and Hendon Radio Society.—Club dinner at the Comedy Restaurant, 7 p.m.

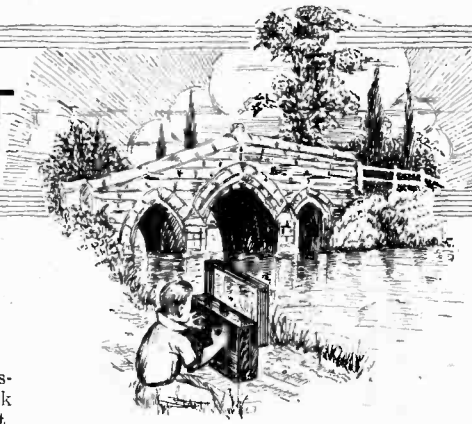
Wigan and District Technical College Radio Society.—Lecture: "Shielded Valves," by a representative of the Marconiphone Co.

MONDAY, MAY 21st.

Hackney and District Radio Society.—At the Electricity Showrooms, Lower Clapton Road, E.5. Demonstration of 8-valve super heterodyne and moving-coil loud-speaker, by Mr. J. R. Jones.

Holloway Literary Institute Wireless Society.—At 7.30. At Holloway School, Hilldrop Road, N.7. Lecture by a representative of Messrs. Ferranti, Ltd.

CURRENT TOPICS



Events of the Week in Brief Review.

A PORTABLE AT THE PALACE.

A party of *débutantes* awaiting admission to Buckingham Palace last week killed time with a portable wireless set.

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THE MOTORIST AND THE PORTABLE.

"Two years ago the portables on the market could be described as little better than toys, capable of showing a modest efficiency if they were operated close to a transmitter. On the other hand, the modern portable is a genuinely robust, compact, and thoroughly reliable instrument."—The Motoring Correspondent of *The Outlook*.

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A ONE-ACT DRAMA.

In the Birmingham Police Court last week :—

Defendant: I did not know a (wireless) licence was necessary.

The Clerk: How long have you been in this country?

Defendant: Four years.

The Clerk: Then you ought to have known a licence was necessary.

Epilogue: You will be fined forty shillings

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TEN-METRE TRANSATLANTIC TRIUMPH.

The first actual Transatlantic two-way communication between amateurs on a wavelength of ten metres is reported by the American Radio Relay League. This feat has been achieved by Mr. C. K. Atwater (NU 2JN), of Upper Montclair, N.W., and M. Pierre Auschitzky, of Arachon, France. The two operators engaged in conversation for nearly half an hour with good signal strength at both ends.

It is only six weeks since the ten-metre band was made available to amateurs.

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THE WIRELESS "WOBBLER."

WNBA, the Forest Park broadcasting station, Illinois, has been ordered by the Federal Radio Commission to discontinue transmissions until further notice because of its tendency to "wobble," says a correspondent of *The Manchester Guardian*. The Commission has several times threatened stations offending in this manner, but the warnings have not been taken seriously.

WNBA is licensed to operate on 1,440 kilocycles, but has been deviating from the path of rectitude to the extent of 500 cycles.

REFORMATION BY RADIO.

The Home Office is contributing £150 towards the installation of broadcast receivers in fifteen reformatories and industrial schools.

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PCJJ'S NEW WAVELENGTH.

Owing to interference on the 30.2-metre wavelength the Hilversum experimental station now transmits on 31.4 metres.

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50 KILOWATTS FOR ROME?

According to a Rome correspondent, field strength measurements are now being taken at eighty different points around the city to determine the most favourable site for a broadcasting station capable of supplying programmes to crystal-set users in Rome and the surrounding country. It is rumoured that the new station will have a power of 50 kilowatts.

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WHERE RUSSIA LEADS.

Thirteen new broadcasting stations are now under construction in Soviet Russia, writes a Continental correspondent. With 56 stations already working, Russia has by far the largest number of broadcasting stations of any country in Europe. A "giant" station for the transmission of propaganda talks to Japan and China is being built at Vladivostock.

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LEAGUE OF NATIONS WIRELESS STATION.

A powerful wireless station to enable the Secretariat of the League of Nations at Geneva to maintain a service of wireless telegrams to as many member States as possible will be discussed by the Council and Assembly of the League in September next. A report on the project has been presented to the League Council by a committee of experts, including Lieut.-Col. A. G. Lee, of the General Post Office, representing Great Britain.

The estimated cost of such a station is £50,000, while the annual working cost is placed at £8,000. It is expected that the annual revenue for the first few years would work out at between £4,000 and £6,000.

In its report the Committee states that, during normal times, when the station was not needed for emergency purposes, the traffic would still be considerably greater than that of military and naval stations, and would probably even exceed that of existing civil stations. The station would handle circular wireless telegrams of Press news, Government information and important League documents; another important feature of its work would be the dispatch of telegrams now exchanged between the Secretary-General of the League and the different Governments and between the Governments and their delegations at Geneva.

The committee considers that the station would distribute at least 1,200,000 words a year.

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DANISH WIRELESS SHOW.

September—the exhibition month—has been chosen by the Danish broadcasting authorities for a big wireless show, probably in Copenhagen.

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WIRELESS PICTURE RECEPTION.

It is regretted that owing to extreme pressure on our space we are unable to include this week, as promised, a special article describing a new method of wireless picture reception. The article will appear next week.

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SMALL ADVERTISEMENTS.

Owing to the Whitsun Holidays the May 30th issue of *The Wireless World* will be closed for press earlier than usual. Miscellaneous advertisements for insertion in that issue can be accepted up to first post on Wednesday, May 23rd.

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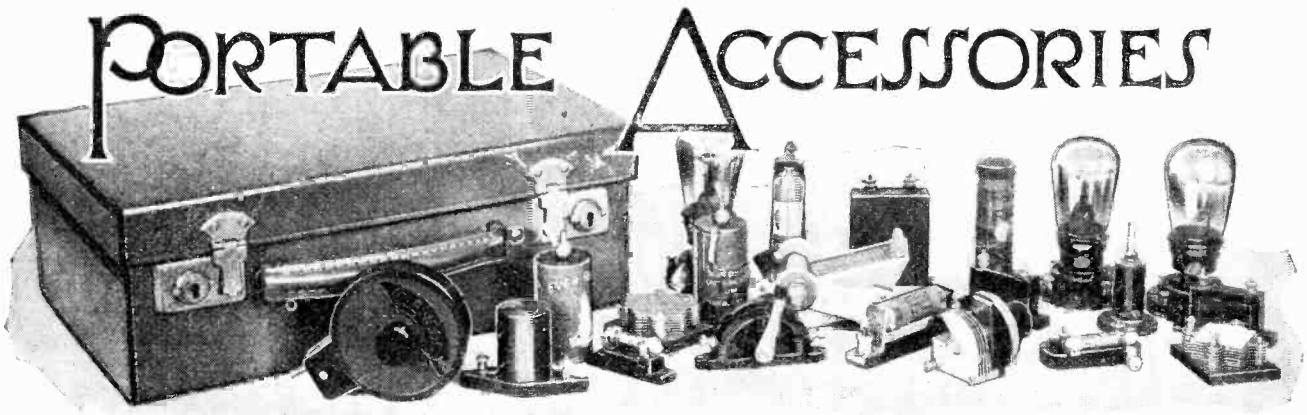
A WIRELESS "HALL-MARK."

The alleged unsatisfactory nature of many of the receiving sets sold in Australia has led the Postmaster-General to suggest the institution of a "hall mark" for wireless receivers. It is proposed that the controllers of broadcasting and other wireless activities should establish a committee to test circuits, approve designs for sets and to grant the right to approved manufacturers to use a special stamp or "hall mark" on instruments which come up to the desired standard.

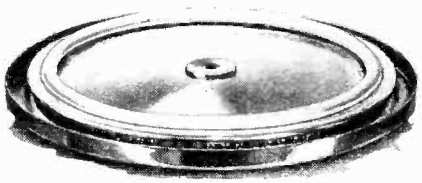
PORTABLE ACCESSORIES



A Review of the Latest Products of the Manufacturers.

ORMOND TURNTABLE.

The performance of any frame aerial receiver is enormously improved if it is mounted on a turntable so that the directional properties of the frame may be turned to the fullest advantage. Yet only a small percentage of the sets on the market are so equipped, and many hours must have been spent in trying to improve the strength of distant stations by closer tuning when slight orientation of the set as a whole would have produced the same effect; it is surprising how



"Ormond" ball-bearing turntable.

infrequently a set is moved unless it is fitted with a turntable.

The ball-bearing turntable made by the Ormond Engineering Co., Ltd., 199-205, Pentonville Road, King's Cross, London, N.1, costs only 6s., and is well worth fitting to any cabinet portable. The stationary and moving plates forming the two halves of the ball race are spun from hard sheet brass and plated, the bottom plate being fitted with a rubber ring where it rests on the table. The movement is perfectly smooth and shows no trace of "lumpiness" under the heaviest load.

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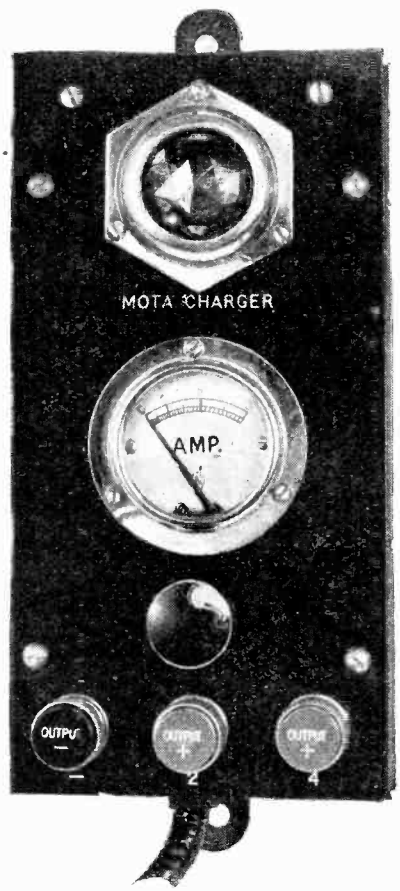
"MOTA" CHARGER.

It is safe to say that the majority of portable sets are used in conjunction with motor cars; indeed, for the transport of many of them a motor car is a necessity. That being so, a unit enabling the L.T. batteries to be charged from the car lighting set in cases of emergency is of immediate interest to the car-owning listener.

The "Mota" charger has been produced for this purpose, and is designed to screw on to the dashboard or other convenient place on the car. There are two models, one for 12-volt lighting sets with terminals for charging 2-, 4-, or 6-volt filament batteries, and the other for 6-volt sets with terminals for 2- or 4-volt batteries. Six-volt batteries can, of course, be charged with the latter



"Mota" charger for replenishing portable set L.T. batteries from the car lighting set.

model by connecting up the cells in parallel.

Each model is supplied complete with 5ft. of acid-proof cable for connection to the car starter battery and is equipped with a miniature ammeter reading 0-3 amps., an "on and off" switch, and a ruby indicator lamp showing when charging is in progress. The price is 22s. 6d., and the makers are the Cantophone Wireless Co., 310-312, Regent Street, London, W.1.

When touring in remote parts of the country away from charging stations the "Mota" charger should prove invaluable, and in the summer months when the car lighting set gets little exercise a few amps drawn off now and again to fill the portable set battery will help to keep it in good condition.

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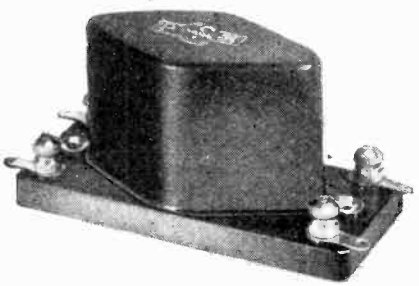
MULLARD L.F. TRANSFORMER.

The new P.M. low-frequency transformer is particularly suitable for use in portable sets, as it combines good performance with small bulk and weight. The dimensions are only $4 \times 1\frac{3}{4} \times 2$in., yet its characteristic is straight from 250 to 14,000 cycles, and a high percentage of the maximum amplification is obtained down to 50 cycles. The characteristics



The light weight of the Mullard "Permacore" transformer recommends it for use in portable receivers.

have been designed to obviate the resonance peak in the vicinity of 8,000-10,000 cycles which is found in many transformers, and there is a sharp cut-off at 14,000, so that the transformer may be

used in superheterodyne sets without causing amplification of high or intermediate frequencies which may find their way past the detector.

The primary is wound with silver wire, which, in addition to its improved conductivity, is less susceptible to corrosion than copper wire of similar gauge. The secondary is wound with nickel wire, and advantage is taken both of its resistance and magnetic properties to obtain a uniform response curve. A special grade of iron, known as "Permacore," is used in the magnetic circuit. This material has a high permeability and will carry a high flux density without saturation.

It is intended that the transformer should be preceded by a valve of moderately high impedance, such as the P.M.5X or P.M.1H.F.

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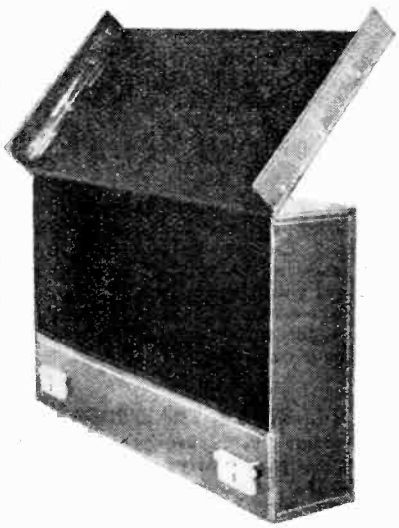
PORTABLE ATTACHÉ CASE.

The "Safety First" type of case made by the Gray's Inn Trunk Co., Ltd., 7, 9, 11, Gray's Inn Road, London, W.C.1,



The "Safety First" attaché case is well adapted for portable set construction.

makes an excellent container for a lightweight portable. It has this advantage over the conventional pattern that the lid can be opened and the set operated with the case in a vertical plane. This means that the frame aerial can be wound round the set itself, thus obviating troublesome flex leads which are necessary if the frame is wound in the lid. Further, there is no need to cut away the case to bring out the tuning controls; they can be mounted on a vertical panel inside the case and operated with the lid raised.

A wide range of sizes and qualities is available, the prices varying from 10s. 6d. to 52s., and the dimensions from 12×8×3in. to 20×12¼×5¼in. Special sizes are made to order.

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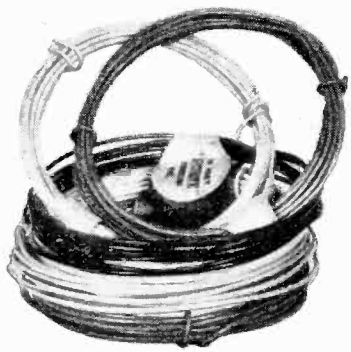
SECURITE WIRE.

Apart from considerations of appearance it is always safest to use covered wire for the internal connections of a portable receiver to minimise the possibility of short circuits.

"Securite" wire has a glazed cotton covering and is made in five colours—yellow, black, red, blue, and green. A



"Securite" glazed connecting wire.

10ft. coil costs 7d. in No. 18 S.W.G. and 9d. in No. 16 S.W.G., but it can be supplied also in bulk coils up to 500 yards. The glazing is hard and durable, and shows no signs of cracking for ordinary right-angle bends.

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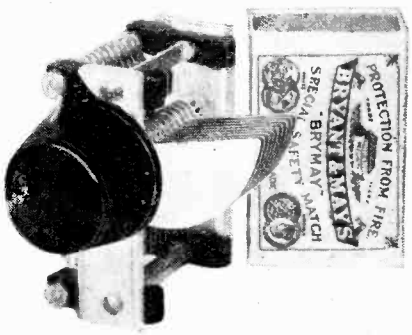
"ELFIN" VARIABLE CONDENSER.

The space occupied by this condenser with vanes fully extended is only 2¾×1¾×2in. It is constructed almost entirely of aluminium, and is therefore in every way qualified for service in a portable receiver, where it may be used either for tuning or reaction control. It is made by the Bowyer-Lowe Co., Ltd., of Letchworth, Herts, and there are four capacity ranges with maxima of 0.0001, 0.00015, 0.0002 and 0.00025 mfd. respectively, the prices varying from 5s. 9d. to 6s. 6d.

A ball race is used in the panel end bearing, and the requisite degree of fric



The Bowyer-Lowe "Elfin" condenser photographed beside a match box.

tion is supplied by an adjustable pivot bearing at the other end. The plates are so shaped that the capacity variation follows a logarithmic law.

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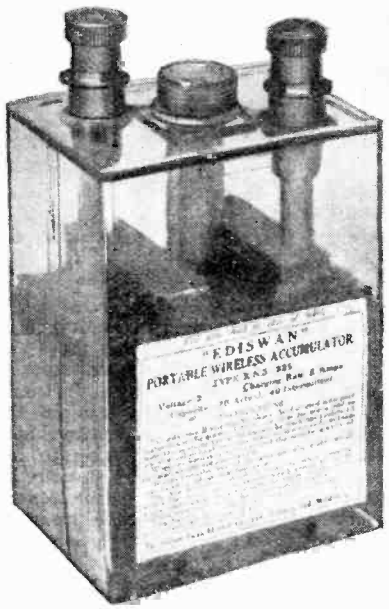
EDISWAN NON-SPILLABLE ACCUMULATOR.

This 2-volt cell is available in capacities of 20 and 30 amp. hours, the prices being 13s. 9d. and 15s. 9d. respectively. The illustration is of the 20 amp.-hour type, in which there are five positive plates having dimensions of 3¼×2½×⅛in. The separators are ribbed and perforated ebonite mouldings occupying small volume and allowing free circulation of the electrolyte.

The non-spilling device is incorporated in the filling vent and can be removed for inspection. Black and red moulded



Ediswan Type XNS portable accumulator.

terminals are used, and the brass terminal screw is given an acid-resisting coating of lead.

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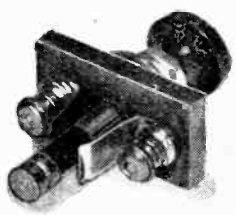
"DECKOREM" BATTERY SWITCH.

Messrs. A. F. Bulgin and Co., 9-11, Cursitor Street, London, E.C.4, have been making L.T. battery switches of the push-pull type since 1924, and their experience is reflected in the "Deckorem" switch illustrated, which is of unusual quality and extremely well finished off.

It is of the one-hole fixing type, and the ⅜in. washers provided give a firm grip on the panel. The spring contacts are of nickel silver and are exceptionally



"Deckorem" battery switch with nickel silver contacts.

strong; the switch goes into the "on" position with a reassuring snap. Terminals are provided, and the price is 1s. 6d.

By Our Special Correspondent.

B.B.C.'s Summer Plans.—Talks Policy.—Wanted: A New Word.—"Controversial" Broadcasts.—Cricket Commentaries.—Is the Studio Audience Wanted?

Summertime at Savoy Hill.

Opinion will be divided, I imagine, on the question of the B.B.C.'s policy in regard to summer programmes. "This is to be a portable wireless summer," I reminded a B.B.C. official. "What are you going to do about it?"

The answer was rather surprising.

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No Niggers.

Reduced to plain English, the official reply amounted to an avowal that nothing of a specially summertime flavour will be attempted this year. At all events there is to be less of the purely holiday type of programme, with its seaside bands and nigger minstrels. The present standard of "all-round" programmes will be maintained, and it is on these that the listener by the wayside will have to pitch his praise or blame.

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Not a Seasonal Pastime.

The B.B.C. explanation is that broadcasting can no longer be regarded as a seasonal pastime. Listeners, wherever they may be—on the sands, in the fields, or in strange hotels—turn to broadcasting in expectation of enjoying the same entertainment as they rely upon at home.

In many respects this argument is a sound one. No one basking on the sands of Margate or Littlehampton is particularly anxious to be reminded that there are niggers at Broadstairs or that the Grand Splash Silver Band is playing at Blackpool.

But there are other listeners who, alas, are unable to visit any of these places, and to them special holiday programmes would be very welcome.

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Plenty of Talks.

It is worth while noting, too, that there is to be no diminution in the number of talks. Now talks are keenly appreciated by a large number of listeners, as *The Wireless World* correspondence pages have recently indicated, but how many talk-supporters would really relish talks on a summer afternoon in a green glade?

FUTURE FEATURES.

London and Daventry.

MAY 20TH.—Ethel Smyth Jubilee Concert.

MAY 22ND. — Compositions by Arnold Bax.

MAY 23RD.—"Tannhäuser" (Act 2) from Covent Garden.

MAY 24TH.—Empire Day Programme.

MAY 25TH.—"The Tragedy of Macbeth," by William Shakespeare.

Daventry Experimental (5GB).

MAY 21ST.—A Military Band Concert.

MAY 23RD.—"Progress and the Builder," a play by Edwin Lewis.

MAY 24TH.—National Orchestra of Wales from Cardiff.

MAY 25TH.—"Carmen" (Act 2) from Covent Garden.

Cardiff.

MAY 21ST.—A Concert relayed from the Castle Theatre, Caerphilly.

Manchester.

MAY 23RD.—"A Touch of Sun," a tropical comedy in one act by Alfred Gordon Bennett.

Newcastle.

MAY 23RD.—A Brahms Programme.

MAY 26TH.—Meeting of the 19th British Esperanto Congress relayed from the King's Hall, Armstrong College.

Glasgow.

MAY 21ST.—"Our Ain Fireside," a Scottish Christening by Duncan Graham.

Aberdeen.

MAY 22ND.—Scenes from Shakespeare.

MAY 26TH. — Old Folk's Programme.

Belfast.

MAY 26TH.—A North American Programme

No Prizes.

Can anyone think of a better expression to replace that clumsy term: "portable set user"? I may say at once that "portabluser" and "portablistener" have already been tried and found wanting. The same applies to "portablaster."

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The Roosters Again.

It is some time since listeners were entertained by the Roosters. This breezy party of ex-servicemen will be on the ether again on May 28th, when they are broadcasting from 5GB.

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Those "Controversial" Broadcasts.

Public apathy in the matter of controversial broadcasting has resulted in a ca'canny policy at Savoy Hill, which is not likely to be interrupted except by an explosion. The debate on Friday next between Mr. James Maxton and Sir Ernest Benn on "Poverty" has been hailed as the dawn of a new era in polemical broadcasting, but I fancy that the authorities have a very shrewd idea of what will be said despite the fact that no manuscripts are being submitted.

How far Savoy Hill is ready to go in the region of disputable topics is clearly shown by the refusal to permit talks on the subjects of anti-vivisection and spiritualism. These are good 'platform" topics, and are just the sort which one would naturally place in the category of things controversial.

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Cricket Commentaries.

The ordinary cricket match does not offer very promising material for a running commentary, and the B.B.C. has therefore decided to revise its policy this season, confining cricket descriptions to eye-witness accounts which can be given in the studio after the match.

In the case of one or two unusually important matches a descriptive narrative will be broadcast during the period of play. The first of these will be from Sheffield on Monday, May 28th, when a

running commentary will be given on the Lancashire and Yorkshire match. The famous Eton and Harrow match and the inter-Varsity matches later on in the season will probably be described in the same way.

To avoid monotony the B.B.C. practice is to sandwich short accounts of the game with periods of light music from the studio.

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Broadcasting before Breakfast.

One of those ideas which crop up annually just when the sap is rising and the cuckoo is singing concerns early morning broadcasts. The plea has once again been put forward that the B.B.C. should give us "physical jerks" before breakfast.

There are several reasons why the B.B.C. declines to inaugurate such a service. The most interesting reason given is that a course of physical exercises would almost certainly bring from their beds many elderly people who over-estimated their physical powers. They would attempt exercises intended only for young people, possibly with serious and even fatal results. I have not heard of any tragedies of this kind in America, where physical training is a regular feature in the programmes.

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Who Died First?

A mystery play, "The Survivor," with an interlude by Michael Hogan and Mabel Constanduros, will be broadcast from 2LO and 5XX on May 29th. Husband and wife are found drowned in a smuggler's cave. The disposal of a fortune of £10,000 depends on who died first. Listeners will hear all the facts of the case in the first two acts; then, in order to give them an opportunity of solving the problem, there will be an interval of five minutes before the performance of the third and last act, in which the mystery is cleared up.

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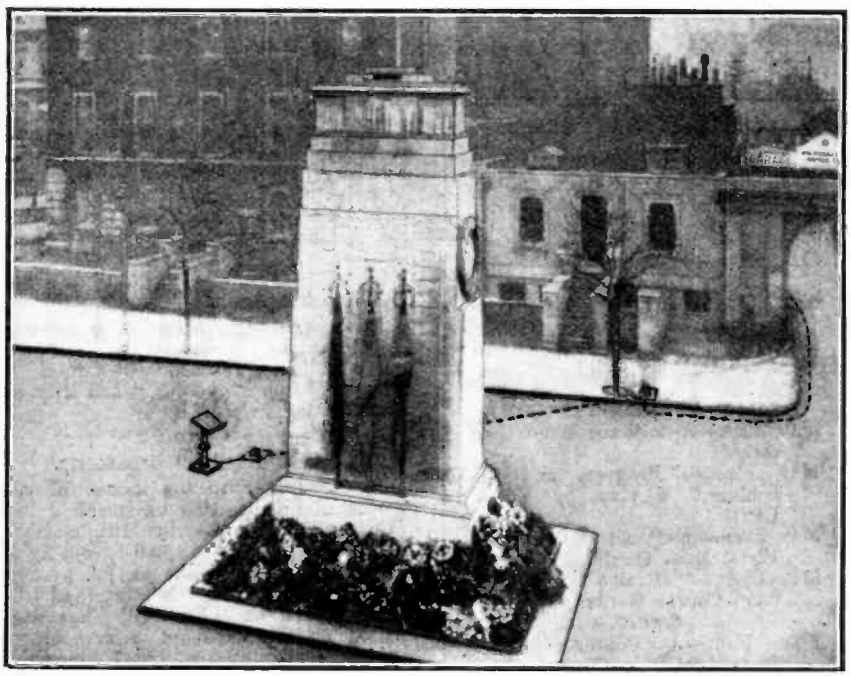
The "Mystery Pianist."

Ponishnoff, who will give a half-hour's recital from 2LO and 5XX on June 1st, is known at the B.B.C. as the "Mystery Pianist." The reason is that on the evening prior to his first broadcast he called at Savoy Hill to inspect the piano which he was to use and, in the midst of the ordinary programme then being broadcast, he sat down and played for a few moments. Telephone messages, telegrams and letters were received asking the name of the brilliant but unannounced performer, a secret which the B.B.C. refused to disclose.



A PERMANENT LINE AT THE CENOTAPH. In last week's issue reference was made to the special cable which the B.B.C. is laying in Whitehall in order to permit of the regular broadcasting of Armistice Day and other services at the Cenotaph. The dotted line in the photograph marks the position of the buried cable. Leads are taken from the plates "A" and "B" to microphones concealed in the lectern and the tree respectively. Transmissions are controlled from the "O.B." van concealed in the yard on the right. The first Cenotaph broadcast will be on Whit Sunday on the occasion of the British Legion memorial service.

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"First Nights."

Two new Scots plays, both in the vernacular, will be broadcast from Glasgow on June 2nd. The first, "Galloway Lambs," is by E. Cumming Tait, whose work is already known to Glasgow listeners. Its story of a criminal's attempt to outwit the police is played out in a lonely shepherd's hut high up on the wild moors of Galloway. The second play is in lighter vein. In a first attempt at radio drama R. Holman has achieved a very amusing farce entitled "What Price Flora?"

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Searchlight Tattoo.

The Aldershot Command Searchlight Tattoo will be broadcast from 2LO and 5XX during Ascot week.

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Pork Talk.

There are many methods—fancy titles, alluring headlines, etc.—to induce the set-owner to listen, but the straightforward appeal is the best. This is from the advance programmes bulletin of WJZ, New York:—

"SMITH TO TALK ON PORK."

That is all.

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That Studio Audience!

I hear that the present plan of supplying variety artistes with a picked audience in the studio may shortly be revised. There have been several occasions of late when the jokes have been spoilt, so far as listeners are concerned, by the rather too vociferous cackles (that is the best word) in the studio itself. What often happens is that the people in the studio, who have the advantage of seeing the comedian's facial contortions, are often able to anticipate a joke which it takes the listener several moments to appreciate. Which means that the studio audience laughs too soon and the listener fails to catch what is said.

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5SW *v.* PCJJ.

If 5SW has not been a howling success where Indian listeners are concerned, it can at least adopt the attitude of the elderly lady chapel-goer who, when asked whether her chapel was flourishing, replied in the negative, but thanked the good Lord that the other sect over the way were doing no better. For it seems that PCJJ is not having things all its own way.

The Bombay station has been attempting a series of relays from Holland. "These have not been very successful lately," writes a correspondent, "on account of the great interference experienced."

It appears, however, that much of the trouble in Bombay is due, not to the deficiencies of PCJJ, but to local electrical apparatus, so it is quite conceivable that the removal of this trouble would enable PCJJ to show that even now 5SW has to make up a good deal of lost ground.

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Where Holland Wins.

Meanwhile considerable success is being obtained by the Indian Broadcasting Co. in Bombay in the relaying of programmes from the short-wave station at Java, Dutch East Indies.

The laurels still go to Holland!

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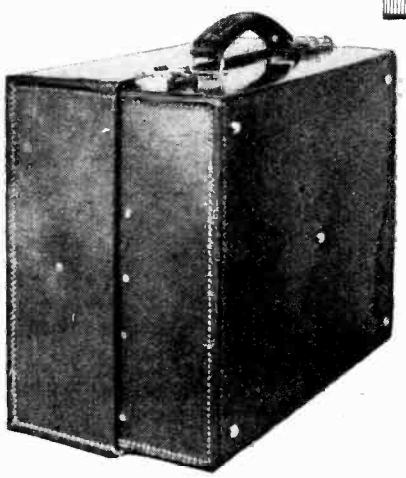
A Point.

Mr. Pathrick M'Rang, of Dublin, writes: "Continental time is one hour ahead of ours, Sir, I ask you then, Sir, to discourage the broadcasting of the Derby result because, Sir, it will enable unscrupulous backers on the Continent to draw their winnings before the winner's left the stable."

Hart-Collins

A Really Portable Set with a Good All-round Performance.



WITH a weight of only 25 lb. and dimensions of 14¾in. × 12in. × 8¼in., the Hart Collins "Tourist" is well within the "portable" category, yet its performance is better than many "transportables" of greater dimensions and weight. The results are equally good on long and short waves—a point worthy of comment, as it is too often found that exceptional efficiency on short waves is accompanied by poor results on the long-wave range, and *vice versa*. The "Tourist" will bring in at least four stations in addition to 5XX on the long waves at full loudspeaker strength, and on short waves six foreign stations were received 1¾ miles from 2LO while that station was working. This indicates unusually good selectivity for a portable, quite apart from the sensitivity implied. The smooth control of reaction on both wave ranges is a contributing cause, as it enables the maximum degree of efficiency of which the set is capable to be arrived at with ease and certainty.

The Brown cone-type loudspeaker, too, is highly sensitive, and makes the most of the output from the P.M.2. valve in the last stage. It has a reed movement similar to the "A" type telephone, though on a larger scale, and the air gap is regulated through a lever by an adjusting knob in the left-hand bottom corner of the lid.

Mullard valves are used throughout, and are quite economical of both H.T. and L.T. current. The 100-volt dry battery supplies 6.5 mA., and the filaments draw 0.5 amp. from the 40-ampere-hour accumulator. The latter is a Lithanode cell filled with absorbent glass wool which retains the electrolyte, and prevents it from leaking through the filling vent.

HART COLLINS "TOURIST."

Type: *Suit-case portable.*
Circuit: *2-v-2.*
L.T. *Capacity: 40 amp. hrs. Consumption: 0.55 amp.*
H.T. *Capacity: "Single" (small standard type). Consumption: 6.5 mA.*
Weight: *25 lbs.*
Dimensions: *14½in. × 11¾in. × 8in.*
Price: *£33 12s.*
Maker: *Hart Collins, Ltd., 38a, Bessborough Street, Westminster, London, S.W.1.*

There are two wave-range switches, one in the lid for connecting the frame aerial sections in series or parallel, and the other on the panel for changing over the aperiodic H.F. transformers. The leads to the frame are neatly concealed in the leather hinge of the lid, which is prevented from bending back too far by collapsible supports on the *outside* of the case. This helps to give the set a clean appearance when opened up for reception. Some idea of the neatness of the receiver can be gained from the photograph on this page; the batteries and instrument panel are covered by a plain polished wood top with oval aperture.

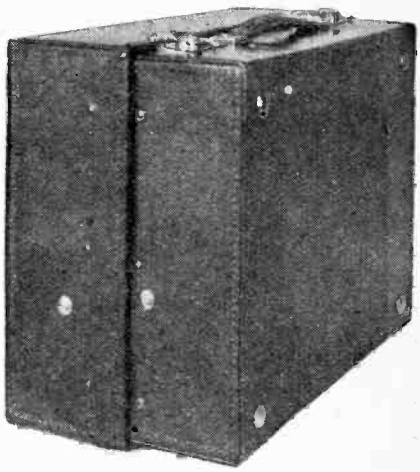
The circuit follows conventional practice as far as the H.F. stages are concerned in employing aperiodic transformer couplings, but a departure is made in the detector stage, which operates as an anode bend rectifier. This affords a clue to the smoothness of reaction control and absence of threshold howl; yet these qualities are obtained without loss of amplification, as a special high-impedance transformer is used to couple the detector valve to the first L.F. amplifier. A telephone jack is mounted in the top left-hand corner of the lid and aerial-earth sockets on the right.

The "Tourist," then, is a set which can be confidently recommended on the score of neatness, economy, and efficiency, to anyone requiring a truly portable receiver.

Neatness and simplicity characterise the appearance of the Hart Collins "Tourist" which is equally simple to control.

McMICHAEL

Perfect Workmanship and High Efficiency on Long Waves.



IT would be difficult to find a finer example of wireless instrument making than the M.H. Portable Five. Considerable thought has obviously been expended in making this set agreeable to the eye as well as to the ear. The instrument panel and the battery cover are of polished mahoganite, the battery cover being engraved with a wavelength calibration scale and instructions for connecting the batteries. Incidentally the engraving is exceptionally neat, being both fine and clear. The control knobs are all machined from the solid, polished, and the graduations machine engraved.

The first impression, then, on opening the set is one of sound construction and unusually high-class finish. This favourable impression is further enhanced when the set is switched on, for the quality is crisp and clean and there is none of the blasting or reverberation sometimes associated with enclosed cone loud-speakers. Excellent loud-speaker results can be obtained up to 40 miles from a main B.B.C. station and 150 miles from Daventry Experimental. 5XX is exceptionally good, and a range of over 200 miles at full loud-speaker strength is certain. Radio Paris is also very loud and clear in London and can be easily separated from Daventry.

M.H. PORTABLE FIVE.

Type : *Suit-case portable.*
Circuit : *2-v-2.*
L.T. *Capacity: 18 amp. hrs. Consumption: 0·55 amp.*
H.T. *Capacity: "Single." Consumption: 7 mA.*
Weight : *28 lbs.*
Dimensions : *15½in. × 12¾in. × 8¾in.*
Price : *£31 10s.*
Maker : *L. McMichael, Ltd., Wexham Road, Slough, Bucks.*

The M.H. Portable Five—a fine example of wireless instrument making.

Indeed, the efficiency on long waves is quite the outstanding feature of this set; so many frame aerial receivers are deficient in this respect that the results on the long-wave range come as something of a surprise. The groups of turns of the frame aerial are connected in series for long waves and in parallel for short. No loading coil is used for long waves, and this fact, coupled no doubt with a tendency to resonance in the "aperiodic" choke couplings in the vicinity of 5XX and Radio Paris, would account for the high degree of amplification obtained.

Changing over from long to short waves is accomplished by turning a single switch. There are no coils or plug-in transformers to change as the H.F. choke couplings are designed to cover both wave-ranges; all the switch has to do is to change the frame aerial connections, the leads for this purpose being concealed in the leather straps which prevent the lid from falling back too far. In addition to the local station and 5GB one or two stations were received on the short-wave range, though there was a background from 2LO at 1¾ miles. Selectivity, however, is quite good when judicious use is made of reaction and the directional properties of the frame.

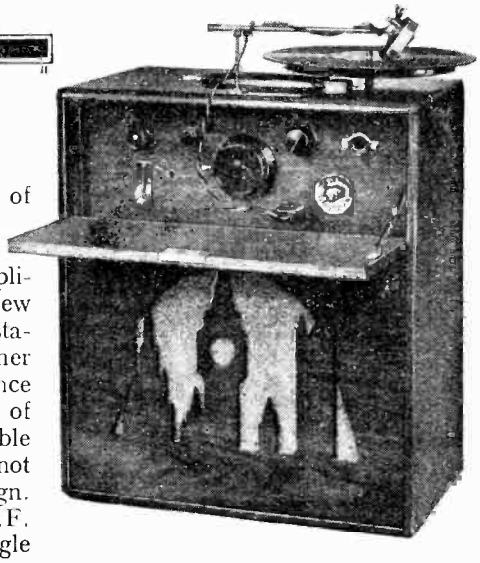
The reaction control which moves to the left for long waves and the right for short is somewhat critical, but is soon mastered with practice. The tuning control, on the other hand, is delightful to operate. A subsidiary vernier knob with a 30-degree scale of its own moves the main dial through 2½ degrees. At the end of its travel the vernier picks up the main dial and moves it bodily so that both coarse and fine control is obtained with the same knob. The edge of the main dial is knurled and may itself be turned for coarse tuning if desired.

Six-Sixty valves are used with a S.S.215P. in the last stage. The total filament current is 0.55 amp., and is drawn from an 18 ampere-hour Exide unspillable battery, while the H.T. current is 7 mA.—quite a normal value for the battery used.

Those who are looking for good workmanship combined with unusually good loud-speaker reproduction will find their requirements fulfilled in the M.H. Portable Five.

Westminster.

A Transportable Radio-Gramophone Receiver.



NEITHER the portable receiver nor the gramophone can be regarded in itself as a complete solution of the problem of outdoor entertainment. Each has its peculiar merits, and both types are to be seen in approximately equal numbers at picnics and on the river. With the wireless set news bulletins can be received when miles from the nearest newsagent, and there is always a special charm in receiving music at first hand, so to speak. On the other hand, dance music may not always be available when the spirit moves, and it is on such occasions that the gramophone scores.

The Westminster Mark II Transportable combines the advantages of both. It comprises a complete four-valve wireless receiver for long and short waves and a gramophone motor and turntable with electrical pick-up for reproducing records through the loud-speaker. The turntable, spindle, winder, and pick-up support are detachable, and pack away in the back of the cabinet, where provision is also made for carrying six records. Thus the cabinet presents a perfectly clean exterior when closed for transport. In the photograph the pick-up plug and jack are fitted on the front panel, but arrangements have been made to use the jack on the top of the cabinet as the bearing for the "tone arm."

The circuit of the receiver-amplifier has been designed with a view to reliable reception of the local station and the two Daventrys rather than ultra-sensitive, long-distance reception. Foreign stations can, of course, be tuned-in under suitable conditions, but their reception is not the primary object of the design. There are two semi-tuned H.F. stages with reaction, and the single tuning condenser is connected across the frame aerial. The detector is followed by a G.E.C. transformer which feeds into a P.M.22 power amplifier valve. This valve has a two-volt filament, five electrodes, and an amplification factor of 82. In conjunction with the Mullard cone loud-speaker (which, incidentally, is mounted in a special baffle), the performance is amazing, both from the point of view of amplification and quality. Judged from the absolute standpoint, by comparison with permanent receivers, the quality is excellent, but for a portable set it is extraordinary. The amplification, too, is more than sufficient, and in a small room the volume control must be used for most records—this with only one valve following the detector. In the open, greater volume is permissible, and the volume control may then be turned full on without causing unpleasant distortion and blasting. Dance records are reproduced with satisfying volume and "punch."

WESTMINSTER.

Type: *Cabinet radio-gramophone transportable.*

Circuit: *2-v-1. Detector used as amplifier with pick-up.*

L.T. *Capacity: 35 amp. hrs. Consumption: 0.6 amp.*

H.T. *Capacity: "Triple." Consumption: 9 mA.*

Weight: *40 lbs.*

Dimensions: *20in. × 16in. × 9in.*

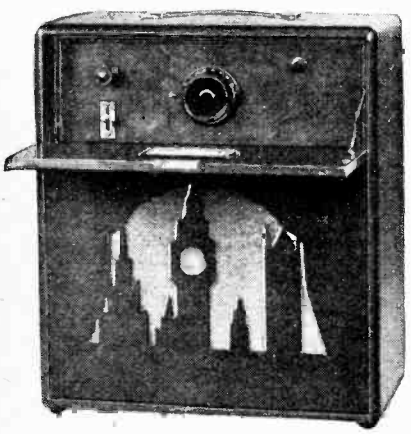
Price: *£42.*

Maker: *The Armitage Manufacturing Co., 9, St. Stephen's House, Westminster, London, W.1.*

Filament current is supplied from a two-volt unspillable accumulator, and an ingenious and effective indicator is used to show when the filaments are alight. The loud-speaker fret is cut in the outline of the Houses of Parliament, and the clock face is illuminated while the set is working by a small lamp connected in parallel with the filaments.

The high-tension current of only 9 mA. is supplied by "super" capacity dry cells which should last at least six months; a much longer service than is usual in portable sets. The total anode current is remarkably low for what one might term "D.E.5A. results." This is yet another point in favour of the pentode output valve, which, in spite of its low current consumption, appears to give a very high A.C. output.

Although radio-gramophone equipments permanently installed in pedestal cabinets are now being produced in large quantities, the introduction of a *portable* radio-gramophone receiver must be regarded as something of a novelty. Yet, in spite of the originality of the design, there is nothing freakish about the performance, and the makers are to be congratulated on their enterprise and ingenuity in evolving a type for which there is undoubtedly a great future.



The Mark I "Westminster," which resembles in appearance the Mark II model, with the turntable and pick-up packed away for transport.

Langham

A Powerful Receiver for Long-distance Work.

THE Langham Portable Long-Range Five needs no introduction; it is already widely known on account of its guaranteed reception of 20 stations. On the calibration chart accompanying each set it is stated that the range is limited only by atmospheric conditions, and dial settings are given for four stations on long waves and 29 stations on short waves. Although at first sight sensational, mature consideration compels one to admit that, with certain reservations, such a claim might be made for the majority of modern five-valve portables; but that is really beside the point, and it is quite a different matter for a manufacturer to come into the open with a specific claim of this nature which is open to verification. It implies unusual confidence in the consistent performance of the product in question.

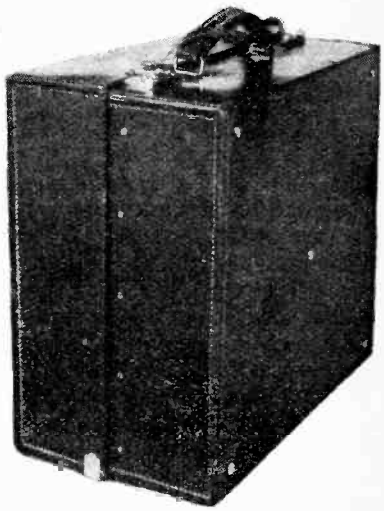
The first test was carried out 1¾ miles from 2LO, and showed the volume and quality of reproduction to be extraordinarily good, credit for which must be shared by the Langham loud-speaker and the Osram D.E.P.240 output valve. Here the long-wave stations came in well, but the short-wave band was dominated by 2LO, which overpowered the two or three distant stations received, even with the frame set to minimum on the London station.

LANGHAM TRANSATLANTIC PORTABLE.

Type: *Suit-case portable.*
Circuit: *2-v-2.*
L.T. *Capacity: 25 amp. hrs. Consumption: 0.8 amp.*
H.T. *Capacity: "Single." Consumption: 19 mA.*
Weight: *27 lbs.*
Dimensions: *15in. × 15in. × 9½in.*
Price: *£36 15s.*
Maker: *Langham Radio, Rosslyn House, 96, Regent Street, London W.1.*

The second test was made 50 miles north of London, and here in daylight 2LO, the two Daventrys, Hilversum, and Nottingham were received strongly with Radio Paris and Zeeson as second strings. After nightfall, of course, things were vastly different, and six stations, including Moscow, were picked up on long waves, and over 30 on the short-wave band, including most of those marked on the calibration chart. We would say, then, that the maker's claims are fully justified if the set is used at a reasonable distance from a main station, and if reception conditions are equivalent to those usually experienced after dark.

The Langham Transatlantic Portable which has drum-type tuning control and dial.



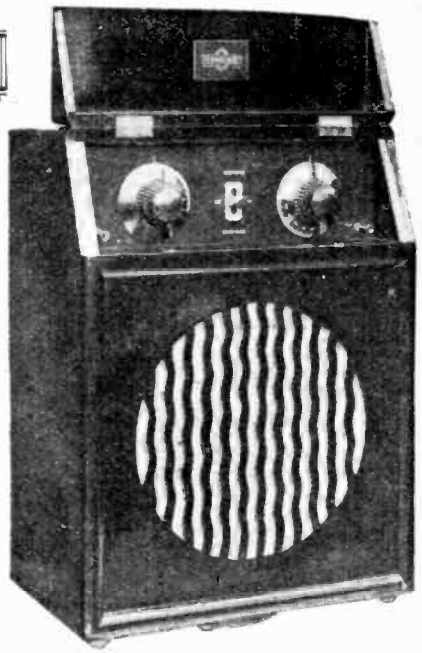
Such extraordinary sensitivity combined with good volume and quality can only be obtained by the expenditure of electrical energy, and it is only to be expected that the current consumption is above the average. The 100-volt H.T. battery is called upon to supply 19 milliamperes, while the valve filaments require a total of 0.8 amp. Cells for grid bias are built into the dry battery, the H.T. section of which has a volume of 153 cubic inches, and therefore falls in the "single" rather than the "double" capacity category. Assuming a capacity of 2,000 milliampere-hours at the 20 mA. rate, a service of 100 working hours may be expected. The L.T. accumulator capacity is 25 ampere-hours, and should therefore last 30 hours on a single charge. The cell lies on its side in the set and acid is supplied to the plates by capillary action in the glass wood packing which is used to separate the plates. In practice this scheme works quite satisfactorily, and at the end of a 4-hour test the filament voltage had only fallen from 2.02 to 2.00 volts.

Interchangeable aperiodic transformers are provided for long and short wavelengths, and these, contrary to usual practice, must be exchanged only when the valves are switched on. This precaution is no doubt connected with the fact that the transformers have iron cores.

The chief merits of the Langham, then, lie in the direction of powerful loud-speaker results of excellent quality and long range under favourable conditions of selectivity.

ORMOND ENGINEERING COMPANY LTD.

Sound Constructions and Exceptional Long-wave Efficiency.



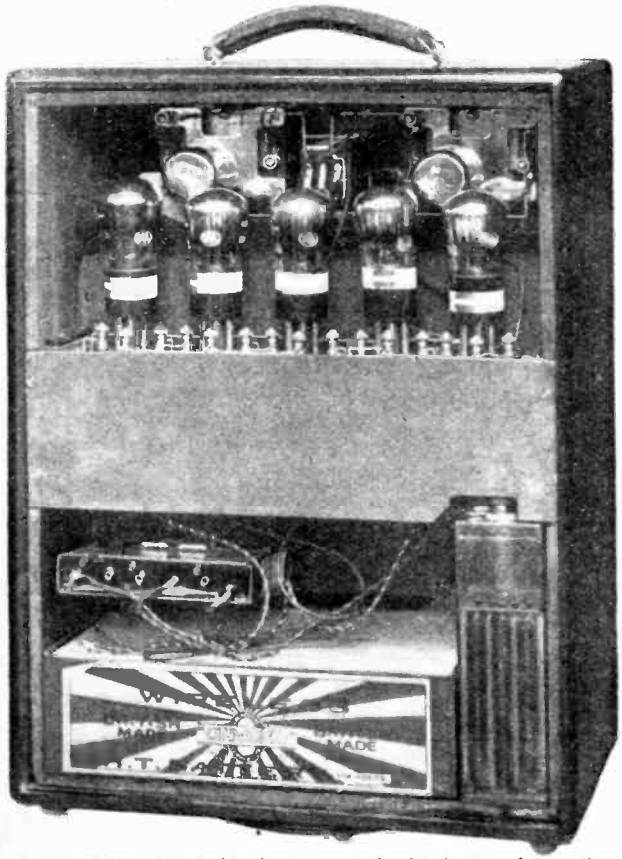
THE Ormond is an excellent example of the cabinet-type "transportable." It is neat and compact, and its weight compares very favourably with many alleged "portables." Coming from the Ormond Engineering Works, it is only to be expected that the construction is solid and the workmanship sound.

The controls could not be simpler. A two-way switch, with central "off" position, gives high or low wavelengths, and there are two slow-motion dials for tuning and reaction.

On switching on the set for the first time one is impressed by its general liveliness; carrier waves can be picked up by the dozen, and most of them can be resolved into telephony. The efficiency on long waves is extraordinary, and Hilversum, Warsaw, Zeesen, and Radio Paris, as well as many other long-distance stations can be received in daylight with certainty. There is a tendency to threshold howling on some wavelengths, but over the greater portion of the dial reaction control is satisfactory. The selectivity on short waves is well above the average, and two or three foreign stations can be tuned in clear of 2LO when only $1\frac{3}{4}$ miles from that station.

The ball-bearing turntable is a great boon when working near to a powerful transmitter, as the position of minimum pick-up can be accurately found with a marked increase in the apparent selectivity, and when conditions are favourable for distant reception a great improvement in signal strength is obtained by setting the frame exactly in line with the station being received.

Quality of reproduction is good, but the loud-speaker movement is non-adjustable, and will not take the full output of which the set is capable without jarring. This condition is not reached, however, before an undistorted sound level adequate to most needs is reached.



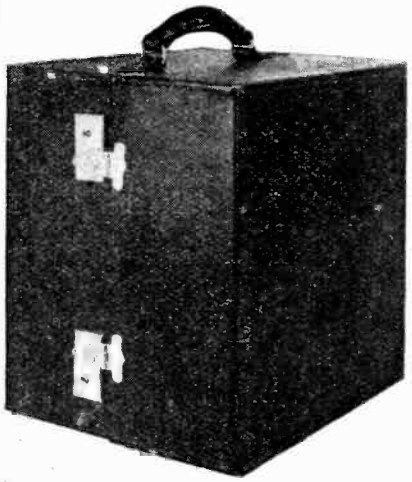
A completely detachable back secured with lock and key gives easy access to valves and batteries in the Ormond self-contained receiver.

The circuit is developed along conventional lines, the two H.F. valves being coupled by aperiodic chokes covering both long and short wavelengths. The valves are mounted on a rubber-sprung sub-panel; there was some tendency to microphonic howling when the set was first tried out, but this subsequently cured itself. Ormond components are used throughout, including the loud-speaker.

This is a receiver which immediately attracts attention by reason of its neatness, sound construction, and lively performance. When the question of price is taken into consideration the Ormond takes its place with the select two or three which remain after a process of elimination, and from which the last difficult choice must be made.

ORMOND 5-VALVE PORTABLE.

Type: *Cabinet transportable.*
Circuit: *2-v-2.*
L.T. *Capacity: 30 amp. hrs. Consumption: 0.55 amp.*
H.T. *Capacity: "Single." Consumption 6 mA.*
Weight: *32 lbs.*
Dimensions: *18in. × 14in. × 9in.*
Price: *£27 12s. 6d.*
Maker: *Ormond Engineering Co. Ltd., 199/205. Pentonville Road, Kings Cross, London, N.1.*



ZONE

Compactness and Distinctive Appearance combined with Efficiency.

IN the matter of appearance and finish this receiver is something quite out of the ordinary. It occupies a space of much less than a cubic foot, and yet is capable of really first-class loud-speaker reproduction. The panels and fittings are made throughout of an imitation ivory material known as "Celastoid," and the engraving is gold-filled. All metal parts are gold-plated, and, in combination with the dark green leather-covered case, the general effect is most pleasing.

To get all the batteries and components comprising a five-valve receiver into so small a space requires considerable ingenuity. The frame is wound round that half of the case which contains valves, batteries, and receiver, the Celestion loud-speaker being mounted in the "lid."

A separate compartment is set aside for the valves, which are all mounted on sprung valve holders.

The battery compartment contains a special 90-volt Siemens combined H.T. and grid bias battery, the sockets of which are marked with identification tags corresponding to those on the wander plug leads; this feature must be a great boon to non-technical listeners who are unaccustomed to thinking in terms of voltage.

The H.T. battery must be withdrawn to gain access to the L.T. accumulator, which is a flat, unspillable cell only 1¼in. in thickness. It is, however, quite simple to withdraw the H.T. battery, which is provided with canvas tags for the purpose.

High-quality British components, including Pye transformer, Dubilier resistances, Mullard valves, etc., are used throughout. The circuit contains many features of interest. Separate frame windings are used for long and short waves, but the aperiodic H.F. choke couplings are designed to cover both wavelength ranges. The L.F. amplifier consists of one transformer-coupled stage and one stage with resistance-capacity coupling. The inclusion in the grid circuit of the first L.F. valve of a resistance "L.F. stopper" is indicative of the thought devoted to the design. The detector functions on the leaky grid principle.

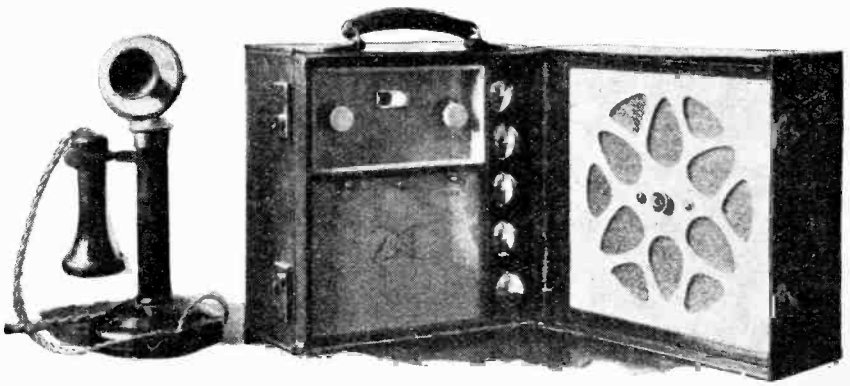
Perhaps the most outstanding feature of the performance is the extraordinarily good volume having regard to the small dimensions of the set. In London full loud-speaker results are at all times possible from the two Daventrys, Radio Paris, and, of course, 2LO. A certain amount of threshold howl combined with a high reduction gear ratio in the tuning controls made searching for distant stations a little difficult, but with patience the knack of following up the tuner with the reaction control is soon acquired. The slow-motion gear ratio is about 40: 1, so that an additional course control for moving rapidly from one part of the scale to another would seem desirable.

Some good advice on tuning is given in the instruction sheet, and this should be carefully studied before putting the set into use. An approximate calibration of both tuning and reaction dials is given for both short and long waves.

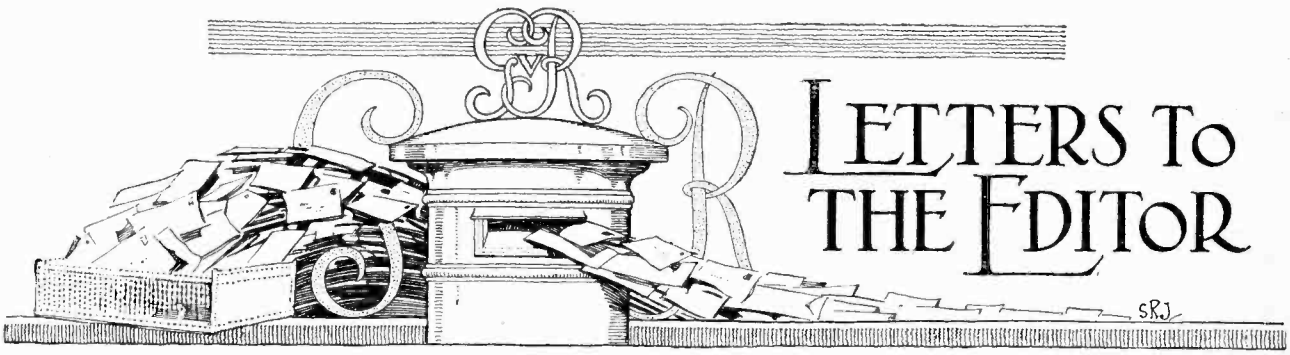
For the many people who are content to sit back and enjoy one programme well chosen, and have no desire to indulge in "radio sampling," and who at the same time take pleasure in the possession of things out of the ordinary, and appreciate neatness and daintiness of construction, the Zone Type "A" Portable will have an irresistible appeal.

ZONE TYPE A PORTABLE.

Type: *Leather-case portable.*
Circuit: *2-v-2.*
L.T. *Capacity: 25 amp. hrs. Consumption: 0.5 amp.*
H.T. *Capacity: "Single." Consumption: 8 mA.*
Weight: *25 lbs.*
Dimensions: *11½in. × 11¼in. × 9½in.*
Price: *£31 10s.*
Maker: *The Zone Wireless Co., Ltd., Poland House 167, Oxford Street, London, W.1.*



The Zone Type A Portable compared with a telephone receiver. The panel, battery cover and loud-speaker fret are of gold-lined white "Celastoid."



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.

SPARK INTERFERENCE.

Sir,—Much has already been written, and much more could be, regarding the gross interference on the broadcast band by morse and spark transmissions, and great were the hopes held out to listeners by the B.B.C. that the 1927 conference at Washington would result in some measure of relief to coast listeners in Britain.

An interesting sidelight on this matter is revealed by the report of the Marconi International Marine Communication Co. and recently published in *The Times*. In this the chairman is reported to have said, "In 1927 at Washington, a Radio-Telegraph conference was held, at which a very determined attempt was made to secure the immediate abolition of all spark sets on ships. Had that attempt succeeded, it would have cast a heavy burden on British shipowners and on your company. I am glad to say that, thanks to the great skill of Mr. ——— and Mr. ——— of the Chamber of Shipping, that was defeated, and a compromise was arrived at, extending the period for the elimination of spark sets to the end of 1939." The question is, Are we going to rest satisfied with this?

UNSATISFIED.

RECEPTION IN INDIA.

Sir,—Your paragraph on page 340 of your issue of March 28th gives the impression that 24 metres is generally bad for India. This only appears to be correct for Southern India. Up here I have received 5SW regularly, including the first experimental transmissions of gramophone records, on an ordinary two-valve short-wave receiver. For the last two months the 12.30 to 1.30 programme which used to come in at fair strength is now very faint, due probably to the sunset being later. The 7 p.m. programme comes in, however, at excellent strength, R6 to 7, always considerably stronger than PCJJ. Modulation is always superior to that of PCJJ.

The only trouble is fairly rapid fading, and the poor quality of the programmes early in the evening; usually two talks taking three-quarters of an hour in the first part. It is also disappointing after sitting up till 2.30 a.m. to hear the home news and weather forecast to be greeted with dead silence for ten minutes.

INTERESTED.

Rawalpindi.
April 18th, 1928.

Sir,—It may be of interest to you and your readers to know how wireless reception is heard in India. The long waves are useless on account of the atmospherics experienced for a greater part of the year, so most wireless enthusiasts devote their time to the short waves. Reception on these waves is only slightly troubled with atmospherics, but the ordinary two valver cannot be depended on for distance and strength during the hot weather. I experienced these troubles on my two valve set and I have, at times, wondered if my set was faulty. In the course of my experiments I added a screen grid valve in the H.F. stage and a second low-frequency. This addition, I must say, has made a marked improvement in distant reception and reliability, and I have lately logged no fewer than 15 telephone stations. The first of the 15 was 5SW engaged in friendly backchat with 2XAD. Both stations were heard on my loud-speaker, and every Monday and Thursday I enjoy listening to the transatlantic conversation. My reception of 5SW is faultless and regular, while that of 2XAD is 75 per cent. intelligible. At 1 a.m. I can hear 2LO or 5XX relayed *via* 5SW without fail. American stations can be heard at 3 a.m. and onwards at ear-phone strength, 2XAF and 2XAL being best. The latter stations die out at 8.30 a.m. leaving only their carriers. PCJJ is now received practically all over India with wonderful strength, but I must say that 5SW's modulation is far more perfect. I hear the Dutch and Australian stations at a more convenient time than western stations, and as they are closer, reception is very loud and clear, ANH, 3LO, 2FC being the most outstanding.

Calcutta. L. C. DESBRUSLAIS.
April 17, 1928.

ANODE AND GRID RECTIFICATION.

Sir,—I see in your issue of May 2nd a rejoinder by Mr. Turner to my reply to his original letter arising out of my comparison between anode and grid rectification.

I gather from this that I had failed to make the letter to which he now refers sufficiently explicit, since he has evidently missed my point. My reference to the wrong relative strength of transmission as between different items was not meant to imply that the B.B.C. is continually altering the strength of the carrier wave, as he seems to have understood. Nor do I think that the average depth of modulation varies very much from one item to another, as Mr. Turner would now seem to suggest; my whole point was that both carrier and modulation are kept roughly the same for transmissions of all types.

If, then, the receiver is left untouched throughout a whole evening's programme, the human voice is reproduced at approximately the same level of loudness as a full orchestra or a brass band. If the adjustment of the receiver is such that the level of loudness is correct for music, the reader of the news bulletin will sound like a giant some forty feet high, while if the volume is reduced in such a way as to bring this vast announcer down to normal dimensions, a musical item that follows sounds as though it were being rendered by a child's musical box.

It is, therefore, necessary *either* to alter the input to the detector *or* to make a change in the degree of low-frequency amplification every time the programme changes from music to speech, or back again to music. For this reason Mr. Turner's proposal to employ a fixed high-frequency input to the detector in conjunction with a fixed degree of low-frequency amplification does not appear to me to be practicable, *except* in a receiver limited to so small an output that it is incapable of reproducing speech above normal level.

London, W.2. A. L. M. SOWERBY.
May 5th, 1928.

READERS' PROBLEMS ANSWERED

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves.

A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

"The Wireless World" Supplies a Free Service of Technical Information.

Frame Aerial Switching.

It is desired that my proposed portable receiver should cover the medium and long broadcast wavelengths, and I am wondering if it would be practicable to wind two frame aerials in the lid, and to wire a switch in such a way that they could be connected in parallel for short waves and in series for the other band. Is this plan workable? N. M.

In practice, you will find that your proposed scheme will not be satisfactory; if the inductance of the long wave frame is sufficient to cover the normal band with a condenser of the usual capacity, it will not be sufficiently reduced for short wave work by joining the two halves in parallel. You could, however, wind three separate and similar frames and connect them in the manner you propose with satisfactory results.

o o o o

The "Everyman Four" as a Portable.

If you consider it practicable, I should like to modify my "Everyman Four" for use as a portable during the summer season, and would welcome a hint as to the necessary modifications. W. H. M.

This receiver lends itself quite well to the modification you desire, and, at a conservative estimate, should give full volume at, at least, 50 miles with a frame aerial of reasonable dimensions. This frame should be connected in place of the aerial-grid transformer secondary, and the complete H.F. amplifier (valve, transformer, tuning condenser, and neutralising condenser) should preferably be enclosed in a screening case.

o o o o

Loading a Frame Aerial.

Is it possible to load the frame aerial of a Hartley receiver for long-wave reception by inserting a coil without making use of a switch? It seems to me that this should be easy, but I cannot see exactly how it can be done, and would appreciate your assistance. G. G. R.

There are two methods open to you; you can insert two similar coils, one at each end of the frame winding, or, better, adopt the arrangement shown in Fig. 1, from which you will see that the frame aerial is cut at the centre tap, the two inner ends being taken to the connections of a coil socket. For work on the short waves this socket is short-circuited by a plug, to which must be fitted a socket into which is inserted a plug joined by a flexible lead to the detector valve filament. For long waves the short-circuiting plug is removed, and a loading coil is substituted, the filament plug being transferred to its centre tapping socket. Of course, if you use a coil in which the centre tapping is brought out to a terminal, you will substitute a spade tag for the plug.

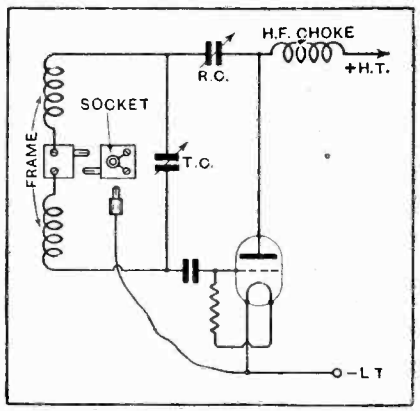


Fig. 1. A "Hartley" frame aerial loaded for long waves. The terminals of the short-circuiting plug are bridged, and a socket is joined to the connecting lead.

RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A s lf-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given: under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

o o o o

The "Everyman Portable."

Is it possible, without impairing results, to use a heavy L.F. transformer in the "Everyman's Portable," which I am about to construct, and will results be in any way impaired by the substitution? G. S. B.

There is no reason why any good transformer should not be used in this receiver; of course, the substitution of a heavy component adds appreciably to the weight, but may increase the strength of signals.

You may encounter some difficulty in finding room for a large transformer; if you cannot accommodate it on the baseboard by making a slight rearrangement of the other parts, it would be permissible to attach it to the top horizontal strip of the framework, with the terminals downwards.

o o o o

An Apparent Discrepancy.

Referring to the practical wiring plan of the "Everyman Portable," it appears that one terminal of the rheostat is connected only to the reaction condenser and to the H.T. negative plug, and I do not see how it can control the current flowing through the valves. Is there any error in this plan? A. F. C.

We would refer you to the second paragraph on page 412 of the descriptive article, in which the connections to the rheostat are discussed. If you examine the particular instrument used, you will see that one of the terminals is in contact with the metal frame, which is, as stated, joined to the metal clip which picks up contact with the positive L.T. battery spring.

A

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(16th Year of Publication)

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CONTENTS OF THIS ISSUE.

PATENT DEADLOCKS.

WHEN a patent is granted for an invention it is in order that the inventor may make use of his invention or permit other persons to do so in return for a suitable reward. The patent protects the inventor from use being made of his invention by other persons without acknowledging and rewarding him for his ingenuity.

The patent law in this country is, however, very carefully worded so as to preclude the possibility of inventions being patented and the public never reaping the advantage of such benefits as the invention may provide—that is to say, the owner of a patent must, if there is a public demand, either proceed to meet that demand by manufacturing the patented article himself or he must be prepared to license others to do so. There are, however, instances frequently cropping up where an obscure patent situation may result in the invention never being properly exploited, although it might be to the considerable advantage of the public and to trade generally that it should be developed.

To take a simple case, it may so happen that two patents are granted to separate individuals such that it is not clear whether some article which a manufacturer may desire to make requires to be licensed under both or only one of these patents, and, if the same doubt existed in the mind of the individual owners of the patents, neither of these would probably be prepared to grant a licence and at the same time undertake to protect the manufacturer from action for infringement by the second inventor. The manufacturer would then have the choice of either obtaining a licence from both or running the risk of a possible action for infringement.

Obscurity of Ownership.

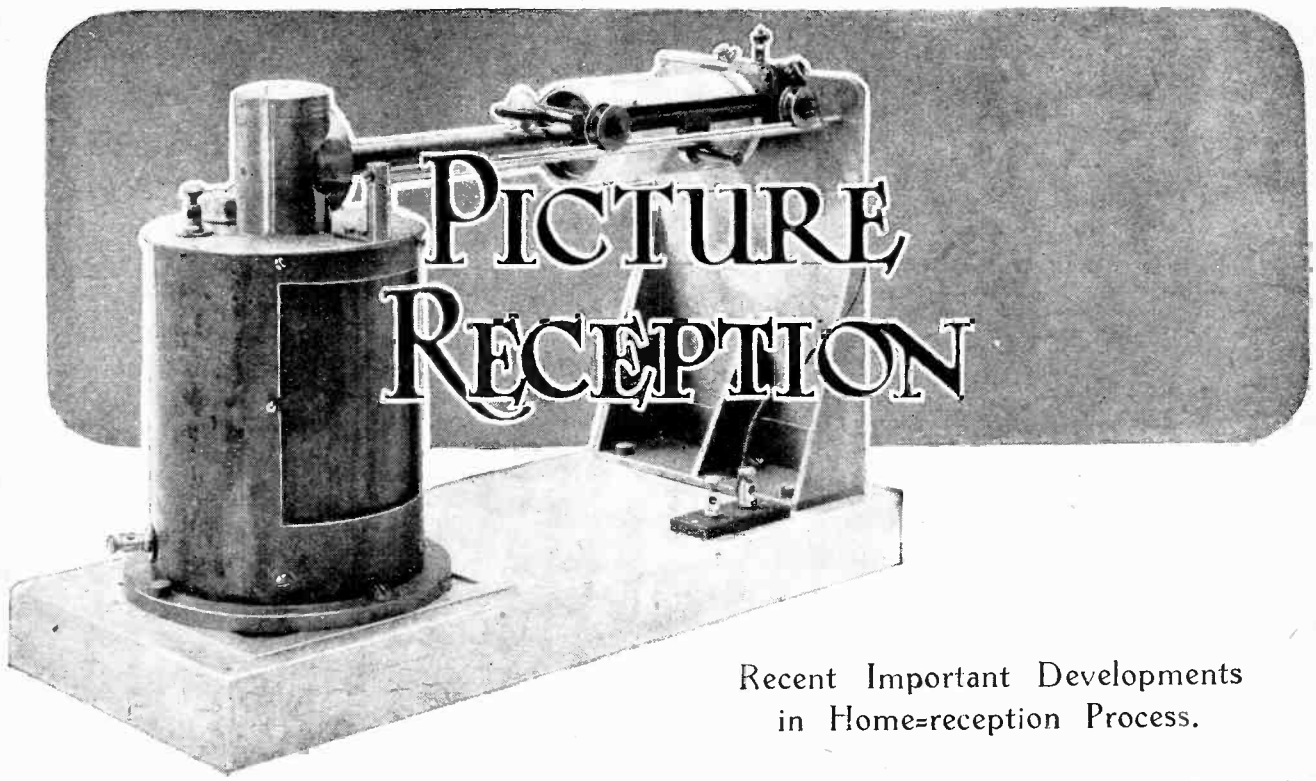
The case of two inventors is a comparatively simple one, but in wireless it not infrequently happens that a very large number of patents may have been taken out and be held by different parties, all relating to some specific instrument, and then the manufacturer is, naturally, in a state of hopeless bewilderment, and probably finds that it is better to leave the instrument alone altogether rather than manufacture it and attempt to elucidate the patent position so as to ascertain to whom he should apply for a licence and pay royalties. The immediate result of such a state of affairs is that the public is deprived of the advantages which would result from the extensive manufacture of such instruments, which, it must be assumed, are an improvement on existing apparatus.

Two instances immediately occur to mind in the wireless industry to-day where would-be manufacturers are neglecting to produce apparatus because of the obscurity of the patent position.

Neutrodyne and Loud-speaker Patents.

We refer to neutrodyne arrangements of high-frequency amplifying stages and the type of loud-speaker which is now commonly termed the "coil drive." In both of these cases there are very many manufacturers who would gladly step in and provide for the public apparatus built to make use of these inventions, but they are unable to elucidate the patent position themselves, and, naturally, they cannot get an unbiased opinion from any of those who hold relative patents.

Now we consider that this is a deplorable state of affairs, and it would seem that in such cases, at the request of a "quorum" of manufacturers, some authoritative body—the Patent Office in this case—might be empowered to investigate the patent position and arbitrate as to the various patent claims, and so clarify the position without the necessity of resorting to what at present is the only procedure, viz., expensive litigation in the Courts.



PICTURE RECEPTION

Recent Important Developments in Home-reception Process.

THE success, or otherwise, of any scientific development can always be gauged by the extent to which subsequent modifications are made. An invention which is put forward as feasible, and yet which in the course of time brings no improvements, is invariably unsound. On the other hand, an idea being presented and later followed by a sequence of improvements becomes full of promise, and by the concerted efforts of many workers is assured of success.

Picture transmission by wire or wireless has from the earliest days of wire telegraphy received the attention of the inventor, yet it is only during the past two or three years that a series of advancements have been made and the project has become an achievement. The transmission of news pictures over considerable distances has changed even during the past few months from mere novelty to a thing of practical utility. Such apparatus has not been created spontaneously, but rather the steady progress made in other branches of science has made its evolution possible. Modern picture-sending gear involves the valve-maintained tuning-fork for synchronising, the low-frequency valve amplifier, the valve voltmeter, the stroboscope, and the polariscope, as well as the innumerable refinements of present-day instrument making. Our next aim is to simplify the apparatus so as to increase the field of application. Picture-receiving gear, easy of operation, will not only attract the attention of the enthusiast in search of a scientific hobby, but is capable of providing a service parallel to broadcasting.

Apparatus for the home reception of pictures as an adjunct to broadcasting has now been developed beyond the experimental stage. This article describes for the first time an entirely new picture receiver suitable for use with a broadcast receiving set, and in which the difficulties of synchronising have been successfully overcome.

Amateur interest in picture broadcasting is rapidly growing, and a new field of experiment is being opened up. How long must we wait for a picture service parallel to broadcasting?

The Process Explained.

To communicate a picture over a distance it is necessary to divide the image into an enormous number of points, the more the better, and to pass on the grading of each of these points, whether light or dark, to the distant receiving station, where the picture is reassembled. Pictures of ordinary size may be subdivided into squares measuring not more than $\frac{1}{20}$in., the larger the squares the fewer will be the number of "messages" to be transmitted, but the poorer will be the received image. Taking a "screen" of $\frac{1}{40}$in. as necessary for producing a reasonably good picture, it is obvious that the number of signals required to communicate a picture of 5in. × 4in. will be $40 \times 40 \times 5 \times 4$, or 32,000. With the present-day methods of line telegraphy or modulated wireless telegraphy, three minutes can be considered almost the minimum time in which these 32,000 signals can be communicated. But this is not the only problem, for it is necessary that every point analysed in the original picture should fall into exact position, line by line, when reconstructing the image at the distant station. This question of synchronisation obviously renders

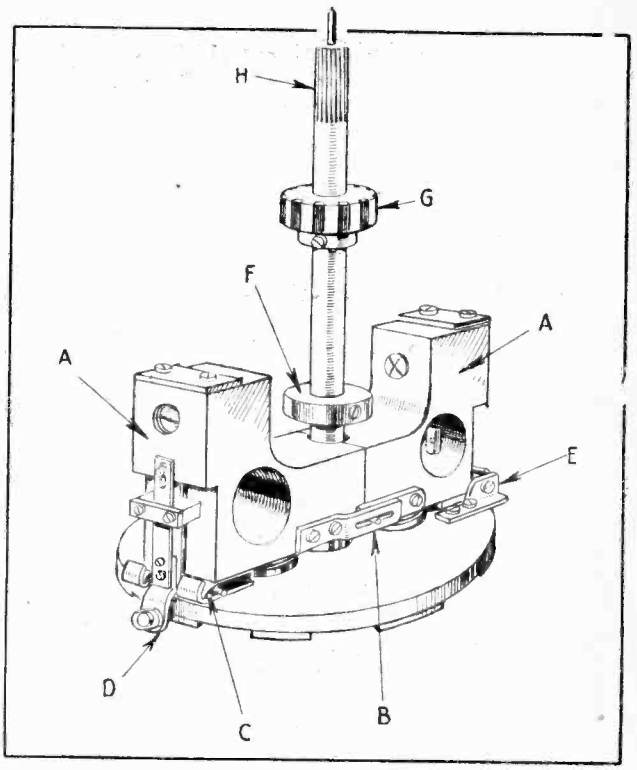
Picture Reception.—

beyond the limits of reasonable possibility any system of television based on picture analysis where it is desired to receive complete pictures at the rate of sixteen a second. The most modern system of synchronising permits of the transmission of the 5in. × 4in. picture in three minutes, yet mechanical limitations are such that we cannot hope, with the materials at present to hand, to build a machine that will render possible picture transmission at sufficient speed to give moving picture reception or television. Because an express train can to-day move at 70 miles an hour, there is no justification for forecasting that nothing stands in the way of building an engine that will haul the train at over 200,000 (60 × 16 × 3 × 70) miles an hour, yet this is the relative difference between the accomplishment of picture transmission and television based on any system of detailed picture analysis.

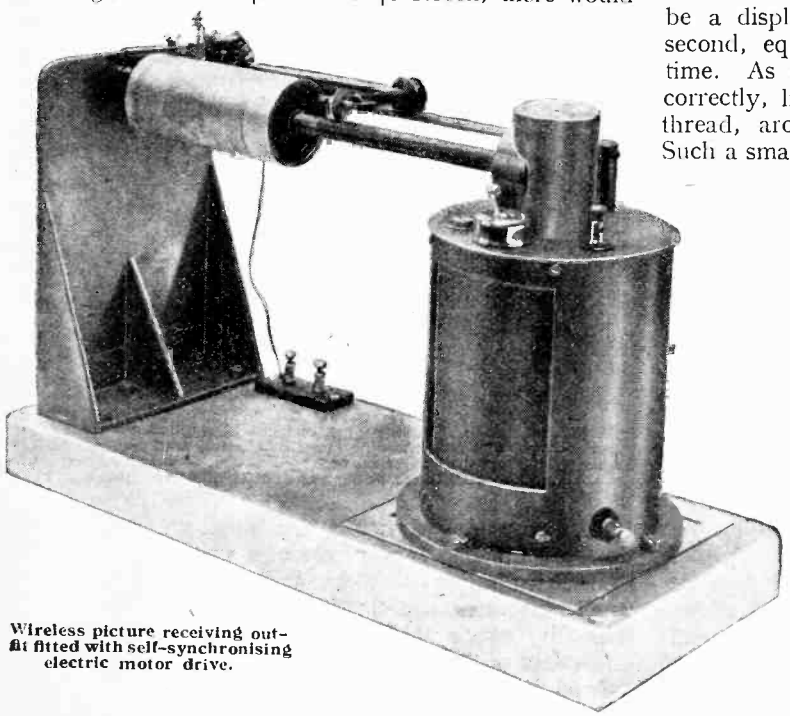
The Synchronising Problem.

Our problem in picture transmission is the reassembling of the dots, some indicating light and the others dark portions of the picture in their correct relative positions. Thus, if the picture is being analysed at the transmitter by being attached to a cylinder revolving in front of a steadily traversing point, then the corresponding cylinder at the receiver upon which the image is being simultaneously recorded must also revolve in the same manner as if it were attached to the actual shaft of the cylinder at the transmitter.

The extent of synchrony required is worth considering. Supposing one cylinder takes two seconds to rotate, which is a customary speed, and the other 2.01 seconds, a percentage difference of 0.05 per cent., then by the time the traversing of the image is completed, assuming a width of 4in. and a 40 screen, there would be a displacement of 40 × 4 × 0.01 seconds, or 1.6 second, equal to nearly a complete revolution behind time. As a result, instead of the image forming up correctly, line by line, it would be spiral, like a screw thread, around the cylinder and devoid of identity. Such a small error in the speed of rotation of the receiving cylinder as one part in 200, as just mentioned, is disastrous, and even one part in a thousand, either too fast or too slow, destroys the detail of the picture as well as producing an imagine of parallelogram shape instead of rectangular.



The governing device. The heavy brass blocks A are linked together at B and pivot on the sharp knife edges C, causing a frictioning contact between the surface D and the stationary circular base over which the flywheel revolves. E is a retaining piece and F a guard ring to limit the movement of the blocks. G interrupts the battery current so that when applied to a pair of electro-magnets underneath the flywheel the iron shoes, the edges of which can be seen, are perlodically attracted. The pinion H meshes with the crown wheel on the horizontal shaft and drives the cylinder.



Wireless picture receiving outfit fitted with self-synchronising electric motor drive.

New Method of Synchronising.

Oscillating valve methods of synchronising are well known, and apparatus has been described in the pages of this journal from time to time making use of swinging pendulums at transmitter and receiver as a means of holding the cylinders in step. Such a method has been successfully developed in the Thorne-Baker system, the pendulum being fitted with contacts so that a circuit is closed on each complete swing. The cylinders were arranged to be arrested by a trigger at every revolution, the trigger being released

Picture Reception.—

periodically by the closing of the pendulum contacts. This method demands that the cylinders shall run slightly faster than is required in order to be held and released by the action of the pendulum. Error is apt to arise in estimating the interval of time for which the cylinder is stopped between each revolution, while the stopping and the spontaneous starting of the cylinder demands a special driving mechanism with a slipping clutch.

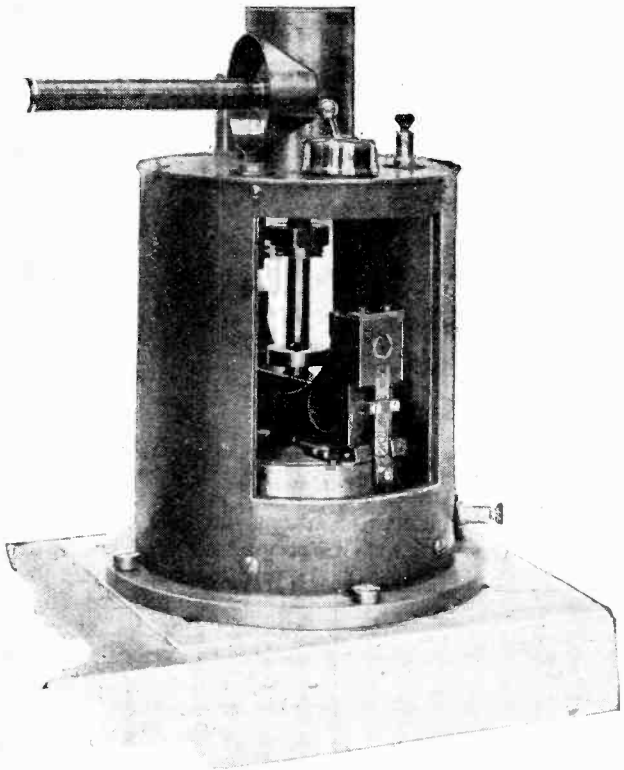
An entirely new method of synchronising has been developed by Messrs. W. Watson and Sons in conjunction with Prof. A. E. Conrady. A mechanism has been developed that will run at constant speed, which, by the way, has many applications, such as the running of clocks for astronomical telescopes and chromographs of every kind. Applied to picture transmission, the driving mechanism will run the cylinder continuously with an accuracy of not less than one part in ten thousand. Local control by means of valve oscillator or pendulum is not resorted to, and it has been demonstrated that when the apparatus is once set after manufacture it will run as required at its constant stated speed. Reference to the accompanying drawing will readily reveal its action. A pair of substantial balance weights are slung on knife-edge pivots about a central spindle. By rotation the weights tend to pivot outwards, lifting at the centre and falling over at the top. In so doing, tension is applied to a flat spring, one end of which is suitably faced and runs against a smooth stationary track forming the base of the instrument. When contact is once established between spring point and its track, there is no further appreciable movement of the governing parts, the friction increasing with the speed.

The image as recorded on the prepared copper screen at the transmitter. The black portions are in the form of an insulating deposit and the white portions represent exposed metal. When traversed by a needle an interrupted current is obtained.

At the receiver the interrupted current is applied to a starch-iodide paper the passage of current producing a coloration. The direction of rotation is from top to bottom of this picture and the image will now be seen to consist of small squares.

This governing device is assembled on the face of a flywheel attached to the base of a vertical spindle, and is electrically propelled by taking in this instance a small current from a 6-volt battery. Propulsion is obtained by means of eight iron segments attached to the under face of the flywheel. These pass over the face of a pair of electromagnets, to which current is intermittently applied through an eight-segmented contact breaker. A

Picture Reception.—
direct drive between a pinion cut in the vertical shaft and a crown wheel gives a reduction gear of 5 to 1 between the self-synchronising motor and the picture-carrying cylinder.



A substantial cylindrical brass case provides bearings for the motor shaft and protects the governor from air current.

It can be shown that this apparatus is more constant in its running than the swinging of a pendulum, for, although the latter is, for all practical purposes considered to have a definite time of swing depending on its length, the close synchrony required for picture transmission reveals that the actual time varies within small limits, depending upon the size of arc through which the pendulum moves.

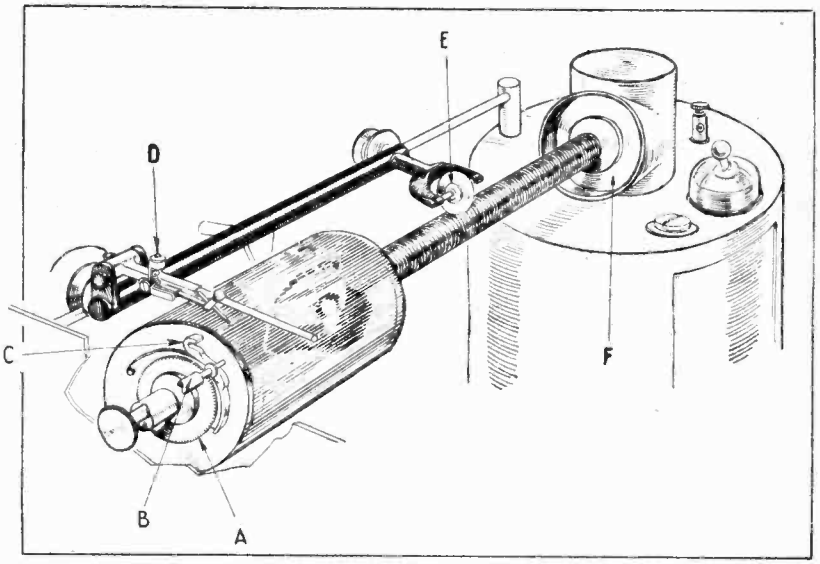
Preparing the Picture.

The image to be transmitted is photographed through a 50-line screen, in the manner used for making process printing blocks, and produced on to a thin copper foil. Lines of varying thickness give the effect of a half-tone image, and in the form of a negative, dark portions in the original appear as thin lines of deposit interspaced with comparatively wide lines of clean copper. Light parts in the original appear as wide lines of deposit with fine spacings of exposed copper. As the image on the copper is an insulator, and is actually hard glue produced by the gum-bichromate process, it will, when traversed by the point of a needle, interrupt a current, the duration of current flow and the intervals between the interruptions depending upon the width of the lines of insulating deposit and exposed copper. An examination of the accompanying reproduction of a transmitting plate will make this effect clear, while the illustrations showing the apparatus reveal the simple mechanism by which the needle point is slowly carried along the image in spiral fashion as it rotates.

Recording the Image.

At the receiver, in place of the copper foil, is wrapped a semi-absorbent paper previously moistened with a preparation of starch and potassium iodide. Now starch in the presence of a minute trace of free iodine produces a strong purple-blue coloration, while if a very feeble current of a few milliamperes is applied to a potassium iodide solution for only a fraction of a second iodine is released. The slightly moistened paper, prepared by dipping in the solution and blotting off, is traversed by a platinum tipped stylus, and the interrupted current from the transmitter applied. The stain effect produced varies with the width of the line of the exposed copper at the transmitter, and a half-tone image of good gradation results.

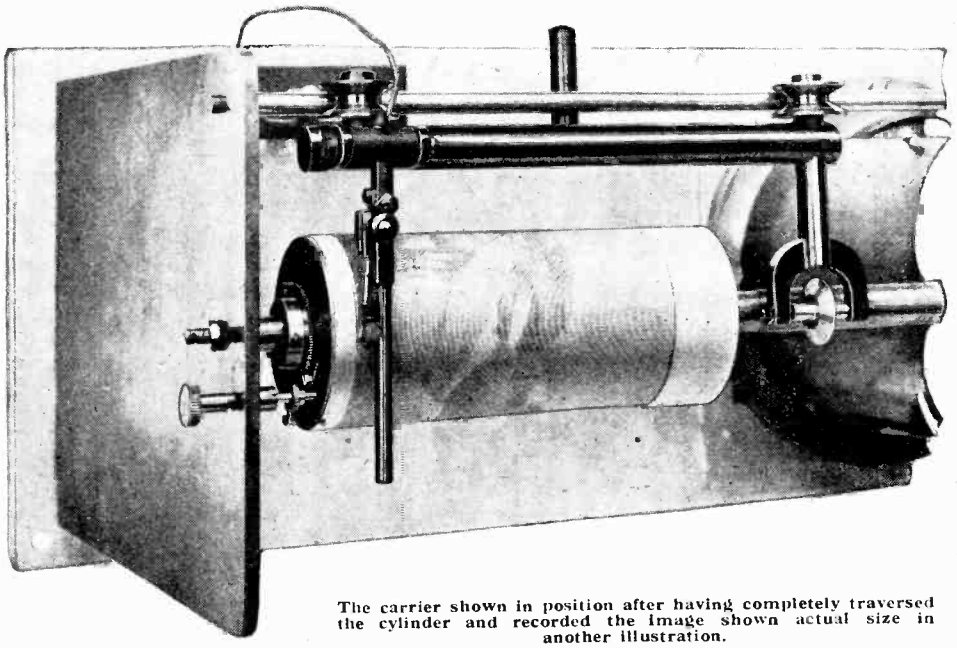
In order that the image may fall in the correct position on the receiving cylinder, and not across the join in the paper, an ingenious trigger device has been evolved. Prior to the actual sending of the picture brief pulses of current are sent out once each revolution at the time when the join in the foil passes under the needle. These are heard in telephone receivers at the receiving station, and the cylinder engaged at the right interval of time. The detailed sketch of this mechanism will make its action clear, the cylinder being actually free on the shaft until a catch is withdrawn.



The carrier and release pin. The knife-wheel E runs on a spindle cut with 50 threads to the inch and causes the stylus to traverse the image. D adjusts the pressure of contact. A is a toothed wheel with which the ratchet C engages when the pin B is released so that the cylinder can be set in rotation at any interval of time. This latter device prevents the image being formed across the join in the paper. F is the crown-wheel which is driven by the vertical shaft of the synchronised motor.

Picture Reception.—

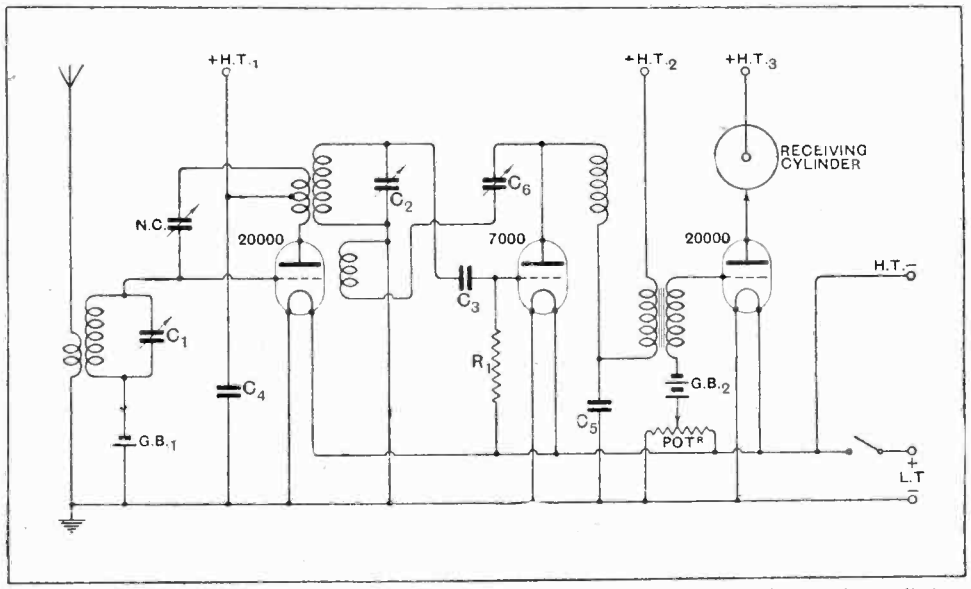
Applied to wireless, the transmitting cylinder may be used to interrupt a high-pitched note, such as might be created by a valve oscillator coupled to one of the amplifying stages of the microphone. The picture receiver would merely be joined to the terminals of a broadcast set, assuming the customary one or two L.F. amplifying stages. As a current fluctuation of only about 3 mA. is required, a special power amplifier will not be needed. The output valve must, however, rectify, and this is achieved by using a valve of the H.F. type, as the output valve with adequate negative grid bias.



The carrier shown in position after having completely traversed the cylinder and recorded the image shown actual size in another illustration.

Greater range and easier reception will be obtained, however, by causing the interrupted currents from the transmitting cylinder to actually "key" the transmitter. Wave trains of C.W. of varying duration are thus sent out. This system demands the use of reaction for reception to heterodyne the C.W. to an audible beat note that can be magnified by the L.F. amplifier. Reaction as extensively used for broadcast reception to-day, has this desired effect, and, assuming the allocation of a special wavelength, say, 200 metres for picture transmission, interference effects would not be objectionable. Alternatively, a properly stabilised H.F. stage with reaction applied in the detector valve circuit goes a long way to effectively preventing locally generated oscillations energising the aerial. The several recent articles on picture receiving which have appeared in this journal have aroused much interest among amateurs anxious to apply themselves to experimenting in this new field, while the important modification by way of simplified synchronising, here described for the first time, removes what has been a difficulty to many. Commercially built apparatus moderate in price and of guaranteed performance now being available, the way is open for the introduction of picture reception as an adjunct to broadcasting.

Important developments may be expected in the near future. F. H. H.



The receiving circuit differs from that used for broadcast reception in that reaction can be applied for heterodyning while the output valve is of moderately high impedance and biassed to rectify.

WIRELESS FROM SOUTH POLE?

A portable short-wave transmitter will form part of the equipment which Commander Byrd, the American explorer, will take with him on his expedition to the South Pole early next year. His ship, the "Samson," will carry four transmitters and a number of receivers.

The aeroplane in which the final stage of the journey to the Pole will be made will carry a wireless transmitter for communication with the base; there is thus a possibility that amateurs may be able to pick up Commander Byrd's messages.

A NEW METHOD OF PUSH-PULL.

Advantages to be Gained by Employing Tapped Loud-speaker Windings.

By L. E. T. BRANCH, B.Sc.

PUSH-PULL amplification is becoming more and more a popular method of obtaining a large undistorted output from the last stage of a wireless receiving set, since by its use two ordinary good power valves can be made to give results equivalent to one valve of the extra-super power type. The most general method of wiring such an output stage is shown in Fig. 1, where A is an intervalve transformer, the

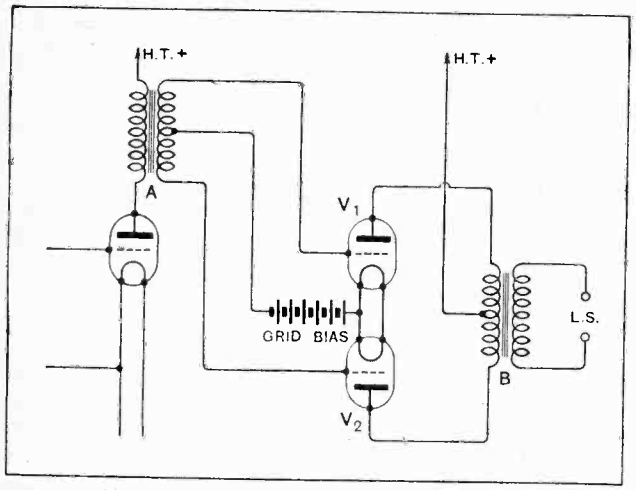


Fig. 1.—The conventional circuit for push-pull amplification.

secondary of which is centre-tapped, V_1 and V_2 are the output valves which are operating under push-pull conditions, and B is the output transformer whose primary is furnished with a centre-tap. The principle of this arrangement is well known, namely, that the transformer A splits the signals into two halves, one of which is handled by the valve V_1 and the other by the valve V_2, these halves then being recombined by the transformer B and fed as one whole again, into the loud-speaker at L.S. Now losses arise in the transformer B due to the resistance of the windings and also due to "leakage inductance." This latter occurs even in the best designed transformer, since the lines of force produced in the iron core by the primary do not *all* cut the secondary winding. It has been previously pointed out by N. W. McLachlan[1] that even if this loss is only about 1 per cent. it is then equivalent to an inductance of about the same value as the inductance of the moving coil[2] and in series with it. This is shown in Fig. 2, where C is an imaginary perfect transformer having no leakage inductance. At low frequencies the effect of the leakage inductance is negligible, but at, say, 4,000 cycles, it will have an impedance of several thousand ohms, consequently the loss of the high frequencies is considerable.

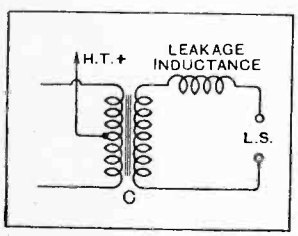


Fig. 2.—An output push-pull transformer where the leakage inductance is shown as an external inductance in series with the loud-speaker.

[1] *The Wireless World*, p. 376, March 30th, 1927.

[2] The moving coil type of loud-speaker is considered because its electrical properties are better known and more easily worked out in making the calculations.

Application to Moving Coil Loud-speakers.

Another method of push-pull amplification is that in which a centre-tapped choke is used in place of the transformer B, and since a choke does not have to transform power, the losses referred to in the case of the transformer do not arise. One method of carrying out the choke-push-pull arrangement is shown in Fig. 3. Let us compare this with the normal one valve choke output stage of Fig. 4. We see that the A.C. current flowing through the loud-speaker is that flowing round the circuit C_1, V_1, V_2, C_2, S, so that, although the two valves together can handle twice the grid swing of one valve, they have to drive the anode current through two valves instead of one, as in the single output of

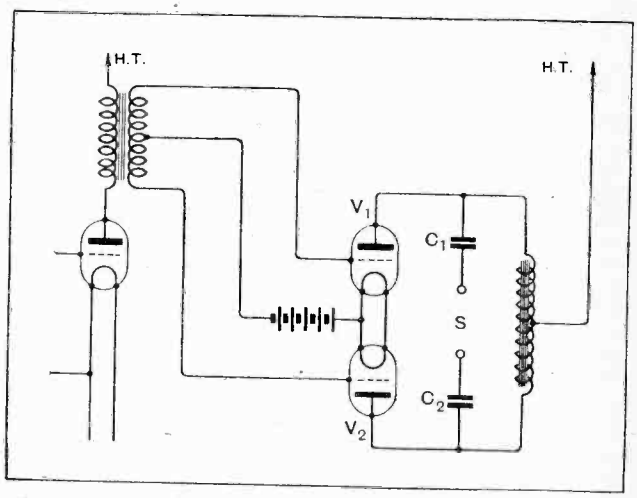


Fig. 3.—Push-pull circuit with tapped choke output. Here the output transformer losses are absent.

Fig. 4. If, for example, ordinary power valves of 8,000 ohms impedance are being used, and the loud-speaker has a D.C. resistance of 1,000 ohms, and impedance of approximately 4,000 ohms (this is so at about 55 and 4,000 cycles, when the moving coil consists of about 1,000 turns of No. 46 wire moving in an air gap of 10,000 lines per square cm†) the 4,000 ohms impedance is then out of phase with the *D.C. resistance of the circuits*, which are $8,000 + 1,000 = 9,000$ ohms in the case of Fig. 4, and $(2 \times 8,000) + 1,000 =$

† *The Wireless World*, p. 373, March 30th, 1927.

A New Method of Push-pull.—

17,000 ohms in the case of Fig. 3. The combined impedances of the circuits are therefore

$\sqrt{9{,}000^2+4{,}000^2} = 9{,}850$ ohms for Fig. 4,

$\sqrt{17{,}000^2+4{,}000^2} = 17{,}450$ ohms for Fig. 3.

If the voltage produced by the valve of Fig. 4 be, say, 20 volts *root mean square*, that produced by the two valves of Fig. 3 will be 40 volts. Since the current flowing through the loud-speaker circuit is obtained by

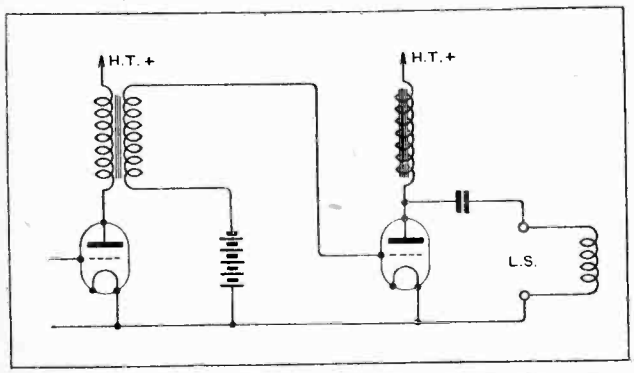


Fig. 4.—Circuit showing the ordinary choke filter fed loud-speaker where one lead is connected to L.T. negative.

dividing the voltage by the impedance of the whole circuit, we have

$\frac{20}{9{,}850}$ amperes, *i.e.*, 20.3 milliamperes in Fig. 4,

and $\frac{40}{17{,}450}$,, 23.0 ,, 3.

If we had used two valves in parallel it could be shown that the current would be $\frac{20}{6{,}400}$ amperes, *i.e.*, 31.2 milliamperes, which is better and simpler than the push-pull arrangement of Fig. 3.

A new modification of push-pull amplification has been worked out, and used by the author, whereby the disadvantages of both the above described methods are avoided.

The essentials are a centre-tapped output choke (or

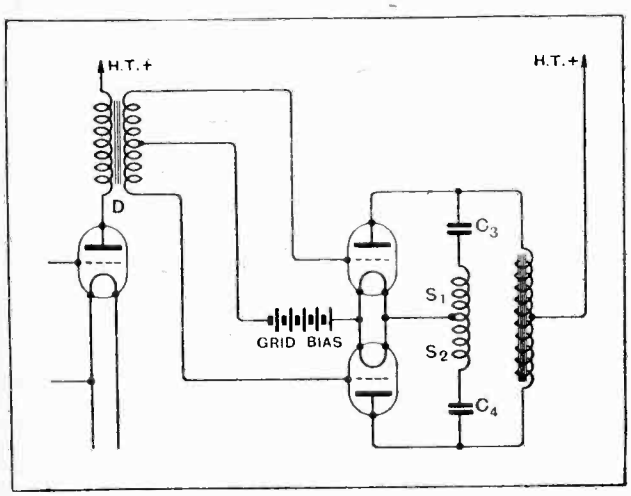


Fig. 5.—Output choke push-pull scheme as applied to a centre-tapped moving coil loud-speaker (S_1, S_2).

two separate chokes may be used equally well), and a moving coil wound with 2,000 turns of No. 47 S.W.G., and having a centre-tapping. This coil will weigh about 1.6 gram more than the normal coil of 1,000 turns of No. 46 S.W.G., and this increase in weight alone will cause a slight decrease in output volume, but this is far more than compensated for by the push-pull arrangement.

Details of the Moving Coils.

The circuit is shown in Fig. 5. D is the usual inter-valve centre-tapped transformer, or, of course, an ordinary transformer may be used if its secondary is shunted by a centre-tapped high resistance. C_3 and C_4 are fixed condensers of 2 mf. or 4 mf. each, and S_1 and S_2 are the two halves of the 2,000-turn moving coil, the centre-tap being taken to L.T. negative. Here we have two separate circuits, each of which is represented by Fig. 6, and since S_1 or S_2 is 1,000 turns of wire, this is practically identical with Fig. 4, hence the *total* number of ampere turns for the moving coil in Fig. 5 is twice that for Fig. 4, and since the power output is proportional to the square of the ampere turns, the power put out by the Fig. 6 arrangement is approximately four times that for the Fig. 4 arrangement (the 1.6 gram increase in weight, and also the slightly increased D.C. resistance of 1,000 turns of No. 47 wire bring this down from "four times" to very nearly "three times"). Thus we obtain the output which a centre-tapped output transformer gives without the loss due to the leakage inductance, and at the same time a greater output than either that given by the push-pull choke output with the ordinary moving coil or by two valves in parallel.

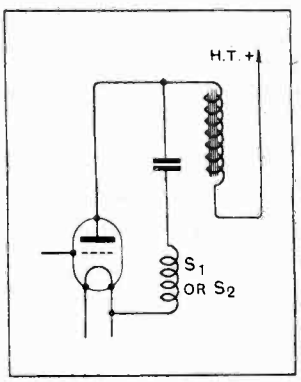


Fig. 6.—Skeleton circuit, including half the turns of the moving coil.

When making the new moving coil it will be found that where a $\frac{1}{8}$in. gap is employed the 2,000 turns of No. 47 wire can be easily accommodated on the usual former, and the method of connecting up this coil, which will have necessarily three leads instead of two, is clear from Fig. 5. It is found advantageous to give a very liberal grid bias to the output valves; in fact, up to double their normal bias.

For those who desire to convince themselves of the advantages of this new arrangement, we will consider the actual calculations for such an arrangement where P.M.254 or 256 valves are employed.

It will be best to regard the new moving coil as two separate coils because, as will be seen presently, each coil works independently of the other. The anodes of the two valves in the output stage are supplied with high-tension current through a centre-tapped choke (or two separate chokes), as shown in Fig. 8 (*a*). Fig. 7 (*a*) shows, for purposes of comparison, a "straight" choke output stage. The equivalent electrical circuits are shown in Figs. 8 (*b*) and 7 (*b*) respectively.

A New Method of Push-pull.—

Considering, firstly, the circuit of Fig. 7, we know that, for an alternating frequency of 50 circles, L_0 can be considered to be negligible, while for a moving coil of 2in. diameter and consisting of 1,000 turns of No. 46 S.W.G., the motional capacity C_m, combined with the 4 mf. blocking condenser, has an impedance of

$$\frac{10^6}{2\pi C^1 \times 50} \text{ ohms* where } \frac{1}{C^1} = \frac{1}{4} + \frac{1}{C_m}$$

and if the strength of the field is 10,000 lines per square centimetre, C_m is approximately 0.74 mf. This gives an impedance of rather more than 4,000 ohms.

At 4,000 cycles, however, C_m has a negligible impedance, while the impedance of L_0 is $2\pi L_0 \times 4{,}000$. If L_0 is 0.15 henry this impedance is also about 4,000 ohms. At 50 cycles, and also at 4,000 cycles, the impedance of 4,000 ohms is 90° out of phase with the valve A.C. resistance and the D.C. resistance of the moving coil R_0. Hence the impedance of the circuit when ρ = 3,500 ohms (P.M.254 or 256) and R_0 = 1,000 ohms, is

$$\sqrt{(4{,}000)^2 + (R_0 + \rho)^2} =$$

$$\sqrt{(4{,}000)^2 + (1{,}000 + 3{,}500)^2} = 6{,}030 \text{ ohms.}$$

Now, by inspecting the characteristic curves of the P.M.254 or 256 valves we see that for a swing each way of, say, 20 volts R.M.S. on the grid *on open circuit* there is produced a change of 60 volts on the anode.

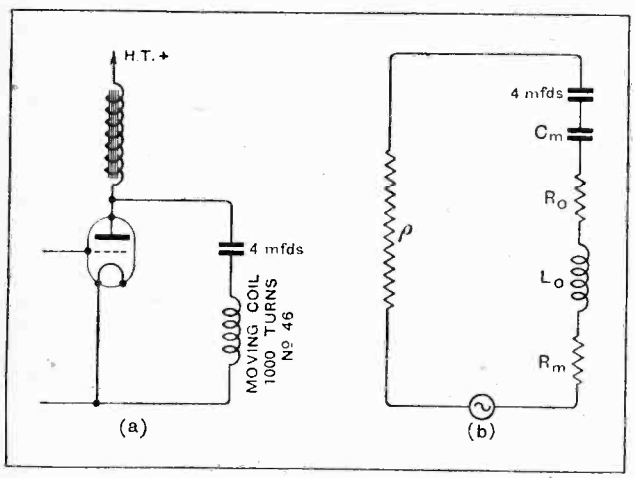


Fig. 7.—A simple choke output (a) and the equivalent electrical network (b).

Hence on the closed circuits at 50 cycles and 4,000 cycles considered above, the change of anode current which will result is

$$\frac{60}{6{,}030} \text{ amp} = 10 \text{ mA. (nearly).}$$

Secondly, we will consider the effect of using two valves in parallel, other things being equal. The combined valve impedance is now

$$\frac{3{,}500}{2} = 1{,}750 \text{ ohms.}$$

This will reduce the impedance of the circuit from 6,150 ohms to

$$\sqrt{(4{,}000)^2 + (1{,}750 + 1{,}000)^2} = 4{,}850 \text{ ohms.}$$

* C^1 is measured in microfarads.

The corresponding current change will now be

$$\frac{60}{4{,}850} \text{ amp.} = 12.4 \text{ mA.}$$

Thirdly, we have to consider the circuit depicted in Fig. 8. The grid bias on the output stage can be and

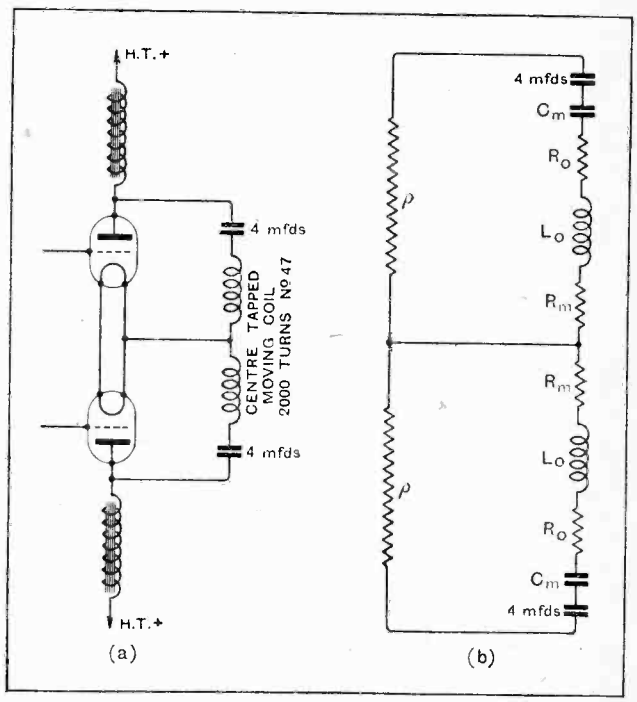


Fig. 8.—The plates of the two push-pull valves are fed through chokes (a). The equivalent electrical network is shown in (b).

(for the purposes of argument) is doubled, thus permitting, if desired, a grid swing of 40 volts instead of only 20 volts. Each of the output valves is now working under push-pull conditions. That is to say, each valve deals with only one-half of each complete wave, and if the grid bias is double the normal, then when one valve is operative the other is dead and its impedance is very large. Thus at any moment the circuit is that given in Fig. 7 (*b*), being one-half of the circuit of Fig. 8 (*b*). But Fig. 7 (*b*) represents the equivalent of the simple circuit of Fig. 7 (*a*).

The impedance of the new circuit is augmented by the

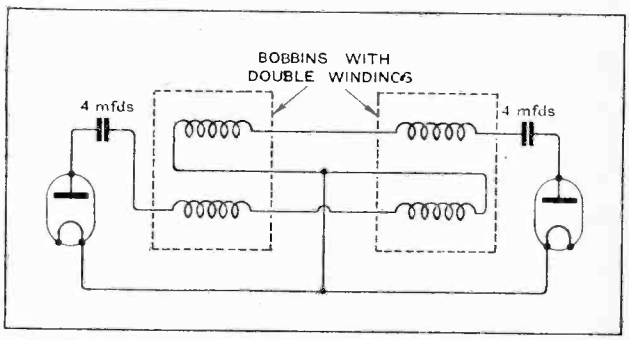


Fig. 9.—Method of adapting existing two-bobbin loud-speakers for use with the modified push-pull arrangement described in this article.

A New Method of Push-pull.—

increase of the resistance of the wire comprising the moving coil, and inappreciably decreased at 50 cycles owing to the decrease of impedance of C_m caused by the extra 1.6 gram in weight of the coil. We can, therefore, take the impedance of the circuit at any moment as being at both 50 and 4,000 cycles, equal to

$$\sqrt{(4,000)^2 + (3,500 + 1,420)^2} = 6,350 \text{ ohms.}$$

Now, however, the grid swing is taken as 40 volts R.M.S. Therefore, the change of anode volts on open circuit would be 120 volts. From this we find the change of anode current on the closed circuit of 6,350 ohms to be

$$\frac{120}{6,350} \text{ amp.} = 18.9 \text{ mA.}$$

In order to make a comparison of the powers radiated in the three cases we have considered, we will take the radiation resistance of the cone and coil wound with No. 46 S.W.G. wire as R_m. Then, assuming this coil with its diaphragm to weigh 18 grams, the radiation resistance of the cone and coil would be with No. 47 S.W.G.

$$R_m\left(\frac{18}{1.6 + 18}\right)^2 = 0.84\ R_m.$$

We are now in a position to compare the powers radiated.

	Single Valve.	Two Valves in Parallel.	Push-pull.
Output current ...	10.0 mA.	12.4 mA.	18.9 mA.
Power radiated ...	$R_m (10)^2$	$R_m (12.4)^2$	0.84 R_m $(18.9)^2$
" " ...	1	1.5	3.0 (Simplified approx. ratio).

The greater output which can thus be obtained from this arrangement of push-pull does not need further emphasis. Moreover, it can obviously be applied in the case of a loud-speaker having two fixed bobbins by adapting two separate windings on each bobbin and connecting these as shown in Fig. 9.

TRANSMITTERS' NOTES AND QUERIES.

Honour for a French Amateur.

We understand that M. Deveria, the President and founder of the Radio Club of Saint-Nazaire, has been nominated a Chevalier of the Legion of Honour, and hereby offer him our congratulations and good wishes.

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American Amateur Regulations.

Mr. K. B. Warner, the secretary of the American Radio Relay League, has corrected a slight misapprehension under which we were labouring when writing the note which appeared in our issue of March 28th. He says: "There is nothing new about the amateur regulations prescribing the observance of a silent period from 8.0 p.m. to 10.30 p.m local time, if interference results to other services; nor in denying amateur stations the right to broadcast news, music, and other forms of entertainment. These regulations have been in effect for many years. The amateur regulations were reaffirmed in October of last year and again in March of this year, repeating these old regulations, the reissuing being necessary because of minor changes in the wavelengths authorised for amateur telephony."

We trust that our mistake has not caused any annoyance to American amateurs. Having seen the "Regulations Governing the Licensing and Operation of Amateur Stations" printed in the official "Radio Service Bulletin" issued by the Department of Commerce, Washington, we naturally assumed that these were new regulations drawn up to cope with existing circumstances, and not merely a recapitulation of those already in force.

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Amateurs Not Guilty.

Mr. Warner assures us that matters are now quite satisfactory. During the height of the winter broadcasting season there were some complaints and the A.R.R.L. took vigorous steps to adjust them. It is now known that many of the complaints of interference were not caused by amateur transmissions at all, but by electrical noises which the listener was unable to identify, and in most cases where there had, in fact, been interference by amateurs, the broadcast receiving set was discovered to be an ancient device of obsolete design.

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International Prefixes.

We have received a letter from Mr. J. A. Partridge (2KF), from which the following is an extract:—

"Whilst in touch with Canadian station 2BE last night on 20 metres I was surprised to hear him use the call-sign VE2BE, and was informed that yesterday the Government had issued new call-signs to the Canadian amateur stations, which included their old call-signs with the addition of the prefix 'VE,' which is to be part and parcel of the call-sign, with the instructions that they should be put into use at once.

"It would seem that there is going to be some confusion arising from the use of these new prefixes, as many of the stations working on the short waves will continue to employ the 'intermediates' arranged by the A.R.R.L. last year.

"I should not be surprised if the new prefix for Great Britain is not 'CG,' and will be issued very shortly with the new permits, and then we must discontinue to use the 'EG' business and employ the standard 'de' as laid down in the book of rules."

We have never entirely approved of the system of prefixes or intermediates drawn up with characteristic impetuosity by the A.R.R.L. while we, in Europe, were—with perhaps too much of our customary caution—considering the matter carefully from many points of view. The letter "E" to indicate Europe was, technically, ill-chosen, as the poor little dot is so easily lost. Norway had already officially adopted the prefix LA, Sweden SM, and Spain EAR, while our own Post Office authorities have never, as far as we know, given official sanction to the use of the letter E before the authorised prefixes G and GI. However, in general practice the A.R.R.L. system has been adopted by transmitters in spite of its many imperfections, for want of something better. The "intermediate" system as used in America is discouraged, if not actually forbidden, by the G.P.O.

We trust that if the matter is again raised a really sound and final agreement may be reached which will satisfy all countries and allow for extension without causing confusion.

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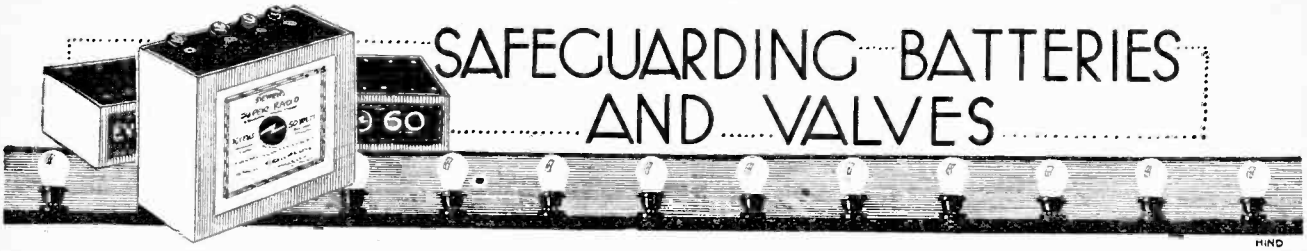
Unsmoothed A.C. in Short-wave Work.

Mr. Partridge also comments, as follows, on the use of "raw" A.C.:—

"I have suggested to the R.S.G.B. that every paper connected with the amateur movement should be asked to open up a straff against the use of unsmoothed A.C. plate supply for short-wave transmission, for two stations using the 50 cycle supply would entirely wipe out the very small band around 20 metres. Under the new scheme it would be advisable that each station should keep within 10 k/c limits, otherwise chaos will result, and any amateur using 'raw' A.C. should be boycotted. I have found from actual experience that a rough A.C. signal is far more difficult to copy, when the strength of signals is poor, than a good D.C. or reasonably smoothed R.A.C. note. The worst offenders at the present time are the Italian and French 'hams,' although quite a number of U.S.A. stations are still using the rough stuff."



SAFEGUARDING BATTERIES AND VALVES

How to Use Protective Fuses.

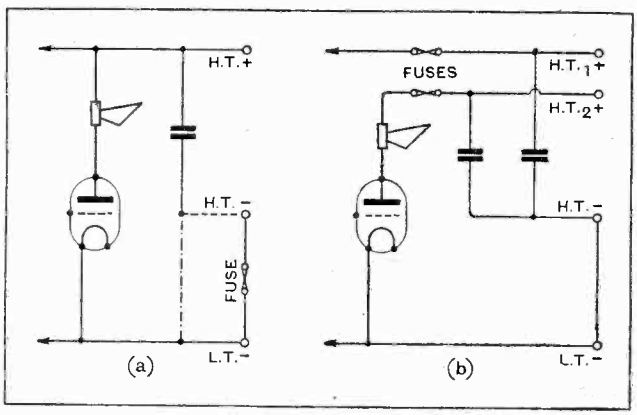
By "RADIOPHARE."

IT is surprising that a wireless receiver, which is at least as susceptible as any other piece of electrical apparatus to suffer harm from excessively heavy currents, is rarely provided with those safety devices which are embodied elsewhere more or less as a matter of course. The writer does not propose to indulge in vain speculation as to why this state of affairs should exist, or to enter a plea for the adoption of "safety first" measures; no doubt designers of sets generally omit them, partly because there is still but a limited choice of suitable components, and also because they are unwilling to introduce a further complication, the benefit of which is not likely to be immediately apparent. Be this as it may, there can be no reasonable doubt that in many cases damage can be prevented by observing the simple precautions to be described.

The premature demise of a valve is usually more spectacular than that of an H.T. battery; it must not be forgotten, however, that the latter is generally more costly, and is even more likely to be damaged by short-circuiting. It must, therefore, receive the same consideration.

Of the various safeguards which are applicable, we need only consider the use of fuses. As is generally known, they consist of thin strips of metal, which, while capable of passing the normal current flowing through the circuit in which they are connected, interrupt its continuity by melting when a considerable rise in current takes place. Fuses for wireless work are of special construction, as it is necessary that they should be capable of carrying the anode current—which is normally anything up to 30 milliamperes—and at the same time should "blow" at less than the rated consumption of the valves, which is often as low as 100 milliamperes. It is often suggested that flash lamp bulbs should be used for this purpose, but they are not really satisfactory, as the average specimen will pass half an ampere for an appreciable period of time before failure of its filament. However, special low-consumption bulbs, which fuse at a very much lower current density, are sometimes available.

There can be little doubt that specially designed fuses are the best; even the low-consumption bulbs mentioned above seldom give protection on currents under 0.2 amp. The use of tinfoil strips is equally open to objection, as it is a difficult matter to cut them sufficiently thin to ensure that they will melt at currents in the order of, say, 0.1 amp.



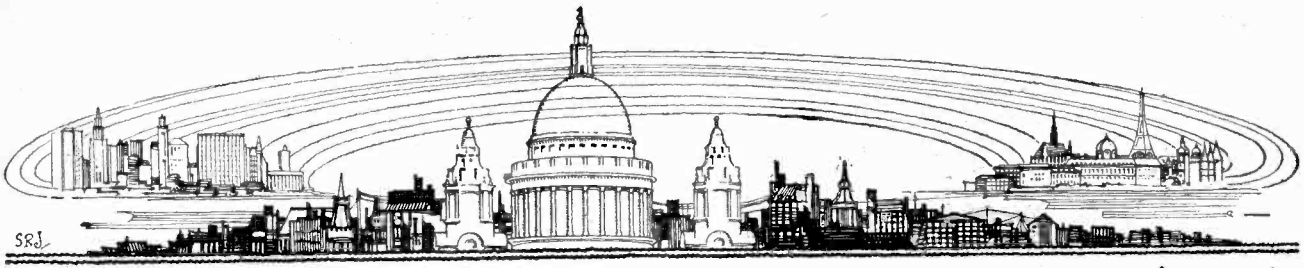
Alternative positions for high-tension fuses.

The Effect of By-pass Condensers.

The best position for the connection of a fuse deserves careful attention. Obviously, its safeguarding effect will be greatest if it is joined direct to the H.T. battery, but here we at once come up against a difficulty; if the element is sufficiently sensitive to protect the most economical type of valves, it is quite probable that the flow of charging current into the large by-pass condensers included in the average set will be sufficient to "blow" it, and, unless the fuses are of such a capacity that this state of affairs will not arise, the plan is impracticable. However, there is a way of overcoming the trouble; if the by-pass condensers are charged up gradually by progressively making contact with a number of battery tapping points, starting at those giving a low voltage, the current flow will not be excessive.

Perhaps the simplest method of connection is that shown in diagram (a) of the accompanying figure; here the fuse is inserted in the receiver between the negative H.T. and negative L.T. terminals. As to whether the capacity-charging current flows through the fuses or not depends on the connection of the low-potential end of the by-pass condenser. If it is joined in the manner shown in "dot-and-dash" lines, the current will clearly pass through the fuse, and the precautions already mentioned must be observed. The dotted line shows the other form of connection, in which the condenser charging current has no effect. The second diagram (b) indicates how damage resulting from short circuits between separate H.T. tappings may be avoided by fitting separate fuses in each lead; as before, the by-pass condenser charging current may, if necessary, be diverted by altering the connections.

The foregoing remarks, with obvious modifications, apply to high-tension eliminators, which are also liable to damage through short-circuits.



CURRENT TOPICS

Events of the Week in Brief Review.

THE DEAF LISTENER.

The Royal Ear Hospital, London, has opened a special department for research into the possibilities of wireless as an aid to the deaf.

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SUNDAY MORNING SIGNALS FROM MELBOURNE.

On Sunday next, May 27th, the short-wave plant of the Melbourne broadcasting station (3LO) will transmit on 36 metres from 7.45 to 8.45 a.m. (B.S.T.).

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WHO WILL OWN BEAM SERVICES?

At the time of going to press speculation is rife concerning the future of the beam and cable services now operated by the Government. The Imperial Wireless and Cable Conference is understood to have completed its deliberations, and the decisions have been submitted to the various Dominion Governments.

The beam and cable services are being discussed in the House of Commons this week.

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IRISH BROADCASTING PLANS.

Listeners in the Irish Free State are to hear relays from Continental stations next winter. In making this promise, Mr. Heffernan, Parliamentary Secretary to the Minister of Posts and Telegraphs, stated in the Dail that the present programme policy was to give something better than the average listener wanted and so create a demand for the best in everything.

Broadcasting last year produced a financial surplus of £5,500 resulting entirely to the increased yield from the wireless import duty.

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COMMON-WAVE BROADCASTING.

Three relay stations all working on the same wavelength will shortly be operating in the Berlin area, writes a correspondent. These stations, which will be at Stettin, Magdeburg, and Berlin East, will each relay the programme from the Witsleben (4kW.) station on a common wavelength of 236.2 metres. While this interesting scheme promises to give superior receiving conditions for Berlin listeners, the greatest care will have to be exercised by each station to maintain the correct wavelength, if heterodyning is to be avoided

FREE STATE WIRELESS SHOW.

We understand that a wireless exhibition is to be held in the Mansion House, Dublin, from October 6th-13th, under the ægis of the Irish Radio Traders' Association.

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SIR CHARLES BRIGHT.

The Fellowship of the Institute of Patentees has been conferred on Sir Charles Bright, F.R.S.E., M.I.E.E. Sir Charles has long been associated with wireless and cable communications, and is a vice-president of the Radio Society of Great Britain.

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FIRST BROADCASTING STATION IN ROUMANIA.

Roumania's first broadcasting station is to be erected by the Marconi Company at Bucarest this year. It will have a power of 12kW. unmodulated energy in the aerial, and will incorporate several new features of design.

Until 1925 the use of private wireless sets was practically unknown in Roumania, but since the removal of restrictions a wide demand has grown up for a national broadcasting system.

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GENEVA SPEECHES BROADCAST ON SHORT WAVE.

At 3 p.m. B.S.T. to-day the Secretariat of the League of Nations will repeat an experiment made last week in the broadcasting of speeches to countries outside Europe. Transmission takes place on 18.4 metres from the Dutch station at Kootwijk (PCLL), the speeches being relayed by telephone cable across Switzerland and Germany.

For the purpose of the test last week the Kootwijk aerial, which is usually directional towards the Dutch East Indies, was altered so as to give uniform radiation in all directions.

The Kootwijk station broadcasts every Wednesday at 1.40 p.m. B.S.T. in Dutch, French, English and German "to all those whom the kingdom of the Netherlands interests."

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WIRELESS ON NORWEGIAN RAILWAYS.

Successful tests have been carried out with short-wave transmitters installed at intermediate stations on the railway between Bergen and Oslo. The experiments have been conducted with the object of providing a reliable emergency system of communication on the frequent occasions when the telegraph connections are broken. In many places the telegraph lines pass over snow-covered mountains.

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SMUGGLING WIRELESS VALVES.

At the Southampton Police Court the Commissioners of Customs and Excise successfully sued for the sum of £100 against Michael Skulnick, of Liverpool, who was found to be knowingly concerned in a fraudulent attempt at evading the payment of duty on 36 wireless valves, in addition to other articles.

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WIRELESS AND THE BLIND.

The wireless for the Blind Fund which was established in Manchester in October, 1926, has presented a gratifying report. 332 sets have been installed in the homes of blind people and two loud-speaker sets have been provided in institutions. £903 has been collected for the Fund, and at the end of March there was a balance of £224.

This sum is not, however, sufficient to meet fresh applications for 23 valve sets and 44 crystal sets, and the fund therefore remains open.

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NOT FOR A PORTABLE.

A high-tension battery weighing 1,000 tons is under construction by the Tudor Accumulator Company at Dukinfield. There are 300 cells each holding 179 gallons of acid, and it is computed that the battery complete would be able to supply anode current continuously for five hours to three million three-valve sets. It is being built to supply current for lighting and power to an important town.

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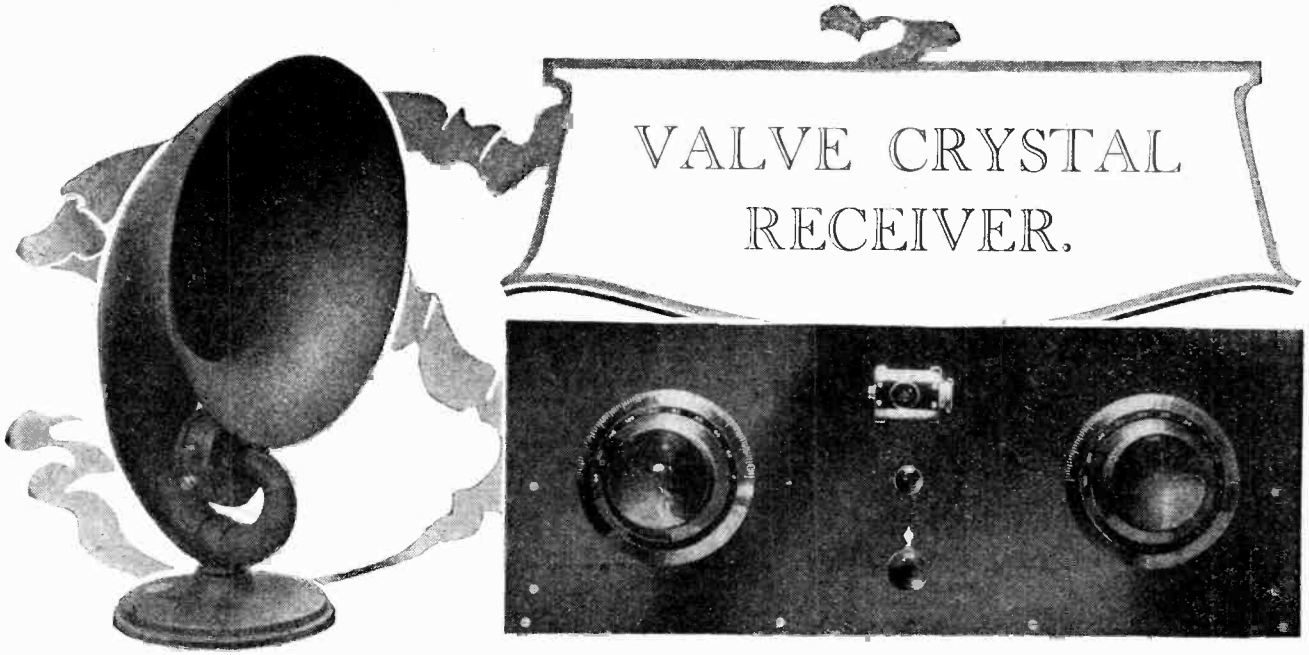
ERRATUM.

It is regretted that an error occurred in the reference on p. 527 of our last issue to the "Seraphone Five" receiver, which was inadvertently coupled with the designation "Truphonic." We are asked to state that although the sets are manufactured by the Truphonic Trading Company, they are marketed as "Seraphone" portable sets.



VALVE CRYSTAL RECEIVER.

A Non-radiating Super-sensitive One Valve Loud-speaker Set.

By P. W. WILLANS, M.A., A.M.I.E.E.

THE instrument which is the subject of the present article is the result of an attempt to introduce into reception practice a somewhat novel method of applying variable reaction in a high-frequency amplifier. The result in the case of the set here described is greatly enhanced selectivity and sensitivity, so much so, in fact, that quite adequate loud speech from 5GB has been obtained with a single valve only in the neighbourhood of Richmond, and foreign stations have been received at loud telephone strength, and under favourable conditions have been readable on the loud-speaker, without any trace of interference from 2LO.

Reaction Without Radiation.

In order to forestall trenchant criticisms from those who consider that single-valve receivers are basically an invention of the devil himself, let it be said at the outset that the present receiver employs a stage of high-frequency amplification, and that reaction is applied to the anode circuit in a manner which excites the aerial to no greater extent than in a neutralised receiver, such as the Roberts or Browning-Drake. Since there is only one valve in the instrument, namely, the high-frequency amplifier, it is evident that this valve must take the place of the detector in the two-valve neutralised arrangement of ordinary type, as far as the production of a regenerative effect is concerned. With ordinary reaction arrangements this has the effect of introducing couplings between the aerial and anode circuits, and it is thus necessary to give special consideration to the type of reaction circuit, so that these secondary troubles may be eliminated.

In order that this aspect of the problem may be made absolutely clear, it is of advantage to consider one or two typical circuits. Referring to Fig. 1, we have a two-valve arrangement embodying tuned aerial and anode circuits, the coupling between which is neutralised, and a magnetic reaction coupling of usual type, from the detector valve to the anode oscillating circuit, is employed. With the correct adjustment of the neutralising condenser, the reaction adjustment will be very largely independent of the aerial tuning, and will operate to counteract the load on the anode coil due to the resistance of the high-frequency valve.

Coupling by Valve Capacities.

In a circuit arrangement of the above kind it would be possible to introduce reaction by deneutralising, or by introducing a supplementary coupling between the circuits L_1C_1 and L_2C_2 themselves, but in this case neither the full value of high-frequency amplification

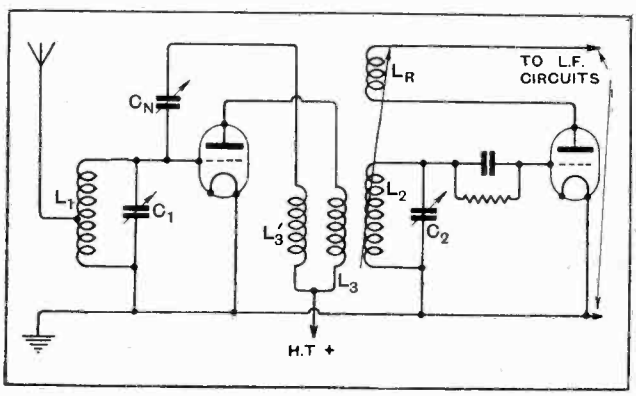


Fig. 1.—A conventional neutralised high-frequency coupling with magnetic reaction on to the secondary of the transformer.

Valve-crystal Receiver.—

nor the full possible selectivity would be obtained, the aerial circuit coming into oscillation without any appreciable reduction in the anode circuit damping.

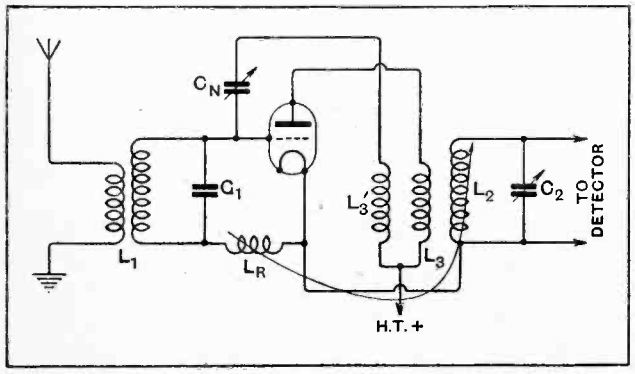


Fig. 2.—Method of introducing a voltage from the anode to the grid circuit. The inter-electrode capacity, however, causes coupling between the output and input circuits.

Assuming, then, that we keep our neutralising, we are set the problem of devising a circuit which is effectively that of Fig. 1, but without the use of the detector valve. Since it is desired to introduce reaction into the anode circuit, it is necessary to evolve some means for inducing a voltage from the anode circuit into the grid circuit in such a manner as to introduce no coupling between

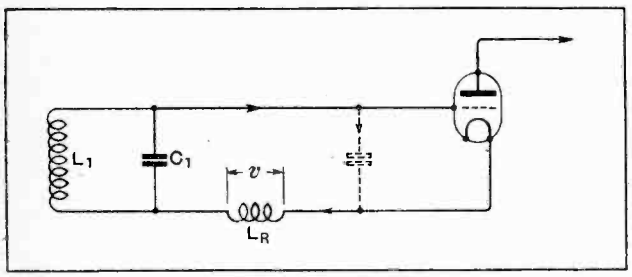


Fig. 3.—The voltage across L_R sets up currents which excite the circuit L_1C_1.

the two circuits. This is not so straightforward, by any means, as would appear at first sight; if, for example, we employ an arrangement as in Fig. 2, apart from considerable difficulties with parasitic oscillations (due to the reaction of L_3 and L_R), coupling will most certainly be introduced between L_1C_1 and L_2C_2 owing to the electrode capacities of the valve, including that between

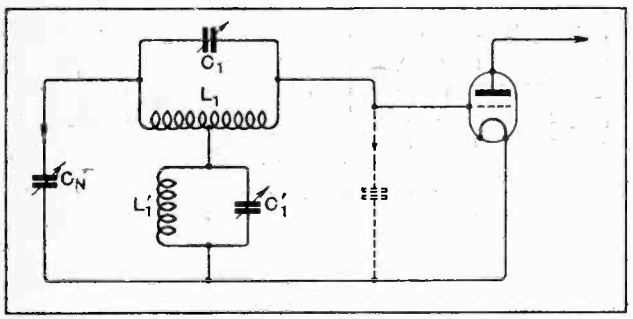


Fig. 4.—A grid circuit neutralisation scheme. Oscillations set up in $L'_1C'_1$ are not communicated to L_1C_1.

grid and filament. In Fig. 3 the effect of this last-named capacity is illustrated in greater detail, and it will be seen that the voltage v across L_R sets up a current, as shown by the arrow-heads, which excites the circuit L_1C_1. The amount of this coupling will vary with the reaction adjustment, and the whole arrangement will be exceedingly unstable and unsatisfactory.

A line of attack on this problem is afforded by the various methods of grid-circuit neutralisation which have been proposed from time to time. The best known example is the circuit shown in Fig. 4, which has been employed as the detector-oscillator in a supersonic

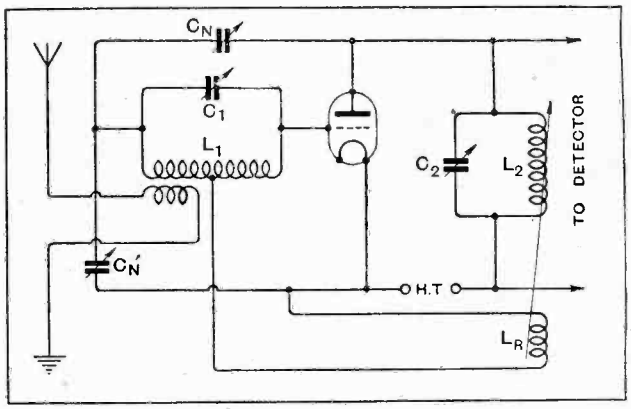


Fig. 5—To apply the scheme of Fig. 4 to neutralising the capacity coupling between the reaction coil L_R and the circuit L_1C_1 we obtain the above circuit arrangement.

heterodyne receiver. In this case the oscillations set up in $L'_1C'_1$ are not communicated to L_1C_1 owing to the "bridge balance" between the grid filament capacity and the condenser C'_N. If we adopt a similar device

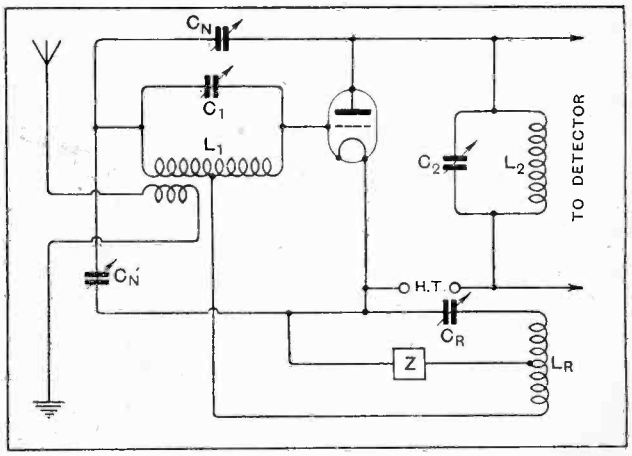


Fig. 6.—Condenser-controlled reaction is here introduced in place of a swinging coil.

for neutralising the capacity coupling between the reaction coil L_R (see Fig. 3) and the circuit L_1C_1, we arrive at the arrangement of Fig. 5. Here it will be seen that the grid coil L_1 is centre tapped, and use is made of this both for the purpose of neutralising with the condenser C'_N, as in Fig. 4, and also for ordinary grid-anode neutralisation, on the lines of Rice, by means of the condenser C_N. The anode circuit is now fed directly

LIST OF PARTS.

1 0.0005 mfd. variable condenser, fitted with bracket and insulating extension piece ("Lockvane" Igranic).
1 0.0005 mfd. variable condenser ("Lockvane" Igranic).
1 Semi-variable condenser, 30/270 micro-mfds. ("Pre-set" Igranic).
2 0.001 mfd. fixed condensers ("Type 610" Dubilier).
1 0.0001 mfd. variable condenser ("Midget," Ormond).
1 Neutralising condenser ("Neutra condenser," Ormond).
1 L.F. transformer, 3.5 : 1 ratio ("Type F." Igranic).
1 Valve holder (Type "Lotus," Garnett, Whiteley & Co., Ltd.).
1 20 ohms Rheostat baseboard mounting ("Peerless Varistor," Bedford Electrical & Radio Co., Ltd.).
1 H.F. choke and base (Cosmos).
1 Single pole single-throw Jack Switch (Lotus).
1 Crystal detector (The Friho Manufacturing Co., 283, City Road, London, E.C.1).
2 4-inch condenser dials.
2 Paxolin tubes, 3in. diam.×3½in. long.
20 Yards 27/42 Litz wire.
4 oz. No. 22 S.W.G. D.C.C. wire.
1 oz. No. 36 S.W.G. D.C.C. wire.
8 Terminals ("Eelex," J. J. Eastick & Sons).
1 9-volt grid battery (Ever Ready).
1 Ebonite panel, 18in.×7in.×¼in.
1 Wooden baseboard, 18in.×8in.×½in.
1 Copper screening plate, 6in.×6in.
2 Panel brackets, 3in. ("Camco," Carrington Manufacturing Co.).
2 Wander plugs ("Springmore" Igranic).
1 Pair grid bias battery clips ("Deckorem," No. 1, Bulgin).
2 Terminal battens, one 6½in.×2in.×¼in., and one 3¾in.×2in.×¼in.
Quantity 18 S.W.G. tinned copper wire and insulating sleeving.
Various wood screws, 4 B.A. screws and nuts.
Approximate cost of above parts, £5 15s.

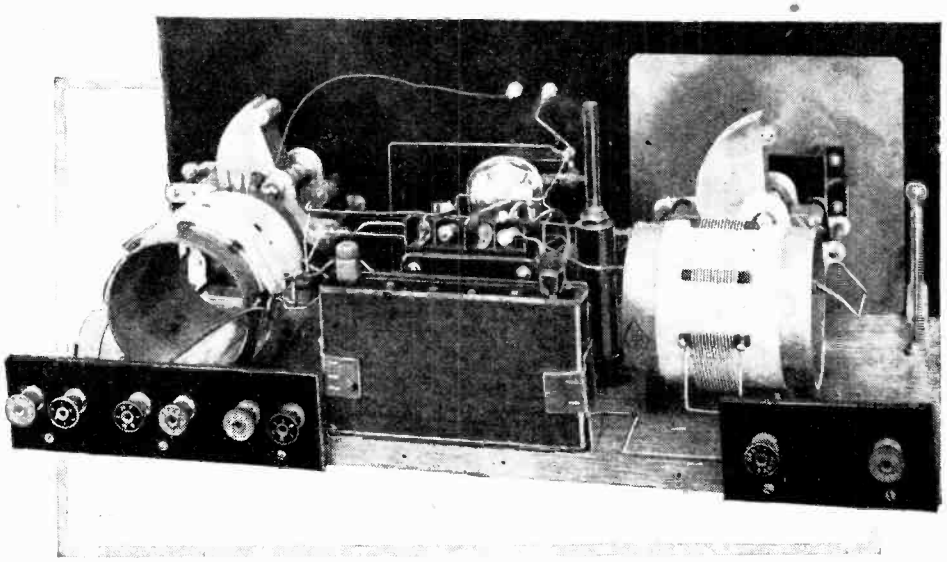
In the "List of Parts" included in the description of *THE WIRELESS WORLD* receivers are detailed the components actually used by the designer and illustrated in the photographs of the instrument. Where the designer considers it necessary that particular components should be used in preference to others, 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.

and not by a transformer winding; this is preferable in order to get the full effect of reaction, and, in addition, owing to the condenser C_2 being connected to the plate, gets rid of the parasitic oscillation trouble.

Simplifying Double Neutralisation.

It now appears that we have two neutralising condensers, C_N and C'_N, and before considering possible simplifications, it is as well perhaps to see how they operate in the circuit which is shown. It is theoretically evident, and also borne out in practice, that for any one position of L_R the adjustments of C_N and C'_N are interdependent, and produce contrary effects. On the other hand, a readjustment of the position of L_R produces an upset in the balance unless C_N and C'_N are individually in correct adjustment. To ascertain this, first adjust C_N by "buzzing" the circuit L_1C_1 with the valve extinguished and listening in the detector circuit, the reaction coil being removed from the field of L_2. Then couple L_R and L_2 together and adjust C'_N until no sound is heard in the detector circuit when L_1C_1 is "buzzed," whatever be the position of L_R. The receiver will then be correctly neutralised, or, at any rate, any slight adjustments for practical working can be taken up on C_N, which is the more critical of the two.

The use of a movable reaction coil proved in practice to be unsatisfactory, however, as secondary effects, such as the variation in capacity coupling between L_R and L_2 come into question, as also the fact that L_R must necessarily be of relatively large size if it is to control reaction by its position. A device operating in an analogous manner to the Reinartz circuit seemed to be wanted, and it was quite by accident that a satisfactory solution was ultimately discovered. It was found that a high impedance Z inserted in series with the reaction coil L_R destroyed the reaction effect, and that this could most readily be restored by an arrangement as in Fig. 6, where the reaction coil is divided into two parts, one extremity going to the grid circuit, the centre to the impedance Z, and the other extremity to a small condenser C_R. The anti-reaction voltage set up in Z is thus balanced by an opposing voltage, and in this way



Rear view of the receiver. On the right the aerial transformer can be seen; the primary is spaced from the secondary and wound over its centre.

Valve-crystal Receiver.—the voltage induced in the reaction winding proper becomes effective in the grid circuit. An arrangement of this sort gives a very smooth control of reaction which does not vary very much over the range of wavelengths controlled by the tuning condensers.

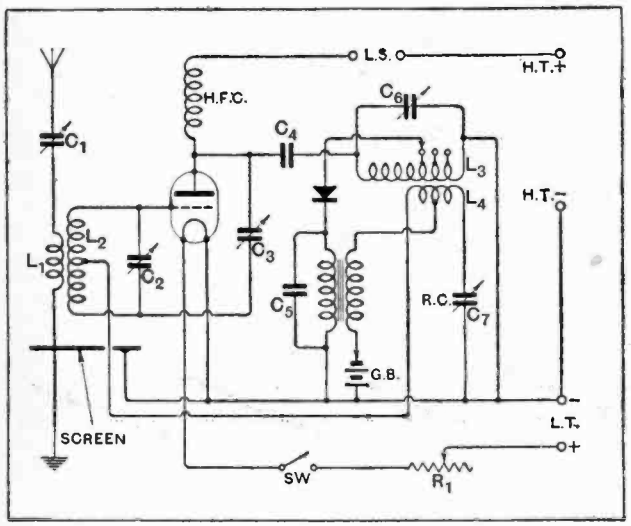


Fig. 7.—The general circuit arrangement of the valve-crystal receiver.

The question of the detector employed in conjunction with the high-frequency amplifier of Fig. 6 has been left an open one, and it is certainly an equally suitable arrangement for either valve or crystal. In the present case a crystal detector is used, together with a reflex circuit, the impedance Z being the secondary winding of the reflex transformer. The simplified circuit arrangement is shown in Fig. 7. The reaction coil (designated L_4 in this figure) consists of a "ratio winding" spaced from the anode winding L_3, and one or two tapping points are preferably allowed for the crystal connection to take into account crystals of different resistance.

The choice of a crystal detector has presented some difficulty. The most common characteristic of reaction circuits to which crystals are attached is "threshold howl," and while a galena crystal gave the most satisfactory signal strength and quality, this effect was very marked in some samples of this mineral. The essential appears to be *a very fine catwhisker adjusted with very light pressure*, and the detector recommended for use enables an excellent stable contact to be maintained which will permit of a definite small amplitude of oscillation without threshold howl.

It will be noted in the diagram that there is no condenser corresponding to C'_g. This is owing to the fact that there is a screening plate mounted on the front panel, and sufficient capacity exists between this and the frame of the condenser to allow for the average grid filament capacity of the valve; furthermore, since the reaction coupling is now fixed, any slight lack of neutralisation in this respect will be compensated in the course of setting the neutralising condenser C_3.

(To be concluded.)

CLASSIFYING RECEIVERS.

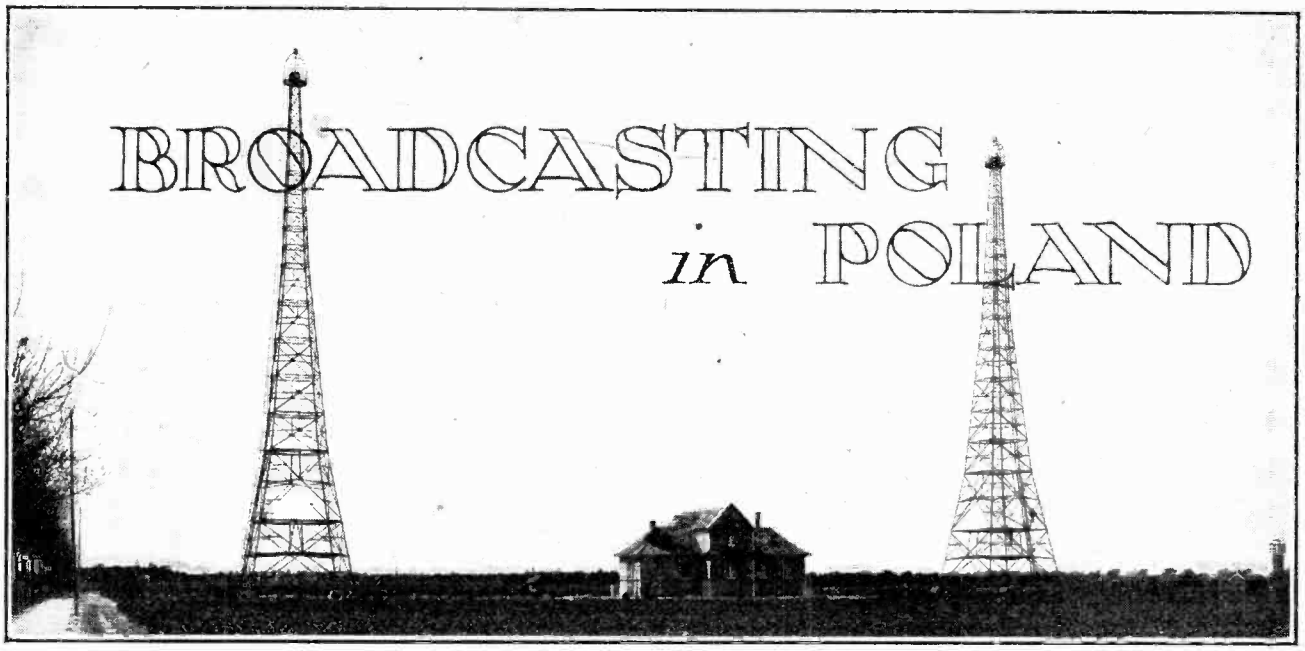
IT appears to be usual, for no very clearly defined reason, to classify receivers primarily by the number of valves which they employ. As a consequence of this, it is common to regard a set containing a large number of valves as more difficult to handle than one using fewer. Since, however, the difference between a four-valve set and one containing three valves may only consist in the addition of a stage of low-frequency amplification, the extra difficulty is in many cases non-existent. Even if the addition of the fourth valve means that a high-frequency stage is added, and with it an extra tuning control, no greater difficulty in handling exists.

The real criterion of ease in handling, so far as there is one at all, is to be found in the number of dials which it is necessary to adjust in passing from one station to another, and the writer feels that, from the point of view of the user, it would often be more satisfactory if we were to group receivers in our thoughts on this basis. Thus a four-valve receiver employing one high-frequency stage and no reaction would be classed, as far as ease in handling is concerned, with a three-valve receiver in which the first valve is a grid-detector with reaction. In the case of either of these receivers there are two dials to be adjusted in passing from one station to another.

It will often be found in practice that, of the two mentioned, the four valve receiver is the easier to use. Where no reaction is employed, the tuning of each circuit is always the same for any given wavelength, so that a station that has once been found on the four-valve set, and for which the dial readings have been noted, can be tuned in instantly at any future time. In the case of the three-valve set suggested as a comparison, the two controls of which are tuning and reaction, this stability of dial reading is much more difficult to achieve. Usually, the setting of the tuning dial depends on that of the reaction control, and this, in turn, is influenced by changes in the anode or filament voltages applied. In consequence, the settings on the two dials that correspond to a given wavelength are liable to a slow "drift" as the batteries run down, followed by a sudden jump back to their original positions when the batteries are replaced or recharged.

In addition to the considerations just advanced, the more powerful receiver is easier to handle in that "searching" is made less difficult by the fact that a station can be picked up faintly without the need for the critical adjustments which, on the smaller set, are necessary before even faint signals can be heard.

It is suggested that the point of view advanced here should be borne in mind by those who are doubtful of their ability to handle properly a receiver incorporating one or more stages of high-frequency amplification, and also by those who are called upon to choose or design a receiver for a non-technical friend. A. L. M. S.



BROADCASTING in POLAND

Anniversary of the Posen Station.

A MONTH ago—on Tuesday, April 24th—the Posen broadcasting station celebrated its first anniversary. This interesting station came into existence in 1927, when it was discovered that the Warsaw station, though adequate for the needs of those residing in and around the Polish capital, did not satisfy the growing demands of listeners situated farther west near the German frontier.

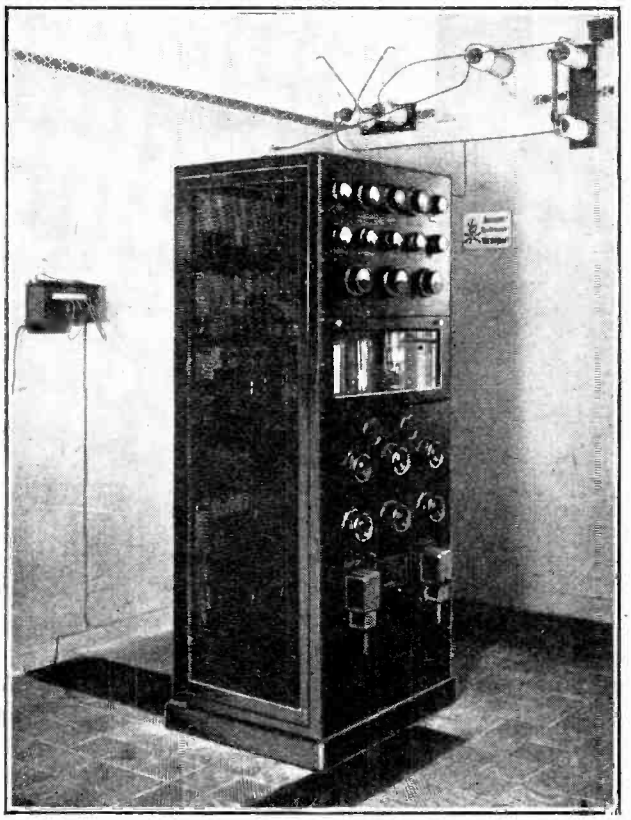
The Warsaw station is controlled by "Polskie Radio," an organisation operating under a State monopoly, but "Radio Posen," in consequence of the efforts of its enthusiastic founders, enjoys comparative independence as a limited company drawing revenue from the Union of the Communes of Posen and district. Of the licence money levied on receiving instruments, "Radio Posen" receives 60 per cent., while 20 per cent. goes to the State, and 20 per cent. in royalties to "Polskie Radio."

Aerial Beacon Lights.

The equipment at Posen is in every way in accordance with modern practice, and it is safe to say that the studio accommodation compares very favourably with that of larger and more pretentious stations. The photograph on the next page shows the large studio, which measures 32 × 36ft., and is furnished with elaborate draping devices to increase or diminish echo effects. Two smaller studios are also installed—one for debates and the other exclusively for talks.

The studios and administrative offices are situated in the centre of the town, but the aerial and transmitting gear occupy an excellent site in open country.

A product of the Western Electric Co. of New York, the transmitter supplies an aerial power of 1.5 kilowatts and operates on a wavelength of 280.4 metres. The steel masts, which are 200ft. high, are self-supporting. At the top of each is an intermittent beacon light, flash-



THE POSEN TRANSMITTER is a product of the Western Electric Co. of New York.

Broadcasting in Poland.—

ing at regular intervals of four seconds, for the benefit of aviators. The aerial itself consists of a six-wired vertical down lead and a horizontal span 175ft. in length. A closely woven wire net buried beneath the aerial provides the necessary "earth."

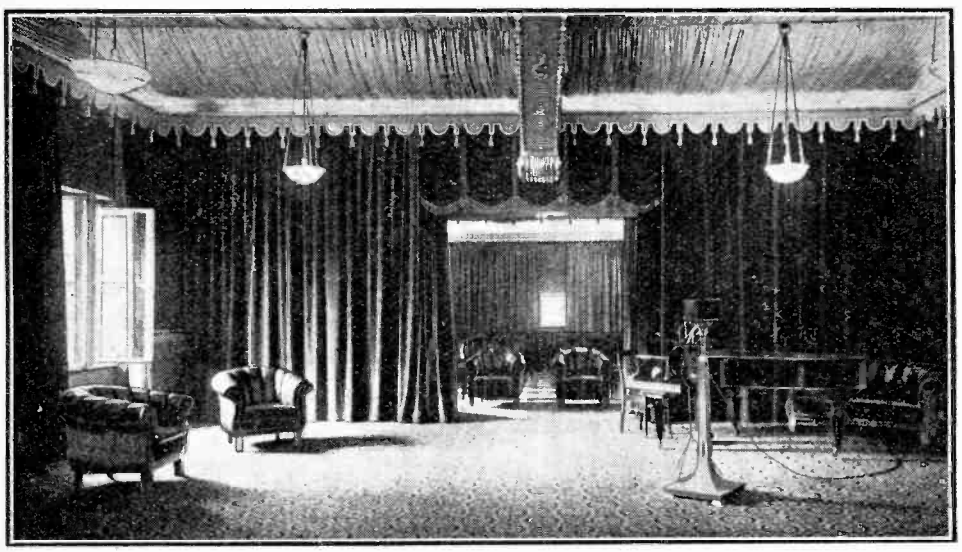
When the Posen station began its activities a year ago it had some 3,600 listeners; to-day it can boast a following of at least 17,000.

Strangely enough, the station is busier on Sunday than on any week-day, no fewer than twelve hours being filled, as compared with eight on other days of the week.

Relays from Warsaw.

A peculiar situation exists in regard to Posen's symphony orchestra. There are seventeen members of the orchestra, but they owe allegiance to the local opera house, and so, when the opera season is running, the broadcasting station has to dispense with its players! Recourse is then had to the excellent concerts from Warsaw, which are relayed *via* land-line.

A very vigorous programme department has built up a scheme of entertainment and instruction which can challenge comparison with most of the stations of Europe. In addition to concerts, talks, and debates, there are language lessons, including courses in English and French. Among the latest developments are dancing lessons and a daily course of gymnastic instruction before breakfast.



THE MAIN STUDIO, seen in the photograph, is unusually large. Beyond can be seen a smaller studio used for debates.

NEWS FROM THE CLUBS.

Field Days: Hunting Hidden Transmitters: Portable Tests.

Wireless Classes in Peckham.

The wireless class at the Peckham Literary Evening Institute, County Secondary School, Peckham Road, S.E.15, continues its weekly meetings on Thursdays at 7.30 p.m. under the direction of Capt. J. Frost. Lectures and demonstrations are given by representatives of the leading manufacturing firms. The subscription is 2s. per quarter, and it is hoped that the membership will increase rather than diminish during the summer months. Communications should be addressed to the Class Secretary, Mr. A. E. Petett, at the Institute.

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A Valuable Presentation.

Dr. Colin Forbes has presented the Dorset Wireless and Television Club with a 6-valve receiver which was demonstrated at the Club's last meeting at 5, Royal Arcade, Weymouth.

During the summer months the club room will be open every Thursday evening and there will be a lecture on the first Thursday in each month.

Mr. J. L. Baird has become a member.

Hon. Secretary, Mr. N. W. Wright, 13, Royal Arcade, Esplanade, Weymouth.

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"Hare and Hounds."

A motor hunt for a hidden transmitter figures on the syllabus of the Slade Radio Society of Birmingham for Sunday, June 3rd. This field day will be carried out in conjunction with the Sutton Motor Club.

On Saturday, May 5th, some 52 members and friends of the Society paid a visit to the Daventry broadcasting stations. The party was conducted through the transmitting rooms of 5XX and inspected the amplifiers and were then conducted over the experimental station 5GB. Special attention was paid to the interesting aerial systems of the two stations.

Hon. Secretary, Mr. H. Clews, 8, Victoria Road, Erdington, Birmingham.

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Listeners Too Easily Satisfied.

"The Design and Construction of a Quality Wireless Receiver" was the title chosen by Mr. A. C. Dale for his lecture before the Croydon Wireless and Physical Society on April 30th. The lecturer dealt separately with the H.F., detector and L.F. portions of a receiver, setting forth very clearly the many points which have to be taken into consideration in the production of a high-quality instrument. He expressed the opinion that the ordinary listener was too easily satisfied with reception which did not approximate to the kind of reception which was possible with a properly designed receiver and efficient transmitter.

Visitors are heartily welcomed at the Society's meetings. Particulars can be obtained from the Hon. Secretary, Mr. H. T. P. Gee, Staple House, 51-52, Chancery Lane, W.C.2.

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Portable Set Tests.

Attractive fixtures for the coming weeks are announced by the Wigan and District Technical College Radio Society. On June 2nd the members will hold a field day at Rivington Pike for the purpose of testing portable sets, and a fortnight later a visit will be made to the works of Messrs. Metropolitan Vickers, of Manchester. On Saturday, May 26th, the party will visit the Automatic Telephone Exchange at Southport.

An "Everyman Four" receiving set and moving coil loud-speaker were demonstrated by Mr. J. Dean at a meeting of the Society. Many members made the acquaintance of a moving coil loud-speaker for the first time and evinced the greatest interest. Mr. A. Evans demonstrated a pick-up and an amplifier of his own design. Some excellent tips for the beginner in wireless construction were given by Mr. T. Houghton, who described a simple valve set.

Hon. Secretary, Mr. M. M. Das, Library Street, Wigan.

FORTHCOMING EVENTS.

WEDNESDAY, MAY 23rd.

North Middlesex Radio Society.—At St. Paul's Institute, Winchmore Hill, N.21: Demonstration of the "Everyman Four," by Mr. J. H. Forbes.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove, N.17. Short wave transmitting demonstration by Mr. F. Dyer (G6HY).

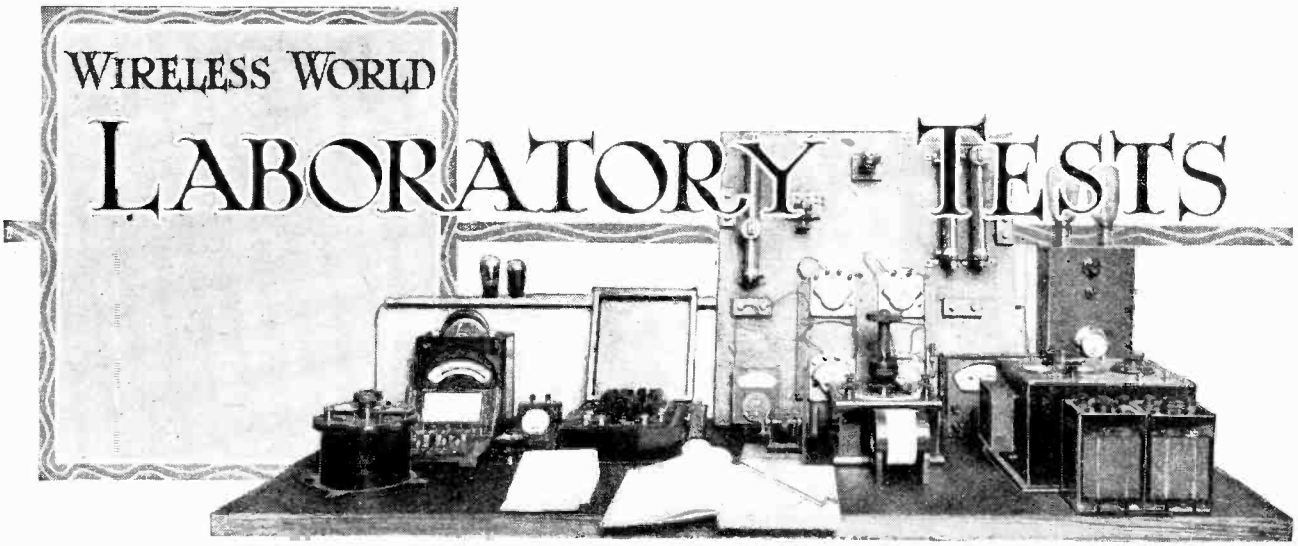
THURSDAY, MAY 24th.

Leyton and Leytonstone Radio Society.—Discussion on Valve Curves.

Slade Radio, Birmingham.—Lecture on "Short Waves," and a Super Heterodyne Demonstration, by Mr. Derek Shannon.

SATURDAY, MAY 26th.

Wigan and District Technical College Radio Society.—Visit to Southport Automatic Telephone Exchange.



A Review of Manufacturers' Recent Products.

POLAR "ALL-BRASS" CONDENSERS.

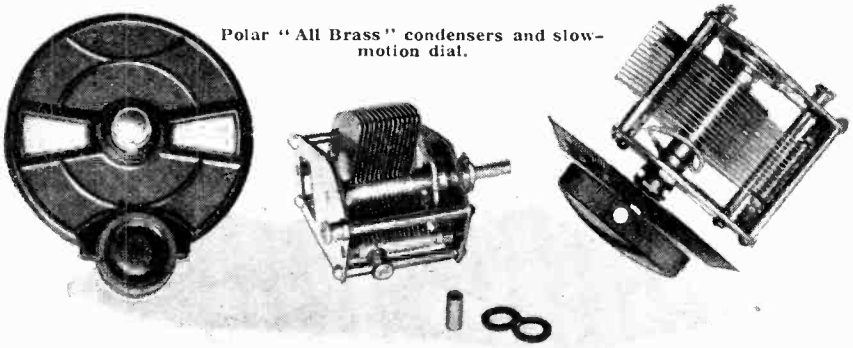
These condensers take their name from the special chemical treatment by which a bright non-oxidisable brass finish is imparted to the metal. The No. 3 condensers have been designed to fill the gap between the cheap, cut lines and the more expensive class of condensers, and the 0.0005 mfd capacity, without vernier, is priced at 8s 6d. Ball bearings are used at both ends of the condenser, a thrust race at the panel end and a single ball fitting into the countersunk spindle at the other. Contact with the moving vanes is established through a rubber-covered flexible lead, and the fixed plates are supported on ebonite bushes of small volume. Each condenser is supplied with insulating washers for fitting to metal panels.

The minimum capacity of the specimen 0.0005 mfd. condenser tested was 21 micro-microfarads, and the maximum 0.00058 mfd.

The No. 3 type condenser is supplied without dial, but a Polar slow-motion dial is available at a cost of 4s. 9d. This is designed for ¼in. spindles, and is therefore suitable for other standard makes of condenser. It has a double 100-degree scale, with spaces for marking the positions of stations on both sides of the dial; this is of great advantage when logging stations, separated by only one or two degrees as alternate stations can be marked on opposite sides of the disc. The full scale of 100 degrees is equivalent to 7½ turns of the friction-drive adjusting knob.

The "All-Brass" condenser is also supplied with the well-known Polar cam vernier built into the end plate. This type is supplied complete with 180-degree dial.

All the above components are obtainable from Messrs. Wingrove & Rogers, Ltd., Arundel Chambers, 188-189, Strand, London, W.C.2.



Polar "All Brass" condensers and slow-motion dial.

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FERRANTI FIXED CONDENSERS.

The Type C.2 fixed condenser made by Messrs. Ferranti, Ltd., Hollinwood, Lancs, has been redesigned and is now suitable for voltages up to 250 D.C. The condenser is of the rolled foil type as distinct from the Mansbridge pattern, and each condenser is tested at 500 volts D.C. before despatch.

The price remains at 4s. for the 2 mfd. capacity, but tag connections are now provided instead of terminals. In other respects the construction remains the same; the metal container is hermetically sealed and is secured to the baseboard with the clips and screws provided.

Ferranti Type C.2 condenser, which is now tested at 500 volts D.C.

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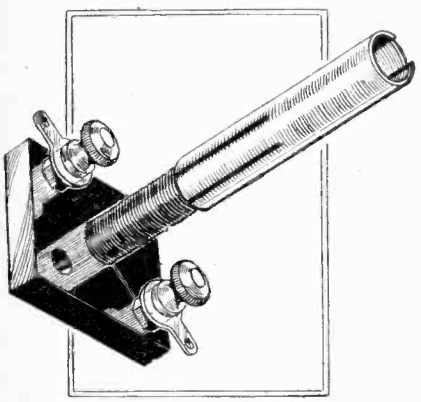
"TAYLORADIO" SEMI-FIXED RESISTANCE.

Designed for baseboard mounting, this resistance consists of a single-layer coil of resistance wire about $\frac{5}{16}$in. diameter and 1¾in. long wound on an ebonite tube and mounted with terminals on a square ebonite base. Normally the resistance has a value of 30 ohms, but this may be reduced to any required value by means of a split brass tube sliding over the coil which short-circuits the turns as it is pushed down. Enamelled resistance wire is used, and the top surface of the wire is bared

to make contact with the short-circuiting sleeve.

The idea is as effective as it is ingenious, and a perfectly smooth and noiseless variation of resistance is obtained.



"Tayloradio" semi-fixed filament resistance for baseboard mounting.

The resistances, which are obtainable from Messrs. W. W. Taylor, 33, Furnival Street, London, E.C.4, are priced at 1s. 3d.

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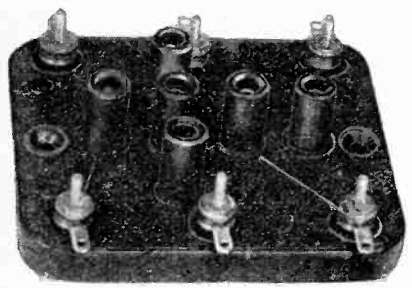
CASON COIL BASE.

The sockets in this coil base consist of phosphor-bronze coil springs enclosed in ebonite legs which are an integral part of the moulded base. A sound contact is thus assured, and there is no possibility of inserting the coil pins incorrectly.

The size of the base is $2\frac{3}{4}$in. × $2\frac{3}{8}$in., and terminals are provided with soldering tags. The numbers of the terminals and a replica of the wiring are embossed on the upper surface of the base.



Cason six-pin coil base.

The makers are Messrs. Cason Mouldings, Chiswick Road, Lower Edmonton, London, N.9.

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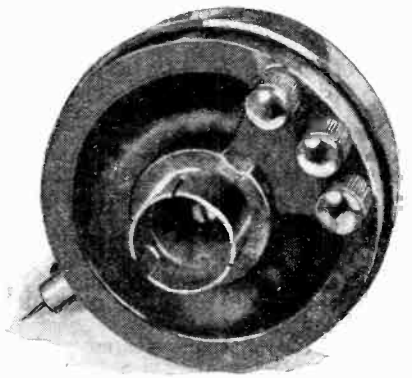
THE DUBILIER PICK-UP.

The new pick-up sent in recently for test differs in several respects from the original model produced by the Dubilier Condenser Company, and appears to embody several improvements.

The Dubilier pick-up differs from almost every other make in being of the electrostatic instead of the electromagnetic type—that is, the movements of the needle in the record track are made to vary the distance between two flat conductors, and thus to vary the capacity between them, instead of, as is more usual, varying the reluctance of a magnetic circuit.

Variation of the capacity of a condenser alone will produce no voltage change to apply to the amplifier, so the capacity type pick-up must be "polarised" by means of a battery, preferably of quite high voltage, and in order to obtain *voltage* variations to apply to the first valve of the amplifier, it is also necessary to use the capacity type pick-up with a high resistance in series with it across the polarising battery. For convenience, the input to the amplifier is usually taken across the resistance rather than across the condenser, since in the latter case a further coupling condenser and grid leak would be required for the application of suitable grid bias to the valve.

The resistance has to be of the order of megohms in order to obtain an appreciable output, since the capacity change in the pick-up is limited by constructional and mechanical difficulties, and this fact constitutes one possible source of trouble inherent to all such



Dubilier electrostatic pick-up.

capacity pick-up schemes, namely, that the shunting effect of the capacities of the leads to the pick-up and those due to the input capacity of the valve itself may very seriously reduce the output of the higher frequencies from the pick-up. For this reason it is always wise to use as short and well spaced leads as possible between the pick-up and the amplifier, and also to use a fairly low amplification valve in the first stage of the amplifier.

In the Dubilier pick-up, the resistance above mentioned is incorporated in the pick-up itself, and the normal H.T. supply to the set is intended to be used as the source of polarising voltage. Three terminals are therefore provided on the pick-up, two for the amplifier input, and one to +H.T. The actual damping on the needle is less than in many electromagnetic types, which is a good point in favour of less record wear, while the output—especially when the above-mentioned precautions have been taken—is quite pleasing.

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"SFERAVOX" CABINET LOUD-SPEAKER.

Those of our readers who are already acquainted with the "Sferavox" loud-speaker will be interested to learn that it is now available in cabinet form. The dome-shaped cabinet illustrated costs £4, but a square cabinet model is also available at £3. They are obtainable from "Sferavox," 130, Fenchurch Street, London, E.C.3.

In both the above models the magnet

"Sferavox" dome cabinet loud-speaker.

system has been improved and the reed has been redesigned to give greater amplitude without rattling or distortion. The diameter of the diaphragm has also been increased to $12\frac{7}{8}$in., and is now mounted on rubber at the periphery.

On test very pleasing results were obtained, and the performance appears to have been improved by enclosing the cone in a cabinet.

Eighty per cent. of the total cost of production is expended on British materials and labour.

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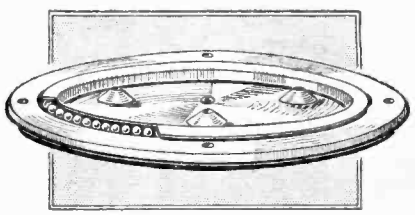
SELECTOR TURNTABLE.

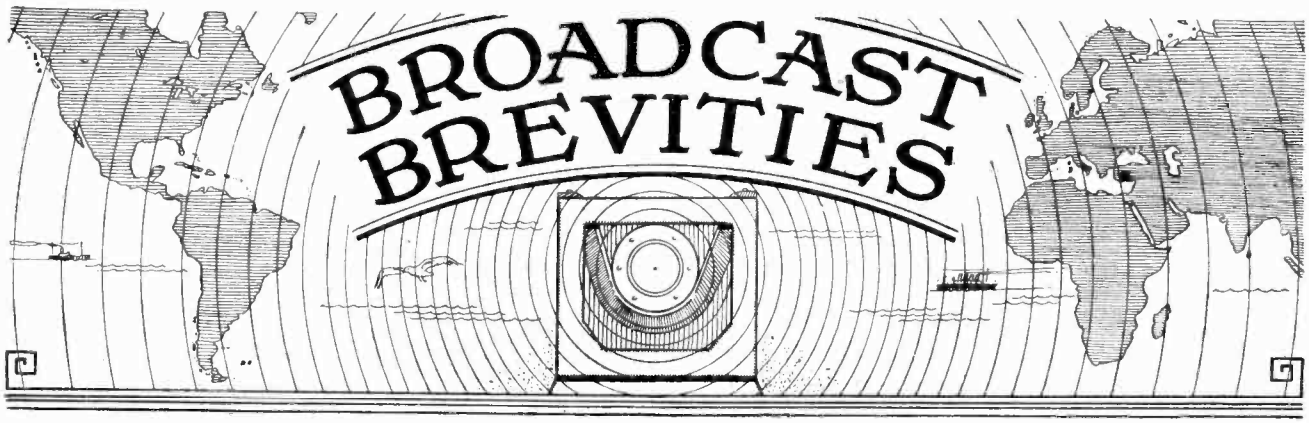
The light weight of this turntable makes it most suitable for use in portable receivers where weight must be reduced in every possible way. It is pressed from aluminium sheet, and the two discs are located with a riveted brass centre bearing. The method of screwing to the base of the set is ingenious. Three cone-shaped projections are raised on the top plate, and the wood screws used for



The Selector turntable.

fixing pass through holes in the apex of each cone. A hole in the bottom plate registers in turn with each of the cones and gives access for the screwdriver. The rubber base ring is held in position by four aluminium rivets.

The price of the turntable is 8s. 6d., and the makers are Messrs. Selectors, Ltd., 1, Dover Street, Piccadilly, London, W.1.



News from All Quarters: By Our Special Correspondent.

Summertime Talks Policy.—New Tuning Note.—Relays from America.—The Vagaries of 5SW.—Letters from Overseas.—The Woman Announcer.

Fewer Talks!

Although it was stated in last week's "Broadcast Brevities" that there would be no reduction in the number of talks during the summer months, I now learn that this represented only half the truth. It is true that there will be no change in the present talks syllabus until the end of July, but thereafter there will probably be a distinct reduction until the autumn.

The afternoon talks will be suspended, and I hear that the 7.25 p.m. talk will also be omitted, leaving only two talks each evening. The first of these will be at 7 o'clock and the other—a "Topical Talk"—after the second news bulletin.

No debates will be held during these summer weeks, and this rather suggests an absence of controversy, unless "Nemo" can stir the embers.

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Welcome to "Nemo."

"Nemo," who makes his first appearance before the microphone this evening (Wednesday), in a conversation with the Vicar of Marazion, to be broadcast from 5GB, will probably take a permanent place in the programmes. While it would be going too far, perhaps, to say that his advent gives the *coup de grâce* to the ordinary talk, it seems quite likely that "Nemo" will help to put a nail in its coffin.

Although the talks as we know them to-day are often little more than pallid editions of the typical magazine or newspaper article read slowly, they do undoubtedly find a considerable audience; but the audience would be tremendously increased if the broadcast spoken word embodied something original and distinctive which could not be had from the printed book.

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What "Nemo" Can Do.

Because some of us believe that the technique of the broadcast talk has never been properly studied we turn expectantly and anxiously to "Nemo."

In his capacity as interlocutor, "Nemo" will have the power to stir up hidden fires; and if he occasionally loses his patience we shall enjoy it all the more. Let him challenge some of the statements which nowadays we have to accept in silence. Let him ask those questions which we are often burning to ask just when the speaker winds up and the dance band comes on.

"Nemo's" presence may mean longer talks, but if he makes them interesting, who will object?

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An Extraordinary Desire.

In complaining to the B.B.C. of his inability to get alternative programmes a correspondent wrote: "What I wish you to understand is that I sometimes want to listen to two programmes at once."

Shorter Afternoon Programmes.

From July 2nd until September 21st the afternoon programmes from 2LO and 5XX will begin at four instead of three o'clock except on Thursdays, Saturdays and Sundays, when the present schedule will be observed.

The object of this change is, I am told, to lighten work at Savoy Hill while so many of the staff are absent on holiday. This may be a good excuse, but I cannot help feeling that portable set users may have something to say about it. And what about hospital patients who have no holiday?

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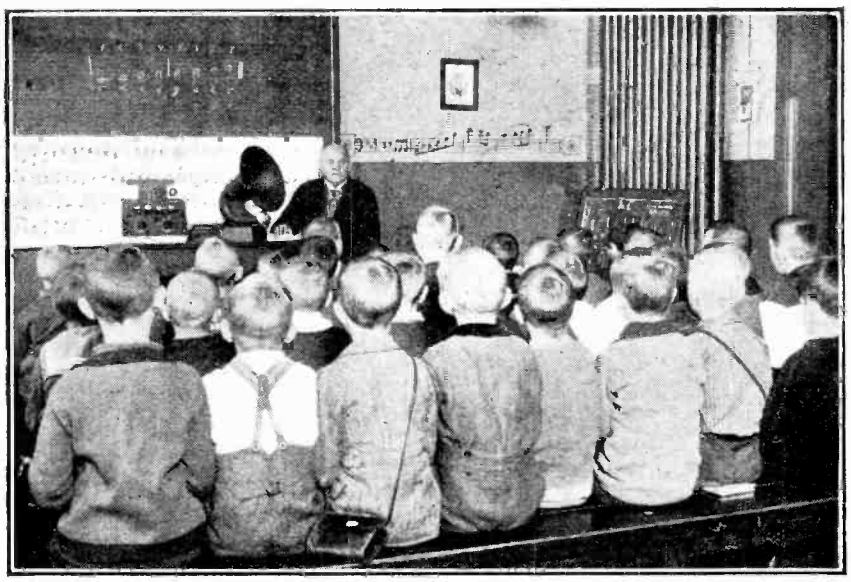
The New Tuning Note.

The new 2LO tuning note, which actually comprises the chord of C Major, is generally regarded as an immense im-



IN A GERMAN SCHOOL. Pupils at the Christburger school, Berlin, listening to a broadcast lesson in music. Educational broadcasting is an important feature in the programmes of the German stations.

provement on its ear-splitting predecessor. The old note has been reverted to for a short period while permanent apparatus for the new signal is being assembled. This consists of eight electrically-driven tuning forks ranging from a frequency of 64 per second up to 4,096.

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Relays from America.

One reason why the B.B.C. is not proceeding at the moment with regular relays of American programmes is, I hear, the comparative failure of the spaced-aerial receiving system at Chelmsford. This ingenious arrangement of antennæ, spread over a distance of some three miles, has not fulfilled hopes that it would solve the problem of fading.

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Different Wavelengths Wanted.

The wavelength question, too, has come up for consideration. Dr. Alfred N. Goldsmith, who is in charge of the short-wave experiments of WGY's satellite stations 2XAF and 2XAD, believes that no real success can be attained unless we on this side are prepared to use a number of different wavelengths. Some reluctance to do so has already been exhibited, and we have a paramount example of this technical inelasticity in the wavelength "curve" of 5SW, which has consisted entirely of "horizontal straight part" for the last six months.

o o o o

Conflicting Reports.

The fickle nature of the short-wave was never better illustrated than by the letters which reach me from time to time from correspondents in the Far East apropos the reception of the Chelmsford station. No sooner has one writer in India deplored the silence of 5SW than another listener not so very far away posts me a pæan of joy because it is so loud!

o o o o

A Letter from Bombay.

Towards the end of March Mr. Eric Dunstan, the general manager of the Indian Broadcasting Company, brought a doleful report of his company's efforts to pick up 5SW, and his remarks were quoted in these columns. The company had "never heard a signal."

Having read this paragraph Mr. Joseph Alams, of Bombay, sends in an excellent report of the programme put out by 5SW on April 5th. He was using a 3-valve (o-v-2) set which gave 5SW on the loud-speaker "as loud and clear as is the signal from our local broadcasting station (Bombay) situated five miles away."

o o o

Experiences in Persia.

Another reader of the same paragraph was Mr. E. H. Butterworth, of Ahwaz, South Persia, who writes: "Your paragraph *re* the failure of Chelmsford to make itself heard in India has solved a problem which has worried me for some time.

"I have been trying to hear this station for a couple of months with total lack of success. My set is o-v-2, and PCJJ comes in excellently on it in the early hours here when they transmit specially for the benefit of South America.

"On three occasions, also, I have heard 2XAF relaying WGY, at decent phone strength, and sufficiently clearly to catch all the announcer said. The distance from here is, I suppose, approximately 7,000 miles."

FUTURE FEATURES.

London and Daventry.

MAY 27TH.—British Legion Service from the Cenotaph.
MAY 28TH.—A Military Band Concert.
MAY 29TH.—"The Survivor," a mystery in three acts.
MAY 30TH.—"The Rebel Maid" (Montague Phillips).
MAY 31ST.—Charlot's Hour.
JUNE 1ST.—"Samson" (Act II.) from Covent Garden.
JUNE 2ND.—Orchestral and Vocal Programme.

Daventry Experimental (5GB).

MAY 27TH.—Mozart programme from Birmingham.
MAY 28TH.—The Roosters' Concert Party.
MAY 29TH.—"Louise" (Act III) from Covent Garden.
MAY 30TH.—Chamber Music.
MAY 31ST.—New Friends on Music—Ravel.
JUNE 1ST.—"Brains," a play by Martin Flavin.
JUNE 2ND.—Symphony Concert from Birmingham.

Cardiff.

MAY 31ST.—"The Paris Doctor," a play in one act by Harold Brighouse.
JUNE 1ST.—"Noises Off" (second edition).

Manchester.

MAY 29TH.—Pot-pourri Programme.
JUNE 2ND.—An Eric Coates Programme.

Newcastle.

MAY 29TH.—Tyneside Programme.

Glasgow.

MAY 29TH.—"The Seal Woman," a Celtic folk opera in two acts.

Aberdeen.

MAY 30TH.—Scottish Programme.

Belfast.

MAY 30TH.—"Shake the Bottle," a tonic revue in several doses.
JUNE 2ND.—A Puccini Programme.

5SW's New Experiments.

These contradictory reports are representative of the bulk of correspondence on the topic. Obviously, then, 5SW is giving nothing like such a dependable service as that provided by the American and Dutch stations. PCJJ, of course, seems to be aided by some omniscient radio deity, for it is heard everywhere, but the WGY group of stations owe their success to a definitely assignable cause. *They transmit simultaneously on different wavelengths.*

It is interesting to note that 5SW will actually experiment with different wavelengths during the summer months.

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A New Role.

Mabel Constanduros will make her appearance before the microphone on May 27th in a new character, for she is to make an appeal from London on behalf of the Royal National Orthopædic Hospital.

o o o o

"The Lost Umbrella."

Will Evans, who is broadcasting on June 5th from 2LO, has been absent from this country for four years. He went to the South of France for three months and stayed four years.

The sketch which he is giving is one of his most popular turns, "The Lost Umbrella." He will be assisted by his wife, Miss Nora Emerald.

o o o o

A W. W. Jacobs' Piece.

W. W. Jacobs' comedy, "A Love Passage," is to be broadcast from 5GB on June 6th.

o o o o

From "Petit Parisien."

Suzanne Bertin, whom many British listeners have heard on tuning in to "Petit Parisien," is to sing from London on June 9th in a programme conducted by John Ansell.

o o o o

The Woman Announcer.

The other day listeners to the Cork broadcasting station were surprised to hear the announcements given out by a lady. Enquiry revealed the fact that the speaker was Mrs. Sean Neeson, wife of the Station Director, who had been called to Dublin to take part in a concert there.

Mrs. Neeson assumed her novel *rôle* with ease and ability, and it is rumoured that Irish listeners would like to hear more of her dulcet tones.

The comparative scarcity of women announcers is rather surprising. One or two of the French stations have women announcers, but the practice does not seem to have spread to other countries. Why?

o o o o

The Melody was Ended.

There was a period of short-lived joy in the 5GB studio a few days ago. A minor breakdown put the station out of action for a minute or two during a variety performance. When transmission was resumed the artistes endeavoured to improve the occasion by singing "5GB has broken down, broken down, broken down," to the tune of the London Bridge ditty. Within a half a minute the transmitter broke down again!

o o o o

New Friends in Music.

Another of Mr. Percy Scholes' educative musical talks will be given from 5GB on May 31st in his series entitled "New Friends in Music." On this occasion the composer with whose works he will deal is Ravel, and the piano illustrations will be played by Kathleen Long.

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.

RECEPTION OF 5GB.

Sir,—I am glad to note that Cornwall is not alone in its varied reception of 5GB. The conditions experienced by Mr. W. H. McMillan are typical of those existing in this district.

It is to be hoped that these letters, coming as they do from all parts of the country, will find vulnerable joints in the armour of complacency in which the Chief Engineer has encased himself. Thousands of listeners heard with derision his announcement that he was satisfied with 5GB. Let us fervently hope they will sever the thread which supports the sword of conditions-as-they-really-are and allow it to pierce the halo of satisfaction which at present encircles the head of this B.B.C. Damocles!

St. Austell, Cornwall. W. A. E. ROWETT.
April 25th, 1928.

SCIENTIFIC WIRING.

Sir,—The article appearing under the above heading in your issue of April 25th is most interesting, and I make no apology for the following comments thereon.

If we can judge from the amount of published data on the subject, I agree the ground covered is new, but not entirely so, for I must draw your attention to an article appearing in your issue of October 12th, 1927—"H.F. Amplification on Short Waves." The author there mentions a means of wiring similar to the present one as being very necessary to all short wave receivers, and particularly essential to high frequency radio work.

This method of wiring, when applied to short-wave receivers, should be carried out with bare wire, but otherwise the same considerations would appear to apply as those adopted for "broadcast" receivers. There is a lot of nonsense talked about wide spacing, and shortness, of leads in short-wave work, and I suggest that the application of the present system to short wave receiver wiring should be more particularly considered.

One further point arises. In general receiver design, two alternatives usually present themselves: shielding in one of its usual forms or extension of all variable control shafts with accompanying wide spacing of components and intelligent layout.

Might I suggest what is required is a combination of both—a receiver employing high frequency amplification wired as set out by your contributor but with all the components insulated from the shield, and in the case of short-wave receivers the modified method using bare wire.

I most heartily condemn the practice of making a shield act as a common L.T. connection, for example, throughout the whole of a set. I might mention that a short-wave receiver of the conventional 0-v-1 arrangement, constructed with variable condensers, variable resistances, coils, etc., set back well from a metal panel, and wired throughout on the lines suggested, with the earthing lead from the shield taken separately until about to enter the "earth," is more stable on 20 metres than many "broadcast" receivers are on 20 times that wavelength.

"MODERN."

THE OSCILLATION NUISANCE.

Sir,—With regard to the recent correspondence on the subject of distortion, may I be permitted to voice a grievance in connection with one cause, which is extremely prevalent in this neighbourhood—namely, oscillation about the silent point?

Almost every night the enjoyment of the programme is entirely spoilt by the well-known whistle, which one would gladly excuse if it ended in the resumption of pure reception.

On the back of the receiving licence the P.M.G. states that "Interference is taking place if a continuous 'note,' or 'whistle' is heard. If this 'note,' or 'whistle,' changes when the *wavelength* of the receiver is altered, the cause of interference is in the receiver, and *reaction* must be reduced until no 'note,' or 'whistle,' is audible."

It would appear, therefore, that the offenders in this respect have so little ear for distortion that they are perfectly happy to alter the *wavelength* of their receiver until the continuous "note," or "whistle," is no longer heard, and to leave it at that for as long as they continue to listen.

In consequence, the only times at which reception is a pleasure are during the lunch-time and afternoon concerts, when, presumably, the disturbers are not operating.

I apologise if the subject of oscillation is rather hackneyed, but it would be a relief to know in what way this ignorance may be remedied. Ignorance it must be, since in a civilised community one cannot conceive of its being done with malicious intent.

BM/HHDR.

Settle, Yorkshire.
April 19th, 1928.

PATENT WARNINGS.

Sir,—We have read the leading article entitled "Popularising Wireless," in your issue of April 11th, with interest and some sympathy. There is, however, an aspect of the matter with which your article does not deal. "Warning" advertisements, such as you refer to, are sometimes issued by this company, and we have reason to know that they are of assistance to the trade and save the honest dealer from the expenses resulting from legal action which would otherwise be necessary. Our experience is that, in many cases, dealers purchase infringing articles—oftentimes imported from abroad—and when action is taken against them they invariably—and we believe honestly—assert that they had no idea that a patent existed. The "Warning" notice seems to us to be the only means by which we can protect the honest dealer. We entirely agree with you that the issue of these "Warnings" is indefensible where there does not exist a definite intention of backing them up by legal action if the warnings are disregarded, but we, at any rate, will not be accused of any such practice.

JNO. T. MOULD.
Igranic Electric Co., Ltd.

London, E.C.4.
May 2nd, 1928.

SHORT WAVE RECEPTION.

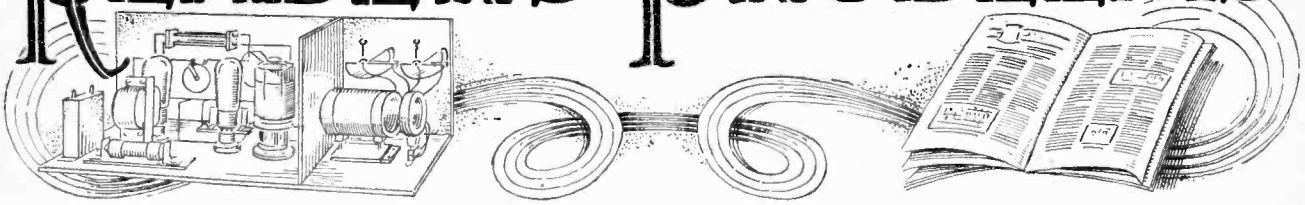
Sir,—Referring to Mr. H. Cohen's letter in your issue of May 9th, I was also fortunate enough to be listening to WGY's short-wave transmission through 2XAD, when a running commentary of the Atlantic fliers' reception in New York was broadcast, and later their individual speeches were also received. The transmission was so clear that the Baron's voice, speaking on the telephone to his mother in Berlin, could be heard above the buzz of the voices in the room.

The conditions were excellent, with no fading, and the whole broadcast, from shortly after midnight, was received at good strength on the loud-speaker with 0-v-1.

The speech of Major Fitzmaurice would doubtless have been received with great enthusiasm in Ireland if it had been rebroadcast through 5XX, but I presume this was not done, as I have seen no report of it in the Press.

C. A. JAMBLIN,
Bury St. Edmunds. G—6BT.
May 10th, 1928.

READERS' PROBLEMS



"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interests of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

Too Much Magnification.

Will you please criticise the attached circuit diagram, and in particular advise me if you consider that the L.F. side is suitable for good quality reproduction? W. L. E.

The circuit diagram submitted shows two H.F. stages, properly neutralised and thoroughly screened, and regarding this part of the receiver we have nothing but favourable comments to offer. An anode bend detector is followed by two resistance coupled stages and a transformer coupled output valve—three stages in all. According to the notes on the diagram, it is proposed that these stages should be of the high magnification type, and we have no hesitation in saying that any signal sufficiently strong to satisfactorily operate the rectifier will completely overload the L.F. amplifier. We advise that one of the L.F. stages should be omitted, or alternatively, that low-magnification amplifiers should be substituted, as shown in Fig. 10 on page 287 of *The Wireless World* for March 14th. This alteration will result in much better response on the higher musical frequencies, and at the same time an input to the detector of reasonable amplitude will not cause overloading.

○○○○

Wasted Volts.

The circuit diagram of my receiver is shown on the attached sheet, and I should be obliged if you would suggest the reason why it fails to give sufficiently loud signals from the local station (16 *miles away*). *A neighbour of mine uses an almost exactly similar arrangement, and obtains comfortable volume—even a little to spare.* F. T. P.

The diagram shows an anode bend rectifier followed by two resistance-coupled L.F. stages. This circuit, under favourable conditions, should certainly give adequate volume at the distance stated, provided the valves and components are properly chosen. Our correspondent's trouble is almost certainly due to the fact that he is wasting one half of the H.F. voltage developed across his tuned aerial coil. The connections of the detector valve to this coil are shown in Fig. 1, from which it will be seen that the grid is joined to

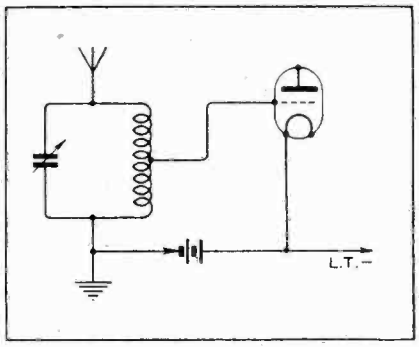


Fig. 1.—An anode-bend detector connected to a tuned aerial coil; one-half of the H.F. voltage developed is ineffective.

a centre tap. We cannot see that this form of connection is likely to confer any benefit when the detector operates on the anode bend principle; conceivably it might act as a volume control when the H.F. input is large, but this is not necessary in the case in point. We suggest that the grid connection should be transferred to the aerial end of the coil.

○○○○

Capacity of Extension Leads.

With a view to reducing the self-capacity of a long loud-speaker extension, I propose to adopt the single wire system with earth return which has been suggested from time to time in your journal, and to use lead covered wire so that the sheathing may act as the return lead. Is this in order? T. W. P.

We are afraid that the use of the lead covering as a return lead will defeat your object, as the capacity of the conductor to the sheathing will be practically as high as that between the two conductors of a twin wire. Would it not be possible for you to find an earth connection at the distant point; there is no need for this to be of high efficiency, as a resistance of several hundred ohms can generally be tolerated provided it is fairly constant.

○○○○

Keeping Out H.F.

My "2 H.F." set is quite stable over the whole of the long-wave tuning scale with one low-frequency valve, but when I add a second L.F. stage violent oscillation is produced at resonance. The diagram showing circuit and values is attached herewith. Can you suggest the reason for my failure with two L.F. amplifiers, and also advise me as to a remedy? W. L. W.

We are confident that your trouble is due to the action of H.F. currents in the L.F. amplifier. This will be more pronounced with two L.F. valves, particularly on the long-wave side. We notice from your diagram that you have connected a damping resistance of 100,000 ohms in the grid circuit of the first L.F. amplifier in the manner adopted in a number of receivers: we suggest that you increase its value to 250,000 ohms. This alteration will almost certainly put matters right, and the amplification of the higher notes will not be sensibly decreased.

RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

The Wireless World AND RADIO REVIEW

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CONTENTS OF THIS ISSUE.

THE MAINS DANGER.

NOT long ago the suggestion that house lighting mains should be used as a means of supplying high-tension current as a substitute for the H.T. battery was regarded as a possible source of danger by way of fire and electric shock. In certain instances, however, electric supply companies have prohibited the connection of eliminators to the mains without sanction, while restrictions are common. Public supply companies are, perhaps, prompted by the liability which they incur to replace battery eliminating equipment in the event of a change-over from D.C. to A.C. The two considerations arising are those of inadvertently earthing the mains through the receiving set and the danger of electric shock to the user. Sets of the future will undoubtedly be entirely mains operated, and both the accumulator and high-tension battery will disappear where mains are available, so that before long regulations may be framed governing the use of mains for wireless purposes in the same way that definite requirements are specified with regard to the design of household electrical gear.

It is as well to consider the reasonable restrictions which might be embodied in such regulations in the light of our past experience with battery eliminators. Insofar as we are concerned with direct current mains, the possibility of earthing the supply *via* the aerial circuit or loud-speaker leads makes it necessary to stipulate that light fuses be provided in each of the main wires within the eliminator, while the "on and off" switch should preferably be of the two-pole type. Other than for screening purposes, it would appear unnecessary to stipulate that the eliminator should be contained in a metal box, any more than to demand that an electric gramophone motor should be housed in such a container as a protection against shock and fire. Metal parts which are "live" should not be exposed, though it must not be overlooked that no precautions are taken against exposing the mains potential in the receiver itself, a state of affairs that will still be tolerated in spite of an upward trend in the working potential of power output valves. The fire danger is mitigated by the now generally adopted anode feed scheme, as the potential dropping resistances prevent the current reaching a value sufficient to cause a temperature rise adequate for ignition. Inconvenience will be caused by stipulating that metal frames shall be earth-connected for the prevention of shock, particularly as such a precaution is not demanded in respect of other household electrical fittings.

As to A.C. rectifiers, fuses and double-pole switch can well be dispensed with, as the possibility of earthing the mains is avoided. True, fuses would serve as a protection against a transformer burning out by excessive load or short-circuited turns, though such a precaution is not in common use in respect of other apparatus where the danger is equally present. Total screening is a desirable point in design rather than a precautionary measure against fire. Advantage is also taken of the opportunity in the case of A.C. supply of creating potentials appreciably higher than that of the mains.

The application of mains to receiving sets is so varied that the average listener, when using mains to operate his battery eliminator and moving-coil loud-speaker, can almost be regarded as an experimenter beyond control by regulation.

Since the general use of mains-connected receiving sets has come about not a single case has arisen within the experience of this journal of either fire or fatality attributable to the connection of the mains to the set. This matter is of importance at the present time, as it is receiving the attention of the Institution of Electrical Engineers, and whatever regulations that body may care to draft they will undoubtedly be adopted by the concerns interested in fire insurance.

Modern Naval Receivers

Long-Range Sets with Screened Grid H.F. Amplifiers.

SERVICE or commercial radiotelegraphic apparatus is not always of great interest to the amateur, as it is designed from a point of view differing widely from his own; indeed, the requirements of a set for Morse reception are often diametrically opposed to those of a telephony receiver. In order to reduce interference, the former is sometimes arranged to give maximum response to a particular note rather than to magnify equally the whole range of audible frequencies. Again, the sensitivity of these sets would often be considered as disappointing by the keen and knowledgeable amateur; this quality must, in some cases, be subordinated to such requirements as easy operation, robustness, and quick wavelength change. However, the new Marconi receivers, designed in collaboration with British naval experts by Marconi's Wireless Telegraph Company, are notable exceptions, as they possess so many outstanding features—some of which are applicable to broadcast reception—that they cannot fail to interest both amateur and professional. By the courtesy of the makers it is possible to give a detailed description of the sets, which, though primarily intended for use at sea, are obviously suitable for military and other purposes.

The series comprises three different types: the R.g.18, the R.g.19, and R.g.19a. Though differing in details, mainly with regard to wavelength range, all have many points of similarity, which will be discussed before describing the features of individual receivers. Each has a total of five valves; two cascade H.F. amplifiers, anode bend detector, and one note magnifier, with a

The type R.g.18 receiver, which covers a single waveband. A, aerial tuning condenser; B, secondary and H.F. tuning condensers; C, gang control knob; D, volume control rheostat; E, local oscillator condenser.

A 10

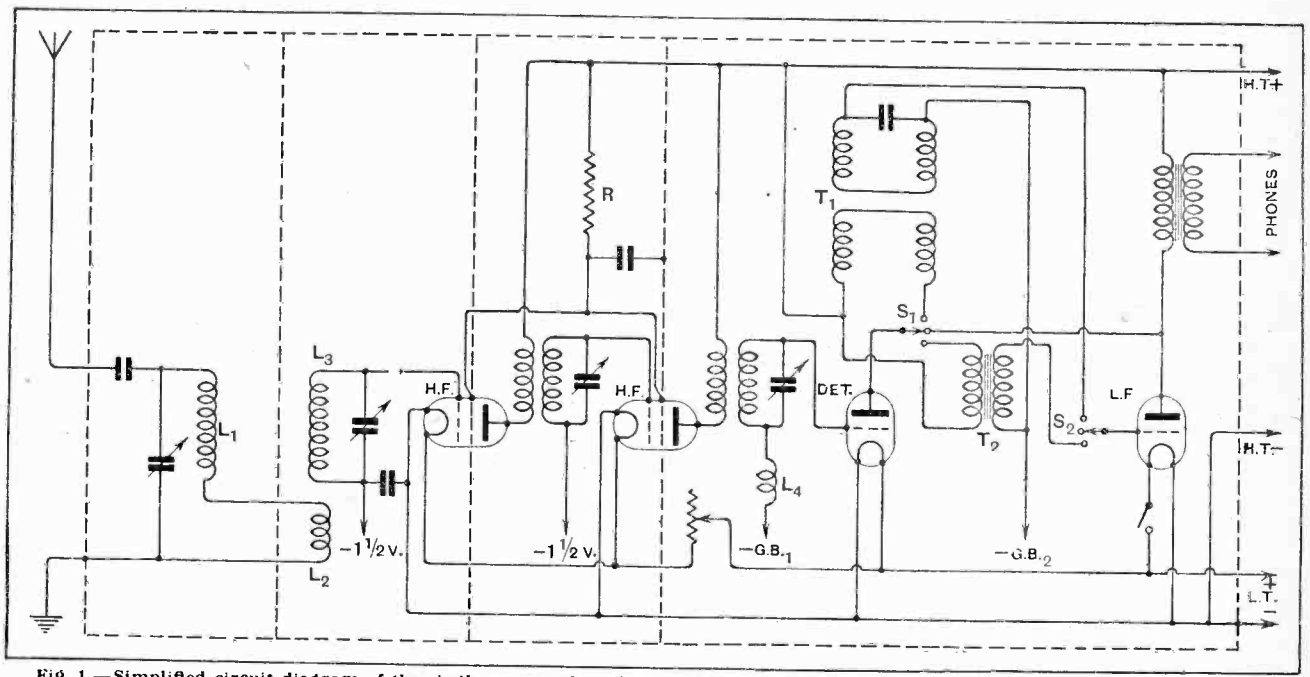
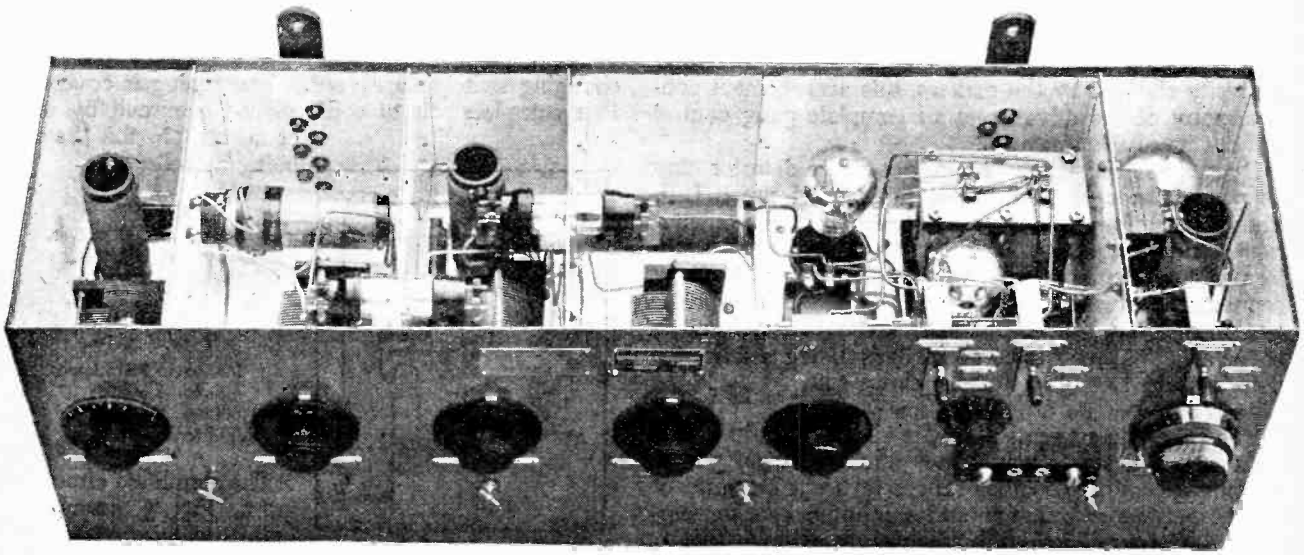


Fig. 1.—Simplified circuit diagram of the single waveband receiver, with heterodyne valve omitted. L_1, aerial coil; L_2, aerial coupling coil; L_3, secondary coil; L_4, oscillator pick-up coil; R, voltage-reducing resistance for valve screens; T_1, note filter; T_2, L.F. transformer; S_1, S_2, linked detector output switches; $-G.B._1$, bias for detector; $-G.B._2$, bias for L.F. valve. Screens are indicated by dotted lines.

separate oscillator, the various functions being performed (in the order given) by two Marconi S.625 screened grid valves, followed by a D.E.H.610, D.E.L.610, and D.E.H.610. It is significant that an inductively coupled and separately tuned aerial circuit is included (even in the R.g.18 set, which covers a limited waveband), although it introduces an extra control; as every care has been taken throughout to simplify operation wherever this is possible without reduction of efficiency, it is to be assumed that the various possible substitutes for this well-tried arrangement are considered as inadequate. The coupling between primary and secondary coils is fixed.

A common H.T. voltage of 120 is applied to the anode of all the valves, and also to the screen grids of the H.F. amplifiers through a resistance in which the surplus of 40 volts is absorbed. Complete screening is adopted, both to prevent interstage coupling and also to obviate pick-up of local interference; consequently, the amplifiers are completely stable over the wavebands covered without the need for neutralising devices. Volume control is provided by dimming the H.F.



Interior view of the fixed wave-range receiver. The heterodyne valve is in the right-hand compartment.

Modern Naval Receivers.—

filaments, and the last valve may be eliminated by means of a switch.

In accordance with usual practice, the H.F. valves are mounted in such a manner that their screen grids coincide with the metallic shield dividing adjacent stages; by these means undesirable couplings between grid and plate circuits are still further reduced. The photograph on the preceding page shows the positions of the more important components in the single waveband receiver.

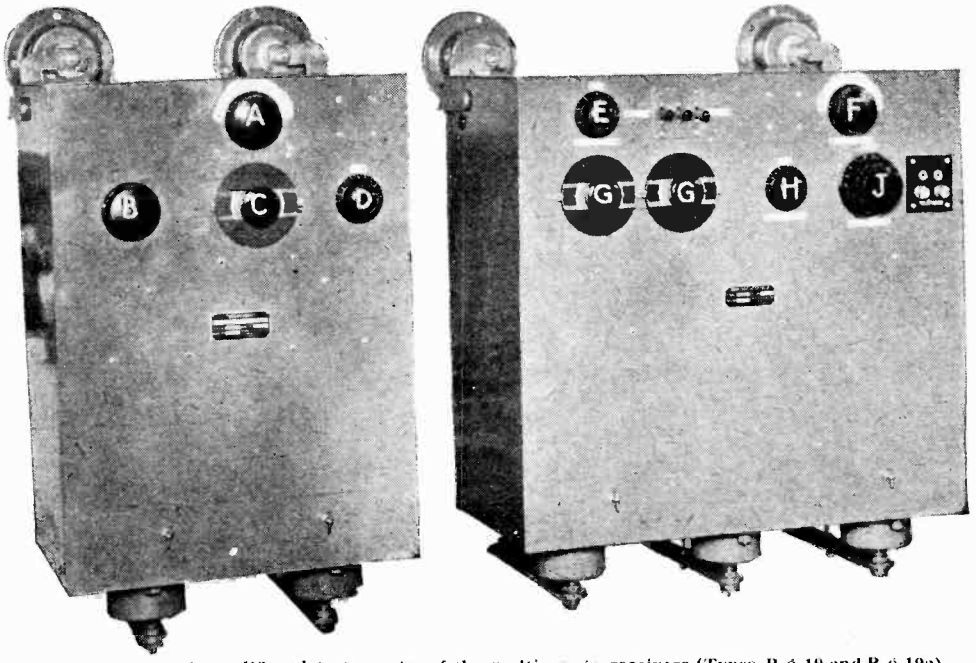
The problem of simplifying control has been solved in a particularly interesting manner. Complete "ganging" of the four variable condensers necessary for the particular circuit arrangement employed would be obviously impracticable unless the circuits were damped so heavily as to reduce the overall amplification (which is actually between 500 and 1,000). However, provision is made for interlinking the various controls over a limited wavelength range; the rotors and stators of the condensers are independently mounted, and the rotors (or, rather, what would be called the rotors when dealing with ordinary condensers) are mechanically connected so that they may be swung through a few degrees. The various dials are calibrated, and to receive a particular wavelength they are set to the reading indicated, after which "searching" is carried out by rotation of the gang control knob, which changes the tuning by about 10 per cent. on either side; thus the single control would be operative, for example, between 450 and 550 metres. As justly claimed by the makers, this arrangement confers many of the advantages of complete gang control without its disadvantages.

By means of a switch the output of the detector may be passed through a note filter (a form of tuned L.F. transformer) for the reception of Morse at a predetermined audio-frequency, or through a distortionless transformer for telephony. A third position gives a direct connection between the detector valve and the phone transformer. A single coil heterodyne valve circuit is used for C.W. reception, oscillations being fed to the detector grid through a fixed pick-up coil.

Details of the Various Models.

The type R.g.18 receiver is the simplest of the three, as it covers a single waveband, normally from 300 to 750 metres, although other ranges in the same ratio of 2.5: 1 between maximum and minimum can be supplied. The simplified circuit diagram is given in Fig. 1, from which it will be seen that the valves are coupled by tuned transformers. Although the pick-up coil is shown (at L_1), the oscillator valve is omitted, its connections being given in Fig. 2. A fixed condenser is inserted in series with the aerial in order to reduce its effect on the tuning of the open circuit. The complete waveband is covered with aerials of from 0.00015 mfd. capacity upwards.

Except in the matter of wave range, the R.g.19 and R.g.19a sets are identical. The first covers a waveband of from 500 to 22,000 metres, and the second from 300 to 10,000 metres. They are made in two separate units, the first comprising an aerial coupler and tuner, and the second an amplifier-detector. Compared with type R.g.18, the most important difference is the use of tuned anode couplings between the H.F. stages; no doubt this is a much more convenient plan when wave-changing switches are used. The tuning is covered by four complete sets of coils, placed in circuit by means of a switch, the "steps" being as follows:—



The aerial and amplifier-detector units of the multi-range receivers (Types R.g.19 and R.g.19a). A, wave-changing switch; B, aerial tuning condenser; C, closed circuit tuning condenser; D, gang control knob for B and C; E, volume control rheostat; F, wave-changing switch; G, H.F. tuning condensers; H, gang control for G, G; J, local oscillator condenser.

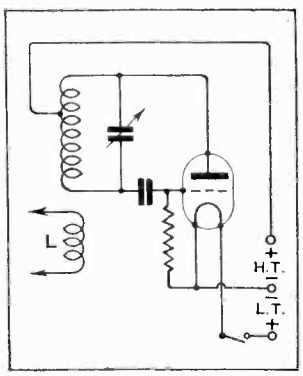


Fig. 2.—Circuit of local oscillator. L, pick-up coil.

Type R.g.19.

500 to	1,500 metres.
1,300 to	3,900 ,,
3,500 to	10,000 ,,
8,000 to	22,000 ,,

Type R.g.19a.

300 to	750 metres.
500 to	1,500 ,,
1,300 to	3,900 ,,
3,500 to	10,000 ,,

The simplified circuit diagram, Fig. 3, from which both oscillator connections and detector output switch-

Modern Naval Receivers.—

ing are omitted, shows that the coupling coils and tuning condensers are separately screened; the former are accommodated in a compartment immediately below that containing their associated condensers and the remaining apparatus. The aerial tuning capacity is a three-element component in which the aerial section of 0.0005 mfd. acts as a form of variable feed, and by reducing the disturbing effect of aerial capacity ensures that the coils included will cover the desired wave range with aerials of from 0.00025 mfd. upwards. The parallel section of the condenser has a capacity of 0.001 mfd.

As the " all-wave " sets are in two separate units, it will be obvious that the method of partial gang control by a single knob as already described will not be applicable to them without some modification. Moreover, the difficulties encountered in applying a mechanically-interconnected tuning system to a number of circuits are increased when several wavebands are to be covered. Here the solution is provided by separately " ganging " the tuner (aerial and secondary) and H.F. condensers; thus there are two knobs, each controlling the tuning of two circuits over a limited band at any part of the scale.

In the matter of size the receivers are only slightly more bulky than average broadcasting sets with the same number of valves; Type R.g.18 is 34¼in. long 11½in. high, and 11in. deep. The measurements of the R.g.19 tuner and amplifier-detector are, respectively, 11½in. by 20in. by 11in., and 21in. by 20in. by 11in. The weight of these two units amounts to 164 lb., so it will be appreciated that the construction is exceptionally robust.

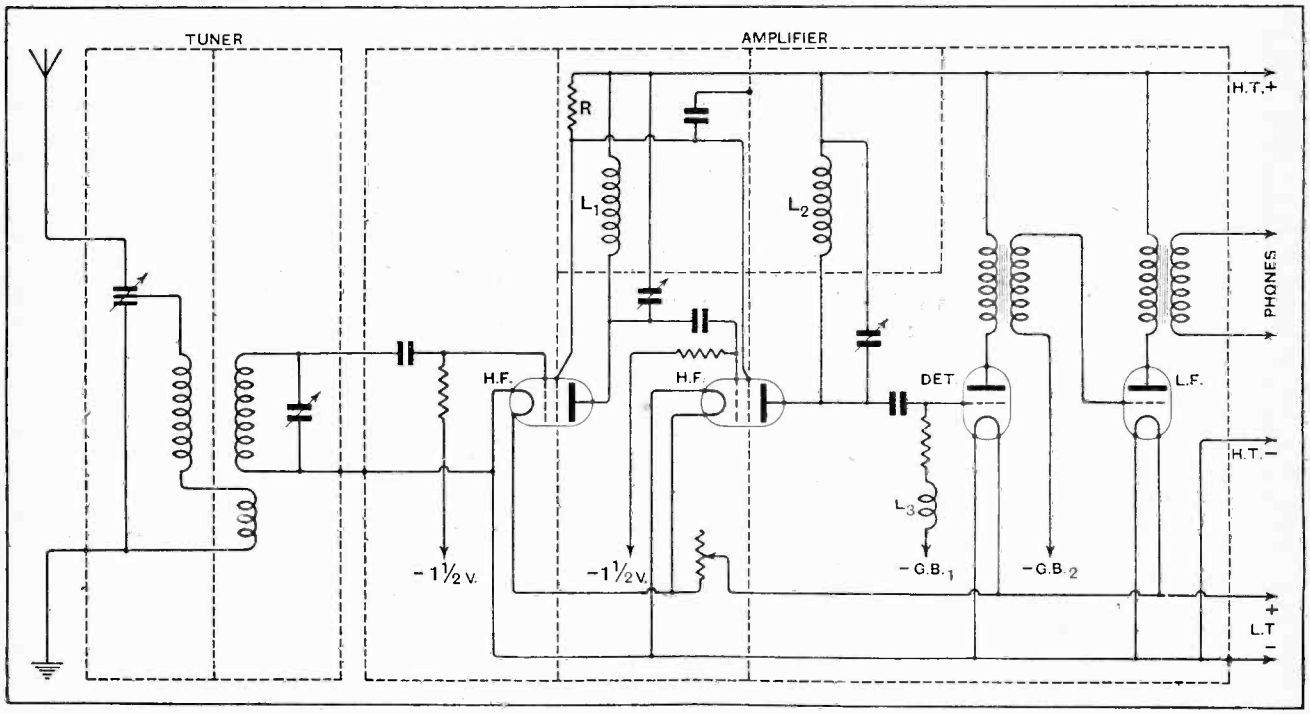


Fig. 3.—Simplified circuit diagram of the two units comprising the multi-range receiver (with switching omitted). L_1, L_2, tuned anode coils; L_3, pick-up coil; R, voltage-reducing resistance for H.F. valve screens.

W. G. Pye & Co., "Granta" Works, Montague Road, Cambridge.—Illustrated leaflet giving details of Pye Heavy Duty Chokes.

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Graham Amplion, Ltd., 25, Savile Row, London, W.1.—Envelope (W.L.26/28) containing full instructions for building the Amplion Cone Amplifier, including blue print and full particulars for use in conjunction with the Vivavox pick-up. Also a pocket size catalogue (W.L.30) of all Amplion loud-speakers, cone amplifiers and gramophone attachments.

CATALOGUES RECEIVED.

Bakelite, Ltd., 68, Victoria Street, London, S.W.1.—Illustrated brochure describing the materials, plant and processes used in the production of Bakelite mouldings, with hints to designers of moulds and particulars of the mechanical and electrical properties of finished mouldings.

A. F. Bulgin & Co., 9, 10, 11, Cursitor Street, London, E.C.4.—Leaflet showing suggestions for adding Bulgin products to the Cossor " Melody Maker."

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County Chemical Co., Ltd., Bradford Street, Birmingham.—Illustrated folder of varnishes, fluxes, etc., used in wireless receiver construction.

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Rumbaken Magneto Company, Ardwick, Manchester.—Illustrated leaflet giving particulars of the A.C.X.2, combined H.T. and L.T. charger.

THE MAINS AND THE EARTH CONNECTION.

Some Considerations when Obtaining Power from D.C. Supplies.

By N. P. VINCER-MINTER.

IT has often been pointed out in this journal that the constructor of an H.T. battery eliminator must take great care before connecting up his instrument to ascertain whether his positive or his negative main is earthed. If the former is the case, it will be necessary for him to take the precaution of isolating the receiver connections from earth in order to avoid blowing the main fuses in his house, if, indeed, he does not do still greater damage. With regard to the actual method of isolating the connections of the set from earth, this is sometimes done by the use of a fixed condenser in the earth lead, although, for reasons which have already been discussed in this journal, this is not always the best method from the purely wireless point of view, the use of a loosely coupled aerial circuit (usually aperiodic) often being preferable. The third method of omitting an earth connection altogether is probably the least satisfactory of all, from a wireless point of view. All three methods mentioned, however, are equally good from the ordinary electrical point of view.

The reason why fuses are blown when a D.C. eliminator is used in conjunction with mains having a positive earth is easily explained. As is well known, either the negative or positive L.T. busbar is joined to the earth terminal of the set, thus earthing the valve filaments. The H.T.– terminal is invariably joined to either the L.T.– or L.T.+ busbar. Whichever is the case, it must be obvious that this means that the H.T.– terminal is definitely earthed; if the set is of the type with H.T.– joined to L.T.–, as in the case of *Wireless World* receivers, and at the same time having L.T.– earthed (this is true of all receivers employing H.F. stages, and of many employing no H.F. stage), then it is obvious that there will be a direct connection between H.T.– and earth. Should, however, H.T.– be joined to L.T.+, then the connection will be through the L.T. accumulator, which, having negligible resistance, is almost the same thing as a direct metallic connection. Now the negative main is connected to H.T.– *via* the eliminator, and, therefore, direct to earth. If now we have our positive main earthed, it is at once clear to us that, since both our mains are earthed, they will be short-circuited, and fuses will be blown with some violence. In the case of the negative main being earthed, this danger will not arise.

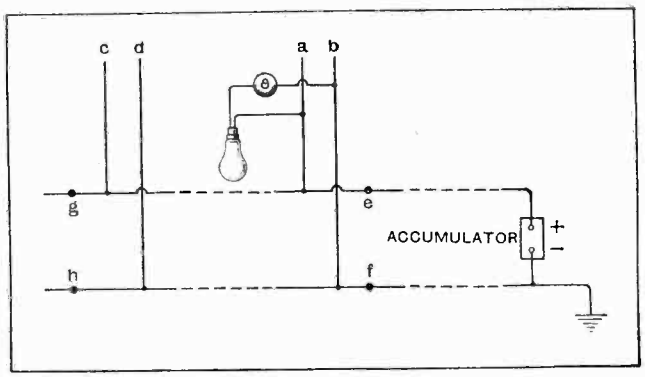


Fig. 1.—The generator in this simple two-way wiring system is represented by an accumulator for reasons stated in the text.

We have been considering the case of D.C. mains, for it is only on this type of supply that the danger arises. In the case of A.C. supply, there is no metallic connection whatever between the main and the receiver at any time, owing to the interposition of a transformer. Moreover, of course, in the case of A.C. mains, there can be no such thing as a negative earth or a positive earth. Actually, one main known as the neutral is earthed, but this main changes its polarity very many times during the course of one second. Since, as we have said, however, there is no actual direct current connection between the mains and the receiver, we will not discuss these points further, as no danger can arise from this source; nor does it matter which way round the adaptor is thrust into the lamp socket, but, of course, it does in the case of D.C., as we shall presently see.

A.C. or D.C.?

Before purchasing or attempting to construct an H.T. battery eliminator, therefore, it is necessary for us to know whether our mains are A.C. or D.C. This information can usually be obtained by glancing at the electric light meter, which usually has the periodicity as well as the voltage marked on it. Thus, in the case of a 240-volt D.C. supply, one will usually see marked "240 v." on the meter, and in the case of A.C. "240v. 50~" In any case, however, the information can be very easily ascertained by the simple method illustrated by the writer in an article on battery charging published by him in a recent issue of this journal.[1] Another method was illustrated on page 280 of our March 14th issue. If we have found that our mains are A.C., the next information we require is the maximum H.T. current demanded by our receiver. Having found this figure, we should add 25 per cent., not only in order to give us a very wide margin of safety, but also in order that we shall not have to reconstruct our eliminator, or purchase a new one, if at any time we wish to add extra valves to our receiver, or purchase a bigger set. In the case of A.C., having found out the voltage (this information is easily acquired by simply glancing at the lamps in the house), the periodicity, and our output requirements, we can safely proceed to get together our

[1] Page 421, April 18th, 1928.

The Mains and the Earth Connection.—components, or to proceed to purchase an eliminator, as the case may be.

In the case of D.C., we have, as before, to find the mains voltage, and also our output requirements. We do not, of course, need to know the periodicity of our mains, which is always zero in the case of D.C. Having elucidated this information, we can purchase or build the eliminator, but, having built it, it is necessary, before testing it, to find out whether we are on the positive or negative side of the usual modern three-wire D.C. system. It may be mentioned that in the case of manufactured eliminators, there is usually a terminal marked "earth" to which users are instructed to connect their earth wire. In most cases, the effect of putting the earth wire on to this terminal, instead of on to the earth terminal of the set (which is itself connected to another terminal on the eliminator), is to put a condenser in series with the earth lead, and so do away with the necessity of finding the polarity of the mains, for, of course, the condenser in the earth lead does no harm even if it is the negative main which is earthed.

Identifying the Earthed Main.

Let us acquaint ourselves with the method of ascertaining which main is earthed; this is an exceedingly simple procedure indeed, but it is thought that it is better to explain it by giving the reasons for what we do, or, in other words, by delving a little into what the layman often regards as the mysteries of the three-wire system, although, as we shall see, it is no more difficult to understand than the ordinary two-wire method.

The simple two-wire system is roughly illustrated in Fig. 1. As the sketch shows, it merely consists of two wires from the generating station, which in some cases are not even lead sheathed, as in modern practice, and in which neither wire at the generating station is earthed. The writer is aware of a small town which is still lit by this system, and also of another apparently more progressive place in which one of the poles at the generating station is earthed. If we understand this system clearly, we shall have no difficulty in solving the so-called mysteries of the three-wire system. Referring to Fig. 1 again, the writer has deliberately illustrated a simple accumulator as the source of energy, since readers are far more familiar with accumulators than with large generators, and the effect is the same in any case. Since this is a one-cell accumulator, it will have a voltage of 2, but if we use our imagination and suppose that it has a voltage of 240, which is a common voltage in use to-day in this country, we shall grasp things more easily. We will suppose, also, that the negative pole is earthed. The lines shown horizontally represent a pair of cables passing up the street, and those shown leading from it at right angles represent branches going to houses.

Let us consider that the first pair of branch cables (a) and (b) lead to a residence called "Parkview," and that the cables (c) and (d) lead to the "Rookeries"; the former house being near the generating station, and the latter house a considerable distance from it, with many other houses intervening along the "line." In the case of the first house, we have illustrated a simple lamp and switch going to one room in the house. The lines for other rooms in the house branch off cables (a) and (b) in a similar manner to the one illustrated.

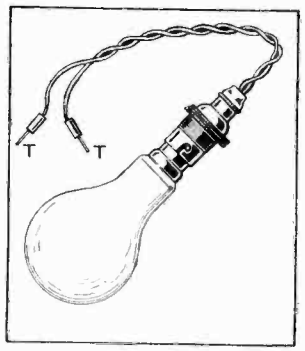


Fig. 2.—The simplest and best type of test lamp.

A Seeming Paradox.

We will now construct a test lamp, consisting of a lamp holder, a length of flex with two inexpensive insulated testing spikes T—T at one end, and lamp as shown in Fig. 2. The lamp should be of the same voltage as the mains.

Now it is quite obvious that if we apply this test lamp across (a) and (b), that is, across the mains of the house which is near the generating station, the lamp will light up, and the same will be the case if we apply it across points (e) and (f), (c) and (d), or (g) and (h). Suppose now we apply one wire of the lamp to point (a) and touch the other on some earthed object, such as a water pipe or the lead sheathing of the wire, if, indeed, it possesses such a modern improvement. Surely, since the negative pole of the generator is earthed, the lamp will light brilliantly, the return circuit being made *via* the earth to the generator. If, however, we put one terminal of the test lamp on (b) and the other terminal on an earthed object, no light whatever will come to the lamp, since there is no potential difference between the earthed negative wire and the actual earth itself.

If we take the case of the more distant house, we can, as before, still obtain a light by joining our test lamp between (c), the live main and any earthed object. But what will happen if we connect the test lamp from point (d) to the aforesaid earthed object? "Surely," someone will say, "we shall get the same effect as when we connected between (b) and earth, that is, no light at all, because the two terminals of the lamp will be connected to points of equal potential, namely, earth." This is not the case, however, and many users may be considerably surprised to learn that in these circumstances the lamp will light with a dull red glow. Common sense tells us that in order to light the lamp we must connect it to points of different potential, and it is obvious, therefore, that in the case of this distant house the earthed wire and the actual earth itself are at a different potential. The reason why this seeming paradox occurs is easily explained by Ohm's law.

Every wire has a resistance, and there will be a considerable resistance along the cables and wires running from the generating station to a house at the end of a long "feeder." Now we have a current passing through this wire, and which, of course, possesses resistance; Ohm's law tells us that if we have a current passing through a resistance there must be a potential difference across that resistance. In brief, there must be a difference of potential across this wire, and therefore, the earthed cable is no longer at earth potential at

The Mains and the Earth Connection.—this far end, for it must be remembered that it is earthed at the generating station, and not at the distant house. There will, then, be a difference of potential of perhaps 20 or 30 volts between the actual earth and the earthed wire at the distant house, and this is sufficient to cause a lamp to glow dully. The actual difference of potential, of course, depends on the resistance of the cable, and, perhaps more important still, on the current that is passing through it. It will be clear now that if the positive pole of our mains were earthed instead of the negative, exactly the same state of affairs will take place, except in this case, however, (a), (c), (g), and (e) would lie on the earthed cable. The method of finding out which wire is at earth potential, and which is the live main, is now clear. We have merely to take a test lamp, as in Fig. 2, connect one wire of it to earth, and the other wire to one pole of our mains. If the lamp lights brilliantly, then we are connected to the non-earthed main and can mark it accordingly; if it does not light at all (do not forget to make sure first that the test lamp is in order by connecting it across the mains), or if it lights with a dull red glow, it will mean that we are connected to the earthed terminal. It cannot be too strongly urged that when the above tests are made, brief contact only should be made to the earthed body, owing to technical reasons which are not relevant to this article.

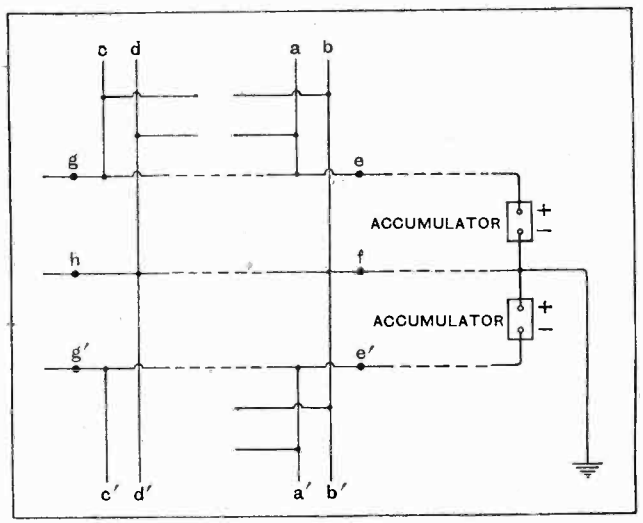


Fig. 3.—A rough idea is given here of the modern three-wire system, the generator being represented as an accumulator.

The Three-wire System.

From this simplified explanation it will not be difficult to study the three-wire system. In this system, three-wires instead of two are used, and although time and space forbid us to go into details, two generators instead of one are used; they are in series, and the middle wire, which is connected between them, is always earthed. We have represented in Fig. 3 the generators by two accumulators in series for the sake of simplicity as mentioned previously. It is obvious that if we have two accumulators instead of one, the potential difference across the two outer wires will be double that across any one outer and the middle wire; thus, if the normal house voltage is 240, the potential difference across the outers will be 480. One outer and the common earthed middle wire of the system are run up alternate streets or sections of the town, an endeavour being made by special apparatus at the generating station to preserve a balance of load on each "side" of the centre wire. In the case of a factory requiring many kilowatts, both "sides" of the system go into it, thus giving 480 volts, so meeting the needs of the factory for big power. There is no need for us to understand any more concerning this aspect of the case.

All we require to know is why with the three-wire system some people have a positive earth and others a negative earth. This is clear if we study Fig. 3, which shows the *three* main cables of the generating station with *two* wires led up alternate streets, and so by further branches into the houses. Up one street is led the common earthed wire, and *one* live one, which is 240 volts more *positive* than the middle earthed wire. Up the next street is led the common earthed wire, and the *other* live main, which is 240 volts more *negative* than the middle earthed wire. Therefore, although the same middle earthed wire is led up all streets, yet in one street this earthed wire will be positive, and in the next street negative. The same markings are used in Figs. 1 and 3, and the only difference is that in Fig. 1 the vertical cables (a), (b), etc., represent wires running into houses in primitive towns, and in Fig. 3 the same wires represent branch cables running up different streets, and further horizontal leads branching off from a b, c d, a′ b′, etc., are shown as an example of cables running into houses. The method of finding which main is earthed, or, to put it more clearly, to find out whether the earthed wire is positive or negative, is exactly the same as the method already described in conjunction with Fig. 1.

The writer has only attempted in this article to give a very rough idea of the three-wire system of lighting, and has not tried to delve into the deeper intricacies of the subject.

Valve Crystal Receiver

Practical Details for Construction and Operation.

By P. W. WILLANS, M.A., A.M.I.E.E.

(*Concluded from page 556 of last week's issue.*)

SO far attention has mainly been given to the principles on which the present receiver operates. It now remains to discuss the more practical side of the question and to give the necessary constructional particulars.

The circuit diagram (Fig. 8) of the receiver is reproduced again from the previous article. Most of the components are of standard type, and no particular reference need be made to them. The coil assemblies are, however, specially designed for the particular circuit employed, the tuning coils being solenoids on 3in. paxolin formers, and the aerial and reaction windings being space-wound in the usual manner with ebonite separators $\frac{1}{8}$in. thick.

Low-loss Aerial Transformer.

The aerial coil assembly is shown in Fig. 9(a). The tuning coil is wound with 60 turns of 27/42 Litz wire, it being desirable in the interests of selectivity that this coil should have the lowest possible losses. A centre tapping is provided and the aerial coupling coil is wound over the centre of the coil so as to preserve electrical symmetry. Fourteen turns of aerial winding are employed spaced 16 turns to the inch, as shown in the figure.

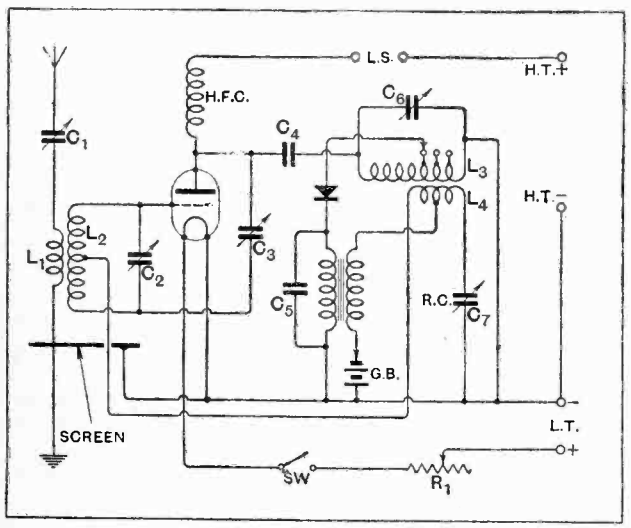
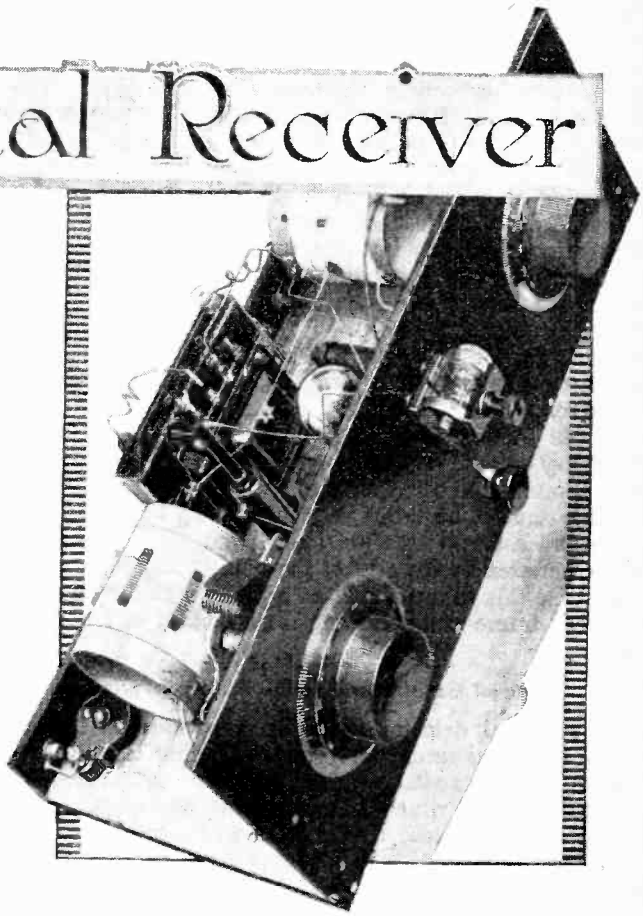


Fig 8.—The circuit diagram of the valve crystal receiver.



The anode coil assembly (Fig. 9(b)) does not require the same precautions as regards low losses, since the damping applied to the anode circuit by the crystal detector is considerably in excess of that due to any reasonably constructed solenoid. Solid wire (No. 22 S.W.G.) is therefore employed for the tuning coil, and three tappings are provided, as shown, as alternatives for connecting the crystal, so as to take into account possible differences in resistance between different specimens of crystal. The reaction winding is wound in two halves of 15 turns each so as to operate according to the principles already outlined.

Balancing Grid-filament Capacity of Valve.

These two coil assemblies are mounted at right angles on ebonite supports on the baseboard so as to be free from magnetic coupling; in this way the neutralisation is preserved over the wavelength range of the receiver. The aerial is connected to its coupling coil through an adjustable condenser by means of which account can be taken of different aerial capacities, and, if desired, a measure of selectivity specified under conditions where it is not essential to obtain increased signal strength.

The aerial tuning condenser is mounted in a somewhat special manner so that approximate electrical symmetry is maintained and no hand-capacity effects experienced. The condenser is mounted on a bakelite bracket

Valve Crystal Receiver.—

so as to stand away from the panel and an insulated bakelite coupling is provided, together with a short auxiliary steel spindle which projects through the front panel in place of the standard spindle. On the panel is located a metal screening plate which protects the condenser from the effect of hand capacity and also introduces into the circuit a certain amount of capacity between the frame of the condenser and L.T.—which, as stated in the previous instalment, fulfils the function of approximately balancing the grid filament capacity of the valve. The condenser with its bracket, coupling piece, and auxiliary spindle may be obtained from the Igranic Electric Co., Ltd.

Care should be taken in connecting the condenser up that the fixed vanes are connected to the grid of the valve; otherwise this capacity will be added on to the capacity between frame and screening plate instead of balancing it.

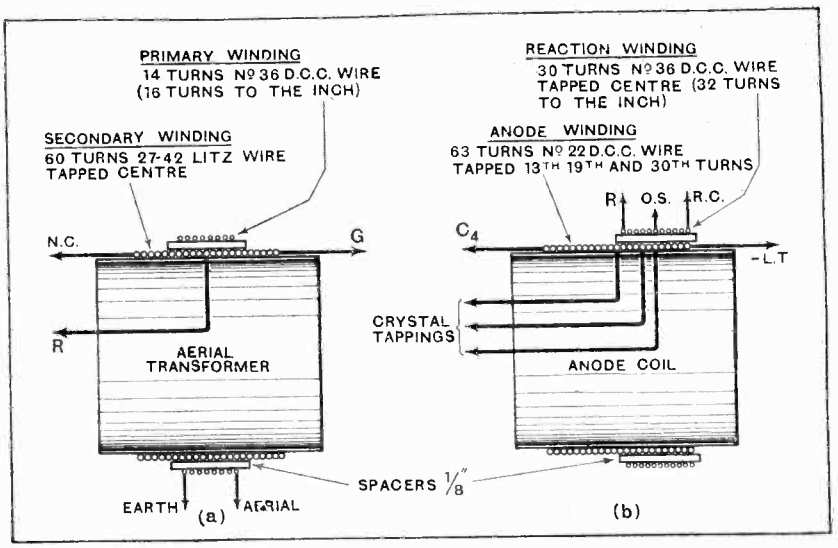


Fig. 9.—(a) The aerial coil assembly. (b) The anode and reaction coils.

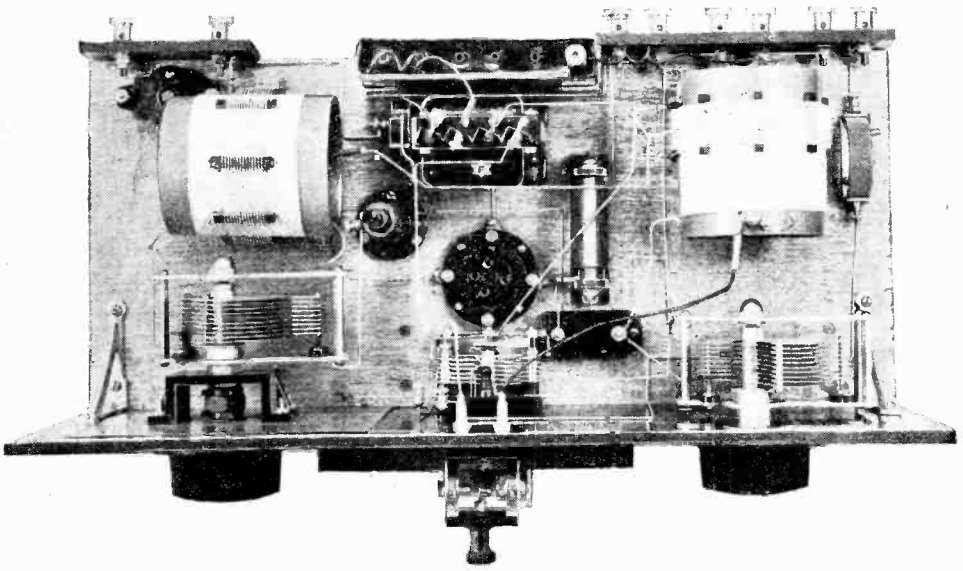
Type of Crystal and Valve Recommended.

The crystal detector which is recommended for use is of the semi-automatic type; searching for sensitive points being carried out by rotating a knob. The essential feature which makes this detector of particular value in the present circuit is the extremely fine cat-whisker, which results in a high contact-resistance, and also the delicate adjustment of pressure which is possible. In operating the present circuit this appears to be essential, although any arrangement satisfying these conditions will probably give excellent results. It must, however, be remembered that any detector employed for this purpose must withstand a reasonable mechanical shock without losing its adjustment, otherwise the reaction conditions will vary and the set will either howl or become insensitive. The present detector has been found quite satisfactory in this respect.

A DE5 or PM6 valve (or any type of similar characteristics) is suitable for use in the circuit, and will enable loud speech of good quality to be obtained from a near-by broadcasting station. With valves of higher magnification a tendency to threshold effects has been experienced, due to the non-linear nature of the characteristic, and on these grounds also a valve of the "medium power" type is to be recommended.

The remaining figures illustrate the constructional details of the various parts of the set, and little comment is necessary. Fig. 10 shows the layout of the components on the baseboard. In Fig. 11 are shown the drilling details for the front panel; here plain knobs for the condensers have been allowed for, although naturally any type of slow-motion dial may be used if required. Fig. 13 shows the two terminal boards, one for the aerial and earth connections and the other for batteries and output, and Fig. 12 is the practical wiring plan for the complete instrument.

As previously stated, three alternative positions have been allowed for the connections of the crystal detector to the anode coil. It is not intended that an interchange should be made when once the set is working correctly, but only that an opportunity should be available of matching the coil with the crystal detector in the most satisfactory manner. It is



A plan view of the receiver that shows the general layout of the components

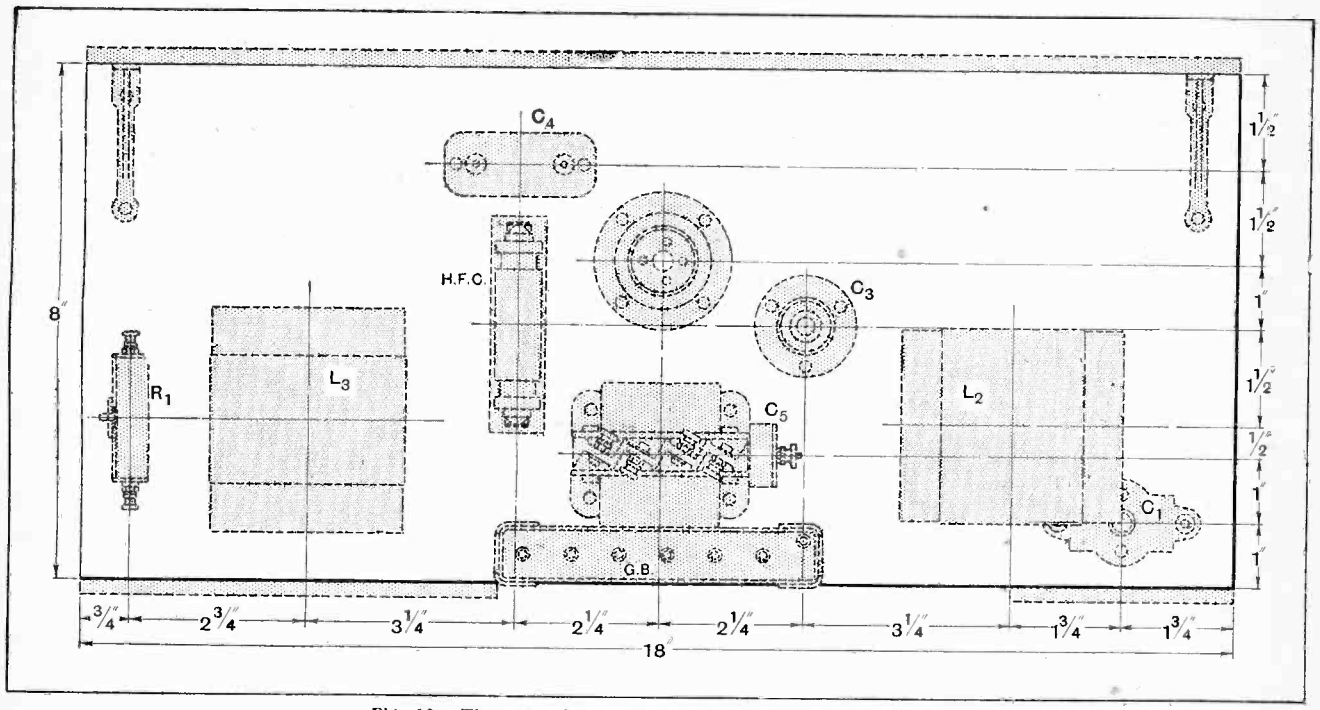


Fig. 10.—The general layout of components on the baseboard.

convenient, however, to make the connecting lead concerned out of flexible wire so that it can easily be interchanged should occasion require it. Apart from this and the grid bias leads, stiff wire of 18 S.W.G. is suitable, and no special comment is necessary.

Operation of the Set.

When the set has been connected up, it is first necessary to ascertain whether (the detector being temporarily connected to any one of the tapping points) the cat-whisker is in contact with the crystal. Having made certain of this, and after adjusting the contact pressure by eye to a light value, the two tuning condensers may be adjusted so as to bring the two circuits into resonance. If telephones are inserted in the output circuit clicks will in general be found when this occurs owing to the two circuits not being correctly neutralised. Adjustment of the condensers C_3 in the right sense will tend to reduce the clicks and will most probably give rise first to a "threshold howl" as the two circuits come into tune;

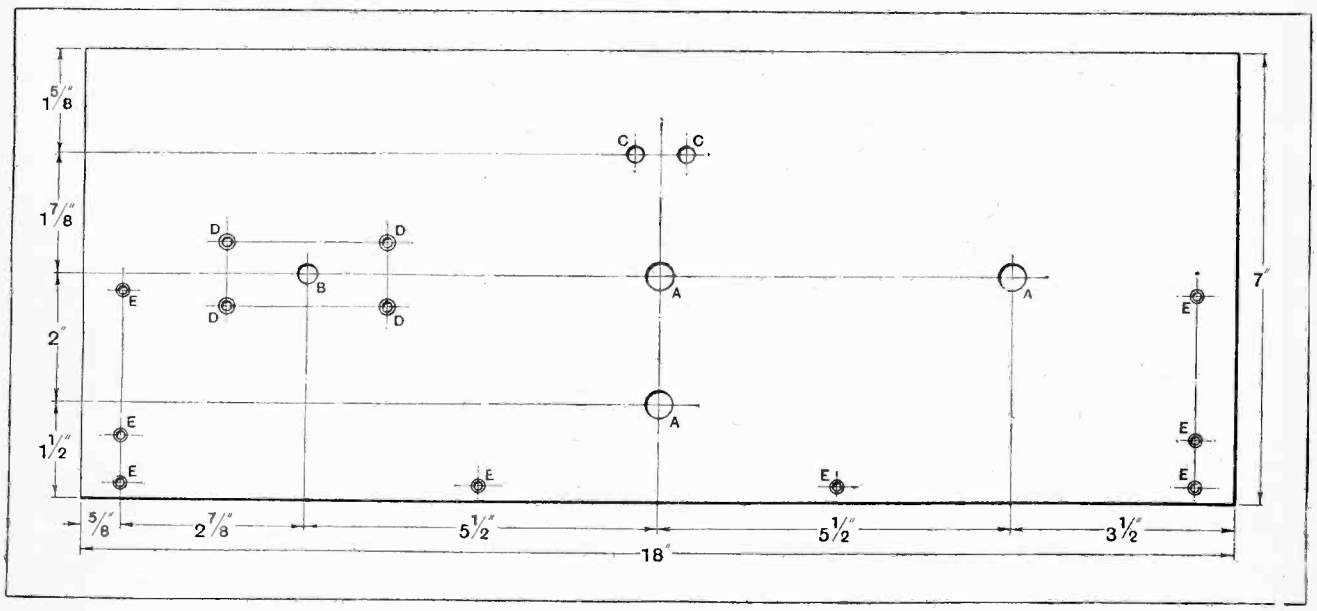


Fig. 11.—Drilling details for the front panel.

Valve Crystal Receiver.—

then as it is brought more closely into proximity with the correct value oscillation will cease. At this stage the reaction condenser C_7 should be brought into play until oscillation again occurs, when the two circuits are brought into tune; readjustments of C_3 will then in general stop the oscillation and enable C_7 to be increased still further, and so on until a point is reached where oscillation cannot be checked by a movement of C_3 in either sense.

An important point to note is that after every adjustment of C_3, a slight searching movement should be made with the grid tuning condenser C_2 in order to ascertain that the set has really been stabilised and that the position of resonance between the two circuits not merely shifted slightly. When C_3 is just in balance it is usually found that a slight movement of this condenser will stop the set oscillating in one position of C_2 only to set it into oscillation in another position. Such a state of affairs indicates that the set is adequately neutralised and it is of no practical importance to attempt excessive refinements in this adjustment.

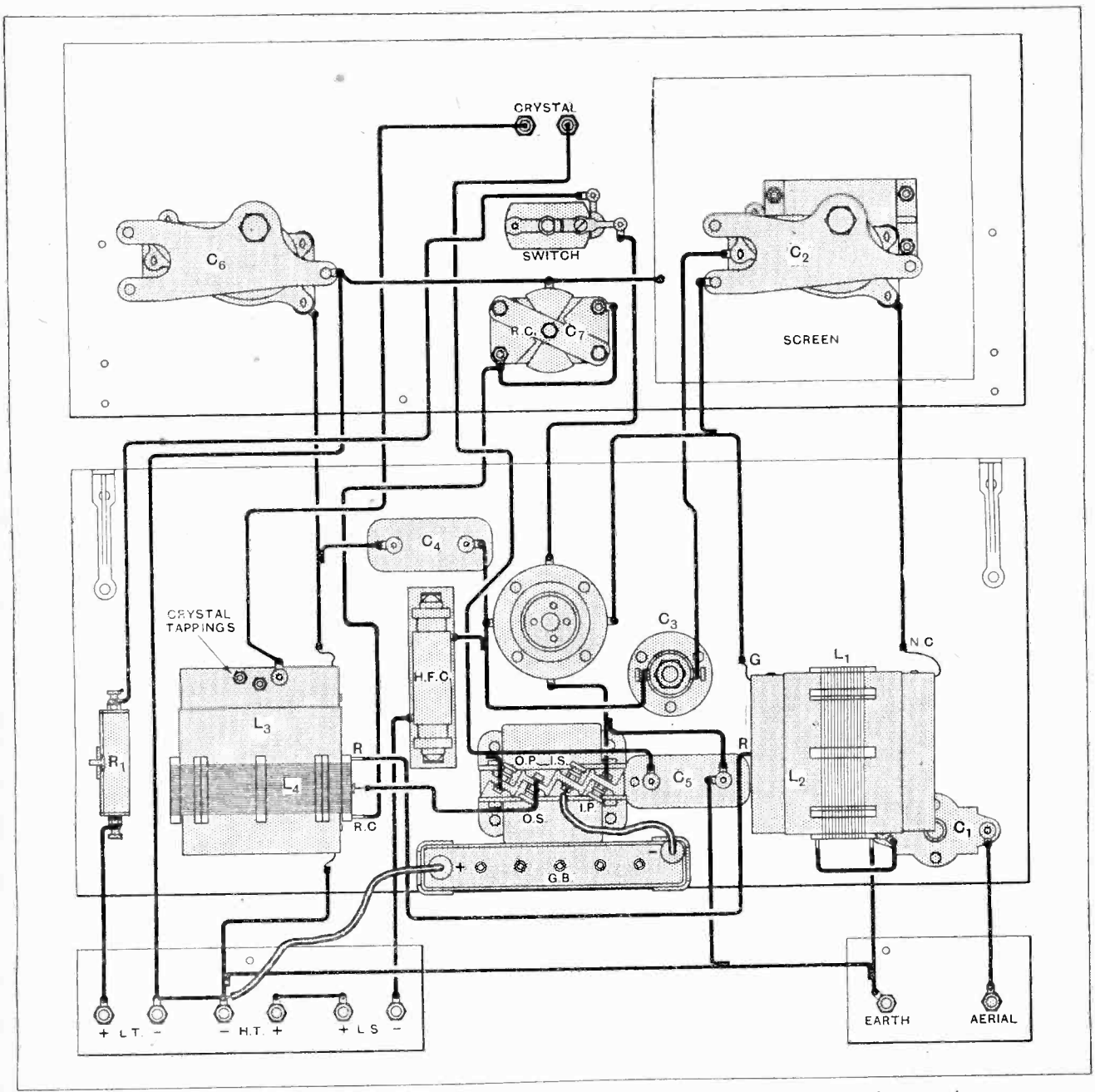


Fig. 12.—Practical wiring plan showing the components on the panel and baseboard in one plane for convenience

Valve Crystal Receiver.—

After C_3 has once been set in the manner above described *it need not be touched again, and the set will remain adequately neutralised over the whole tuning range.*

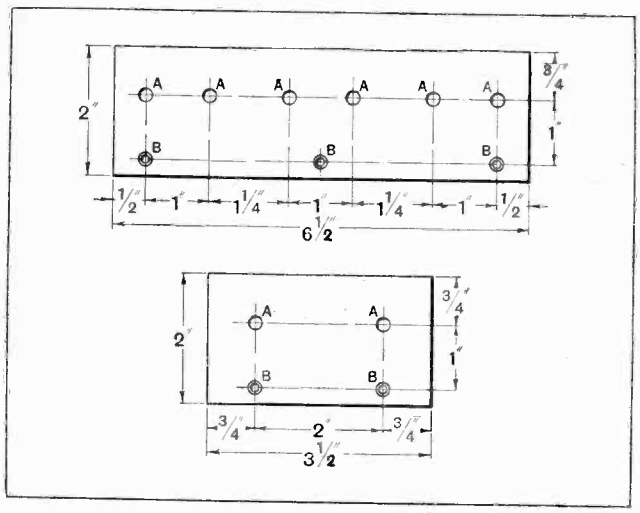


Fig. 13.—Details of the two terminal boards.

The next thing to do is to adjust the crystal detector contact for best signals, and to select the most suitable tapping point. If we start with the point nearest to the "live end" of the coil we shall obtain a condition where maximum damping is thrown into the circuit. Maximum reaction will then be required to make the circuit oscillate and the lightest possible contact pressure on the crystal. If a setting for the cat-whisker can be found where the circuit will go smoothly into oscillation at the top of the tuning range, this tapping point may be employed as a permanency, otherwise a lower point is indicated.

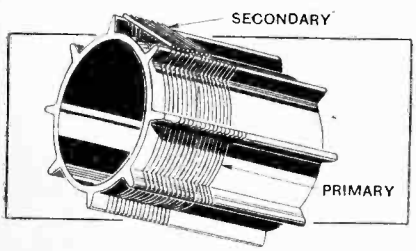
Regeneration Without Radiation.

An excess of reaction coupling will always produce an audible "howl" from the set, but a criterion of satisfactory performance is that it should be possible to tune in a 600-metre spark station with the reaction adjusted so that the musical character of the spark is lost, and the characteristic "scratch" due to oscillation produced, and at the same time no trace of audio-frequency "howl" experienced.

Once these preliminary adjustments have been made the performance of the set may be tested over the whole of its tuning range, and any necessary resetting of the series aerial condenser C_1 effected in order to increase signal strength or selectivity. The writer believes that the performance of this little single-valve set will prove really astonishing, the effect of the special reaction circuit in bringing up signals and improving the tuning characteristics being most marked. The valve, it will be noted, now amplifies at high and low frequencies and introduces a regenerative effect into the anode circuit without affecting the aerial circuit, and this, it would seem, marks about the limit of what is possible except by the use of the somewhat more elaborate super-regenerative methods.

EASY CONSTRUCTION OF H.F. TRANSFORMERS.

When constructing interchangeable H.F. transformers such, for instance, as were used in the "*Wireless World* Standard Four," it is possible to make a coil in a manner more simple than that described, and with only a small sacrifice of efficiency.



A high-frequency transformer in which the fine primary winding is wound in semi-cuts in the ribs of an ebonite former.

A former of ribbed ebonite type is used, and slots are cut down into the ribs with a fine-bladed saw to half their depth. Fine primary windings are then wound into these slots and connections taken out through holes in the former to the base, the Litz winding being wound on top of the ribs as shown, the slots being narrow enough to prevent the Litz dropping down into them. E. J. H. M.

READERS' NOVELTIES

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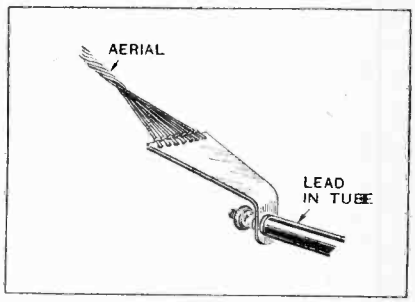
MAKING THE BEST OF A BAD THING.

Many wireless enthusiasts have doubtless often been exasperated when attempting to secure the ordinary No. 7/22 aerial wire to the lead-in tube owing to the smallness of the terminal that is generally provided. The wire usually slips completely out, and if it does not do this, probably one or two strands of it are gripped by the nut, and in any case corrosion quickly occurs.

This extremely annoying occurrence can be completely obviated by the simple device shown. A piece of sheet copper of about 20 gauge should be obtained, cut and bent to the shape shown, a hole being drilled at the narrow end to take the ordinary screwed rod of the lead-in tube. It is necessary to drill seven holes in the other end of the copper sheet, one



Method of securing each strand of a 7/22 aerial cable.

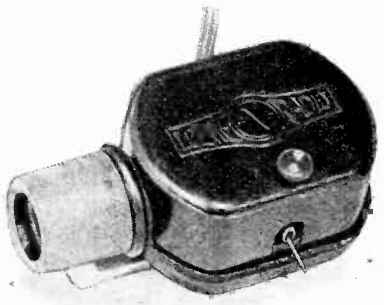
strand of the usual seven-strand aerial wire passing through each hole. It is most important that the strands should be soldered to this copper plate in order to make good contact, and the nut of the lead-in tube should be screwed up tightly. C. N. G.

NEW APPARATUS

A Review of the Latest Products of the Manufacturers.

THE LÖWE PICK-UP.

This pick-up, obtainable from the Löwe Radio Co., Ltd., 4, Fountayne Road, Tottenham, N.15, is of the electromagnetic reed type in a compact little moulded case. The reed is perhaps rather heavily damped for the weight of the pick-up, thus leading to slightly more record wear than is desirable. The quality of the



Th Löwe electromagnetic pick-up.

output from this pick-up is quite good—especially in view of its low cost of 18s. 6d.

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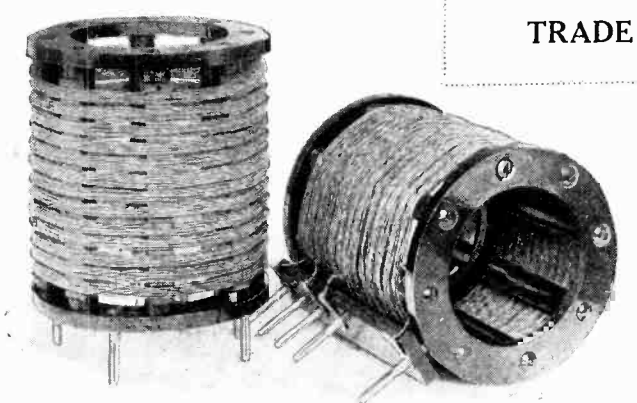
B. AND J. PLUG-IN TRANSFORMERS.

IT is always interesting to observe the methods adopted by manufacturers in producing their own versions of the efficient high-frequency couplings which have been described during the last year or so in the pages of this journal. Naturally the problems involved in designing a component for commercial manufacture and for home construction are somewhat different.

The interchangeable H.F. transformers made by the B. and J. Wireless Company, of 2 and 3, Athelstane Mews, London, N.4, are suitable for standard circuits, and include several novel features. They are somewhat similar to those discussed in the article describing the "Regional" receiver, but are wound on skeleton formers made up with eight ebonite rods secured to end rings of the same material. The effect of possible warping of the rods is counteracted by inserting internally a third ring.

The position of primary and neutralising windings is unconventional; these coils, instead of being placed externally over the secondary, are wound directly on the rods, the secondary being separated from them by ebonite strips. This procedure ensures that the fine wire coils are adequately protected against mechanical injury by the comparatively heavy and robust conductor used in the secondary, which is of Litz 27/42 and 9/40 respectively for the short- and long-wave transformers. The windings of the latter are in sections.

In order to reduce the mass of metal, ebonite screws are used throughout in the construction of the former. The aerial-grid coil is of the auto-transformer type, with the commendable refinement of an optional second aerial tapping.



B. and J. "Qualitone" plug-in transformers.

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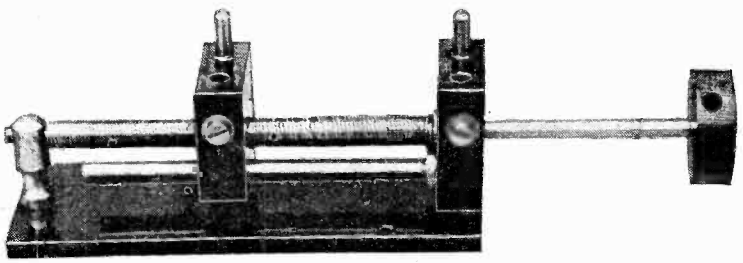
THE RED DIAMOND COIL HOLDER.

Two plug-in coils can be accommodated in this holder so that it is well-suited for a reaction detector circuit. The moving coil holder works along guides so that the two coils are always parallel to one another and a fast thread of large diameter gives fine control without backlash. As in all "Red Diamond" products of the Jewel Pen Co., Ltd., 21-22, Great Sutton Street, London, E.C.1, the ebonite is of the best quality and is given a highly polished finish.



Red Diamond type R.D.32 coil holder.

TRADE NOTES.

"Ekco" Eliminators in the North.—A new depot has been opened at 75, Robertson Street, Glasgow, by Messrs. E. K. Cole, Ltd., to deal in Scotland with the increased demand for "Ekco" eliminators, which have become very popular among amateurs. The sales organisation of the depot is in the hands of Mr. A. Caldwell Young.

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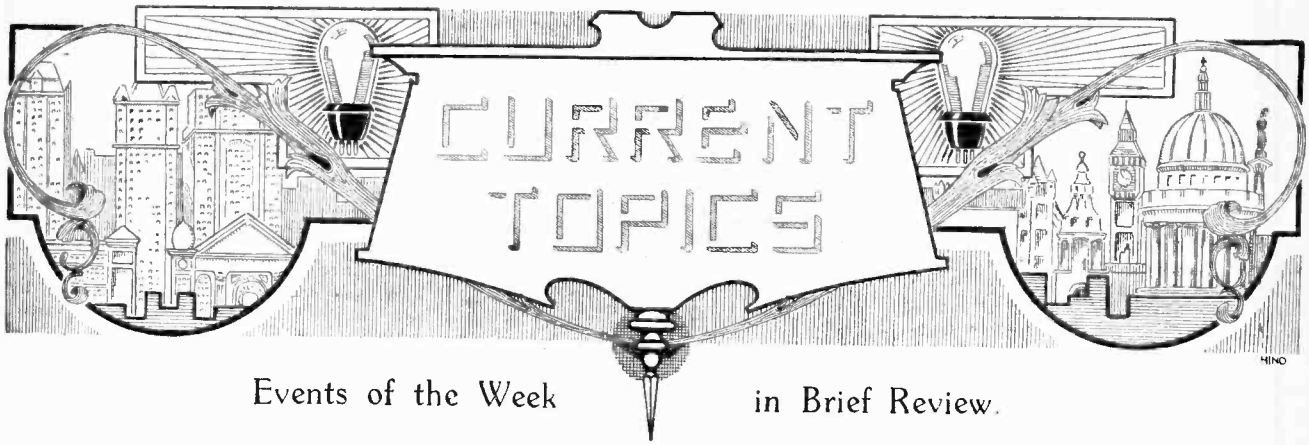
Electroplating on Aluminium.—Messrs. Malcolm Owen, Ltd., 54, Newcomen Street, London, S.E.1, are now in a position to undertake the electro-deposition of copper, nickel, zinc or chromium on aluminium or aluminium alloys sheet or castings. A plant has also been installed for imparting a durable non-corrodible iridescent surface to aluminium panels.



Events of the Week in Brief Review.

GUSTY.

"Reception good but gusty," ran a cablegram recently received by the engineers of KDKA, Pittsburgh. It was assumed that "gusty" implied a fading tendency.

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MUSIC AT MEALTIME.

The first restaurant in Birmingham to include broadcast reception among its attractions is the Queen's Restaurant, in Congreve Street. Small cone type loud-speakers have been installed in the main dining room.

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DANISH TESTS ON SATURDAY.

Test signals on 42.12 metres will be sent out early on Saturday next, June 2nd, by 7RL, owned by "Radiolytteren," Raadhusplads 55, Copenhagen, V. The times (B.S.T.) are :—00.00 to 00.05, calibration; 00.05 to 02.00, telephony. Reports from British listeners will be welcome.

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WIRELESS COAST BEACONS.

The installation of wireless beacons round the British coasts is now in progress. Beacons at The Caskets and Start Point will be working in four months, and at Lundy Isle in about six months. Parliamentary sanction has also been given to the erection, during the current financial year, of further beacons at South Bishop, Dungeness and Cromer, Sule Skerry, and Kinnaird Head.

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NOISY OYSTERS.

The song of the oyster, which interfered with submarine signalling experiments off the American coast last year, is again causing interruption to tests off Hatteras, North Carolina. It is stated that the noise of the oyster resembles the sound of a person humming a tune.

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A TRUSTY STANDBY.

During a recent interruption in the telegraph service to the Isle of Man, communication was maintained by wireless.

Wireless is constantly in use in America for similar emergencies, and very often the work is carried on by members of the Amateur Radio Relay League.

NEARING 2½ MILLIONS.

A substantial increase in the number of wireless licences was recorded last month. On April 30th there were 2,482,455 licences, compared with 2,470,696 at the end of March.

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NO WIRELESS FOR THIRD CLASS.

A broadcast receiver is to be placed on the Paris-Bordeaux express for the benefit of first and second class passengers.

It is presumed that the third class passenger will have to take his "Everyman Portable."

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FIRE CALLS HEARD AT 600 MILES.

The Melbourne Metropolitan Fire Brigade has acquired a number of transportable wireless sets—transmitters and receivers—for emergency communication between the city fire stations. Sunday afternoon is testing time, and after a recent experimental transmission from the central station in Melbourne reports were received from listeners in Queensland, over 600 miles away!

CONVICTS AND TALKS.

Convicts in Wormwood Scrubs are stated to be enjoying the educational broadcasts. There is, however, no truth in the suggestion that "old timers" are pleading for extended sentences to "finish the course."

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NO CHANGE.

Doctor, to patient, who is complaining of being run down: What you must do is to get right-away from the monotony of your daily employment. Go somewhere every evening where there is plenty of music and variety. By the way, what is your business?

Patient (sadly): I am a wireless announcer.—*Bournemouth Echo.*

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AUSTRALIAN WIRELESS ZEAL.

All kinds of wireless activity now taking place in Australia are reviewed in a handsome art-brochure issued by Amalgamated Wireless (Australasia), Ltd. The work illustrated includes beam transmission and reception, the manufacture of

NOT A BROADCASTING STUDIO. This photograph was taken in the "dummy" studio which has been installed at the Berlin Academy of Music for teaching broadcast technique. The work of the academy in this direction was described by Herr Frank Warschauer in our issue of March 14th last.

all classes of apparatus for wireless transmission and reception on long and short wavelengths, police wireless equipment, and, last but not least, research.

The company has 850 employees, and is controlled, managed, and operated by Australian people. It is described as the second largest wireless organisation in the British Empire.

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SET BUILDING IN JAPAN.

The prospective wireless experimenter is likely to have a lean time if he stays in Japan, where the ordinary listener is obliged to regard his set as a box of mystery.

The man who wishes to construct a set must place his credentials before the Chief of the Bureau of Communications, writes an observer who has recently returned from Japan.

On the form of application which he then receives, he must stipulate the object of the installation, the place where it is to be made, the specification, and the stations which he expects to pick up. Sets must be of a type approved by the authorities, and must be designed so as to be deaf to wavelengths over 600 metres. Aerial reaction is strictly prohibited.

Finally, when the constructor presents his finished instrument to the authorities, it is sealed to prevent any alterations.

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QUEER HAPPENINGS AT CORNFORTH.

A peculiar situation has arisen at Cornforth (Co. Durham) where, as recently reported in these columns, the aerial belonging to a private resident was found to be fouling an electric light wire and causing a leakage. In the course of a subsequent meeting of the Parish Council, it was discovered that the private aerial had been erected prior to the installation of the council wires. It was stated, morever, that the owner of the aerial enquired of the council's workmen whether the proximity of the new wires was likely to be dangerous, and had been informed that such was not the case.

Several members of the council expressed surprise that the owner of the aerial had enjoyed perfect reception while his aerial was in contact with the lighting main, and one member questioned the council's position in the event of a fatality after the council had signified that an aerial was correct.

In view of the perplexing situation the council has agreed not to send any notices to the owners of wireless aerials, but to leave the responsibility to the persons concerned, viz., the owners themselves!

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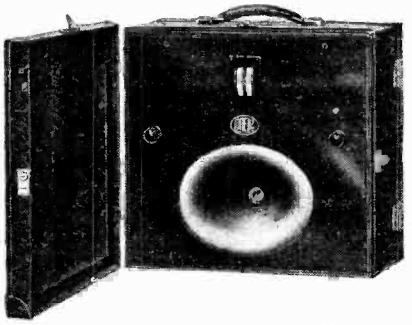
AIR BEACONS IN U.S.A.

Two interesting stations are being operated by the U.S. Bureau of Standards in experiments to determine the value of directional wireless to aircraft, writes a correspondent. The more important station is at College Park, Washington; the other is Bellefonte, Pa., halfway between New York and Cleveland on the new trans-American air line.

The stations have been designed to transmit signals modulated at two low frequencies which together operate the visual directional indicator recently developed by the Bureau of Standards. This device, which enables the pilot to maintain his proper direction in relation to the two sending stations by means of a dial and pointer, is only partially affected by engine ignition interference.



GERMAN PORTABLE DESIGN. The Lorenz "Weltspiegel," a new six-valve self-contained instrument with frame aerial concealed in the lid.

Recent flying tests have shown that at night bearings taken up to fifty miles from the transmitters were reliable; between 50 and 75 they were usually accurate but uncertain at times. During daylight hours no discrepancy was noticeable.

FORTHCOMING EVENTS.

WEDNESDAY, MAY 30th.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove, N.17. Lecture: "Permanent Magnets in Loud-speakers," by Mr. A. G. Tucker.

THURSDAY, MAY 31st.

Leyton and Leytonstone Radio Society.—"Junk Sale."

Slade Radio, Birmingham.—Members' Night—Constructing and Experimenting.

SATURDAY, JUNE 2nd.

Wigan and District Technical College Radio Society.—Portable Set Tests at Rivington Pike.

SUNDAY, JUNE 3rd.

Hackney and District Radio Society.—Field Day: Visit to Blackmoor.

MONDAY, JUNE 4th.

Croydon Wireless and Physical Society.—At 8 p.m. At 5, Altyre Road, East Croydon. Talk on "Short Wave Work," by Messrs. W. F. Pearson and T. A. F. Iserbyt.

TUESDAY, JUNE 5th.

Hounslow and District Wireless Society.—At 8 p.m. At Trinity Hall, Bulstrode Road. Seventh Annual General Meeting.

WIRELESS CIRCUITS AND CHEWING GUM.

The weighing of newly-manufactured chewing gum by a device embodying wireless principles is the subject of a report from Boston, Mass. The device, which is being tested out by the Eastern Manufacturing Co., is stated to be applicable in the case of all manufactured articles, such as chewing gum, rubber fabrics, and paper, which proceed from the machine in the form of a continuous web.

The material passes between two parallel metal plates which act as a condenser in the receiving circuit. Variations in the weight of the web change the capacity of the condenser and affect the response of the circuit to a wave of controlled frequency. The variations are shown on a meter and can quickly be translated into terms of avoirdupois.

WIRELESS AT WESTMINSTER.

(From Our Parliamentary Correspondent.)

The Beam Service Debate.

An interesting debate took place in the House of Commons last week in regard to the Imperial Cable and Wireless Conference. Mr. W. Baker, a Labour member, contended that the merger between the Eastern Telegraph and the Marconi Companies and the boom in their shares indicated that a decision had been arrived at to hand over to a private monopoly the profitable beam service now worked by the Government. That, he said, would be a national disaster, and he contended that the Marconi Company had a record of reckless finance.

In reply, Sir John Gilmour, who was the chairman of the Conference, declared that the Conference was still in being, and it had had to obtain the fullest information possible as to the various factors bearing on the matter. The problem before the Conference was admittedly not an easy one to unravel. Their work had entailed the consideration not only of how the affairs of this country would be affected, but what repercussions it was likely to have in Australia, Canada, India, and elsewhere. During the sitting of the Conference had occurred the merger between the Eastern Telegraph Co. and the Marconi Co.

The merger referred to, for which the Government had no responsibility, was made subject to satisfactory arrangements with the British Government and the Governments of the Dominions and India. The possible reactions of this merger on the problem referred to the Conference had to be examined in great detail and had necessarily been the subject of conversations between the representatives of the Conference and the companies concerned.

As to the future, communications were still proceeding. The Conference was only empowered to make recommendations to the Governments concerned; it could not itself come to operative conclusions. In these circumstances it was quite impossible to say how soon those decisions might be made, but before any definitive action was taken, the matter would be brought before the House of Commons.

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Television and Broadcasting.

Mr. Malone enquired of the Postmaster-General whether his department had been kept informed of the progress made in the development of television; and whether, seeing that this invention must necessarily function in conjunction with the national broadcasting services, he proposed to amend the licence and agreement under which the British Broadcasting Corporation now functioned so as to permit that body to employ television.

Sir Wm. Mitchell-Thomson replied that the answer to the first part of the question was in the affirmative. With regard to the second part, television was still in the experimental stage, and the time had not yet come to make arrangements for the provision of a public service.

WIRELESS AT THE PARIS FAIR.

Some Interesting Exhibits Described.

IN the Electricity Hall of the Foire de Paris, which opened on May 12th, approximately ninety stands were devoted to the display of wireless sets, components, and valves.

The general impression obtained after a visit to the Fair is that in France the interest in broadcasting is still not very great, and consequently the industry has not developed to a degree which approaches the progress in this country, America, or Germany. The problem of running a broadcasting service has not yet been tackled seriously in France, and until some action is taken it is hardly likely that much progress on the manufacturing side will be seen. Those who have receivers in France are usually as much interested in reception of foreign stations as their own, and the general standard of quality of reception is not high.

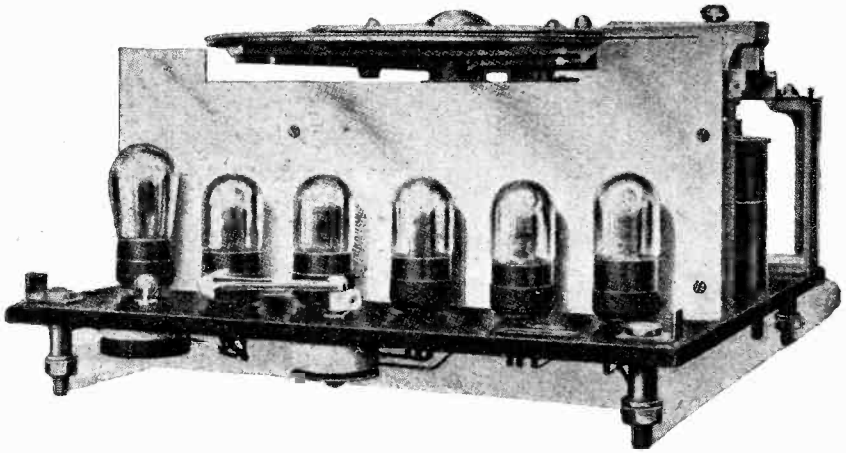


Fig. 3.—A rear view of the Elgédyne set. The first valve has two grids and serves the dual function of oscillator and first detector.

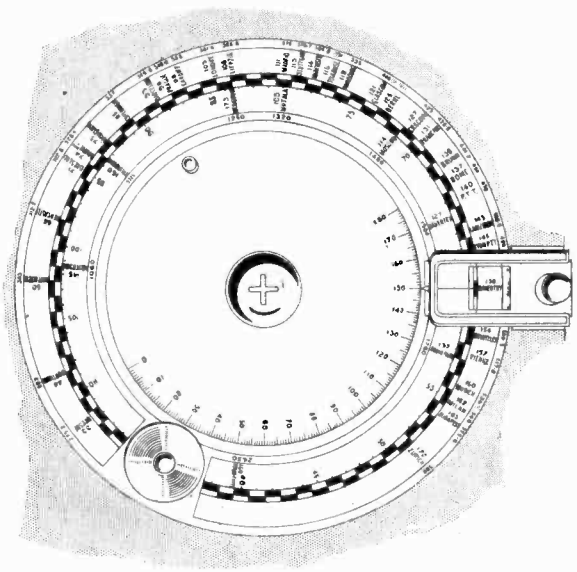


Fig. 2.—The automatic dial of the Elgédyne, which greatly simplifies tuning and orientation of the frame.

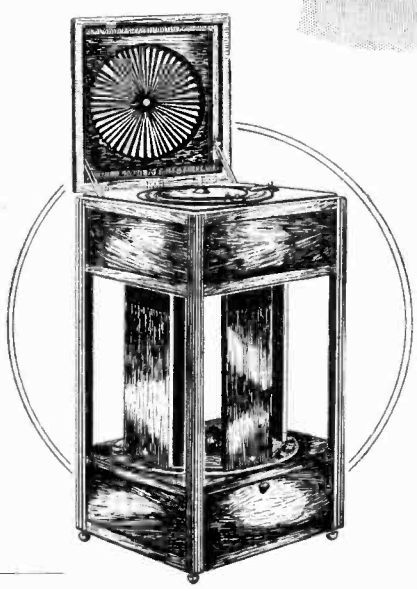


Fig. 1.—The Gaumont Elgédyne self-contained superheterodyne receiver.

It is a pity that more scope does not at present exist for the manufacturer, for some of the receivers on view at the Fair show distinct originality of design. In fact, what we would describe as "stunts" or "gadgets" are very much more in evidence in the French receivers than in our own.

The French designer is still handicapped to a considerable extent for the reason that he has not available valves of the variety and efficiency of our own; but there are now signs that better valves are to be produced, and probably a proper organisation of the broadcast service would result in a general boom in radio in France.

Calibrated Sets.

One of the most unusual receivers was the "Elgédyne," shown by Gaumont (Fig. 1). This set is entirely self-contained with a rotatable frame located below the receiver. The Gaumont pleated loud-speaker is fitted into the lid, and tuning is effected automatically by first rotating one disc (Fig. 2) until the station required comes opposite the pointer, and then rotating the centre dial until the value in degrees indicated on the first dial also comes opposite the pointer. The circuit is a superheterodyne; a four-electrode valve (2 grids) provides the first detector and the oscillator, and there

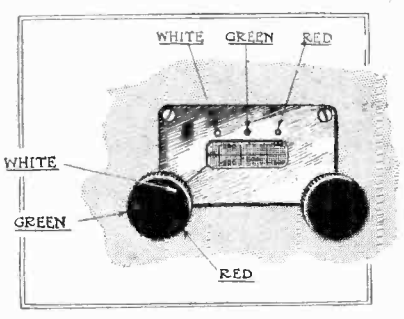


Fig. 4.—The direct calibration dial of the Radio L.L. superheterodyne receiver.

Wireless at the Paris Fair.—are two intermediate stages of amplification, detector, and two low frequency stages. The receiver unit is shown in Fig. 3.

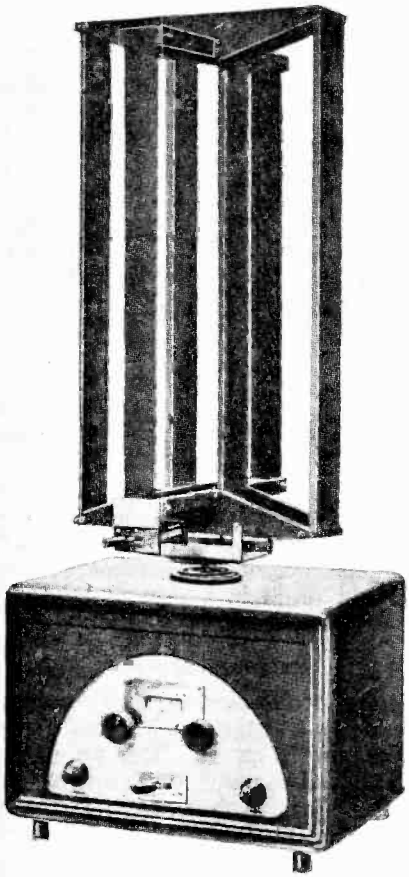


Fig. 5.—The Radio L.L. self-contained frame aerial set incorporating the direct calibration scheme shown in Fig. 4.

There are several examples of French sets where the receiver has been calibrated. This is, of course, rendered easier by reason of the fact that frame aerials are very popular, probably because landlords in Paris appear to have strong objections to outside aerials. An example of

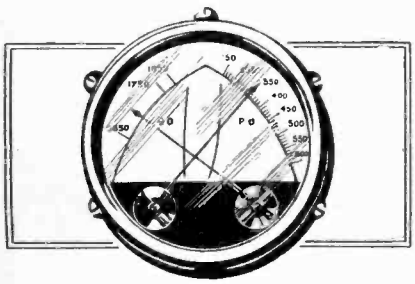


Fig. 6.—The Ondographic calibrated dial on which final positions are shown by the intersection of the two pointers on the appropriate curve.

direct calibration is shown in Fig. 4 which is the calibration unit of the Radio L.L. superheterodyne receiver shown in Fig. 5. The knob on the left controls three wavelength ranges, and the corresponding calibration is obtained by observing the setting of the squared paper which is mounted on a drum rotated by the knob on the right.

Another example of a calibrated set is shown by the Société des Etablissements Péricaud. In this case two wires set at right angles to one another traverse a square frame behind a glass window, one passing up and down the frame and the other across. The wires are connected with two tuning controls, and a calibrated chart is placed behind the panel; the point of intersection of the wires gives the calibration of the set.

Another set which provided a direct indication of tuning was shown at the stand of J. H. Berreus. Here two pointers in an instrument resembling an ordinary meter intersected at the point of tuning and so indicated the wavelength (Fig. 6). This same receiver had a further feature of interest in that a pointer over a map of Europe with Paris as the centre served to assist in the orientation of the frame to receive the various stations on the map.

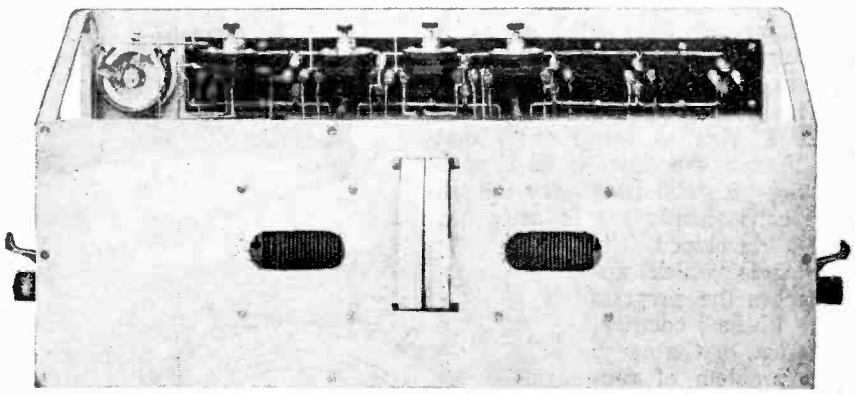


Fig. 7.—The Sicra superheterodyne receiver with twin thumb controls.

From the point of view of set design one of the most interesting receivers was to be seen on the Sicra stand. The receivers made by this firm are outstanding amongst most of the apparatus at the fair on account of their solidity of construction and the skill behind the mechanical design. Their 7-valve superheterodyne is extremely interesting. The first valve has a double grid and acts as a detector and oscillator, there are then three stages of intermediate frequency amplification, detector and two low frequency stages. What is of special

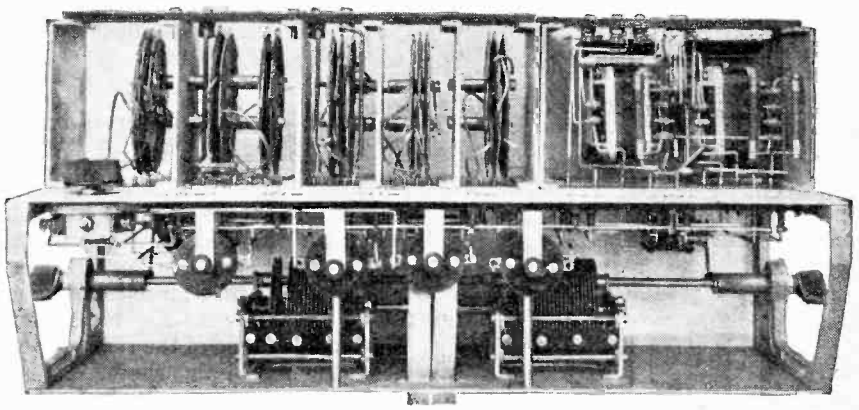


Fig. 8.—Interior of the Sicra receiver showing screened I.F. transformers.

Wireless at the Paris Fair.—interest is the extremely robust construction and neatness of controls. The sets are mounted entirely in metal frameworks, and two views of the superheterodyne receiver removed from its case are given in Figs. 7 and 8.

There still appears to be a very strong leaning towards the superheterodyne in France which seems to be the more surprising because of the long and short wave broadcast transmissions to be taken into consideration in the design and the necessary duplication of tuning.

The super is necessarily complicated in construction, and therefore expensive, and we believe that a very ready sale could be found for simpler sets where every attention was paid to quality.

The coil driven loud-speaker is not in evidence yet, but there is a large variety of types of cone speaker available.

Multiple grid valves appear to find special favour in France, the employment of two grid valves being quite standard practice, whilst three grid valves were in use in certain receivers. The screened grid valve has not yet made its appearance.

A NEW WAY OF USING TRANSFORMERS.

The Advantages of Choke-capacity Coupling.

THE steady rise, year by year, in the standard of reproduction required from a wireless receiver, results in the continuous discarding of components that are no longer considered good enough to be worthy of a place in the set. Of all the components that are thus put out of commission, none, save perhaps the loud-speaker, represents a greater financial loss than the low-frequency transformer, for which any sum up to thirty shillings may have been paid. There must be many hundreds of transformers, most of which were considered first-class instruments in their day, which have been put on the shelf merely because the standard of reproduction demanded of a modern set is so much higher than that required when they were designed, that they have now to be looked upon as hopelessly out of date.

There is no novelty in the suggestion that the secondaries of such transformers may be turned to account as chokes for inter-valve coupling, but it is worth while to emphasise that the standard of reproduction attainable by connecting a transformer in this way is very decidedly higher, if a suitable valve be used, than could be hoped for by connecting it as the makers originally intended, while the amplification of the stage is reduced by an amount which is small in comparison with the gain in quality.

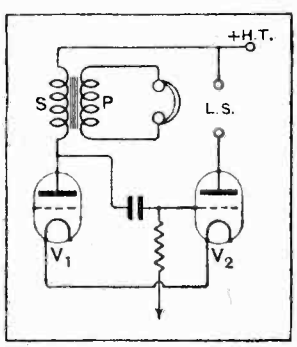
The Secondary for Coupling, the Primary for Phones.

It is not the real purpose of this note, however, to remind readers of the possibility of turning old transformers to account in this way. Rather is it intended to draw attention to an additional convenience that accrues in so doing.

Usually the employment of a transformer secondary as a choke is looked upon as a makeshift device by which a transformer of which the primary is "burnt out" can be rescued from oblivion and made once more to play a useful part in a set. It is now suggested that transformers which are electrically sound, but of such a design that they are not good enough for incorporation in a modern receiver, should be employed in this way in order to obtain quality better than that which they can provide when used as their makers intended.

When a loud-speaker is in use, and especially when the set and the receiver are not in the same room, it is generally by no means easy to tune in a distant station. To connect telephones in place of a choke or resistance in the receiver is an awkward business, unless resort is had to elaborate switching, which is to be deprecated. It is not comfortable, either, to connect telephones to the output of a powerful set, as one may at any moment get signals at a strength which is little short of painful. But if a transformer secondary is in use as a choke, it becomes extremely simple to "cut in" with telephones at that point, for it is only necessary to connect them to the primary terminals of the transformer. In this way the process of finding a distant station, and of adjusting the strength of it correctly for the loud-speaker, may be made very easy.

A circuit suitable for the arrangement suggested is shown in the figure; the primary of the transformer may be connected to a jack on the panel or to terminals, whichever is the most convenient. Over and above the abolition of switching, this device has the advantage that the temporary insertion of telephones does not alter in any way the D.C. conditions under which the receiver is working, for the telephones are not directly connected in any plate circuit. In addition, the step-down provided by the transformer is desirable when telephones follow a valve having an impedance of the order of that usually associated with choke-coupling.



Method of using the secondary of an old transformer as a choke for L.F. coupling. Telephones can be connected across the primary.

The choice of the valve preceding the transformer secondary (V_1 in the figure) may be made according to the following rule. Its impedance should be n times that of the *lowest* impedance valve that could safely be used, having regard to the magnitude of the steady current through the windings, before the transformer used as such. n in the above stands for the ratio between primary and secondary in the transformer, and, in the case of the out-of-date instruments that we have been discussing, will generally be 5. A. L. M. S.

TRANSMITTERS' NOTES AND QUERIES

General Notes.

A number of amateurs in the 4th Canadian District (Alberta, etc.) are listening for EG signals each Saturday, Sunday, and Monday mornings, at 0630 G.M.T. on 23 metres.

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Mr. Heightman, of "Belowda," Clacton-on-Sea, has received what are believed to be the first 10-metre signals from American amateurs.

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Mr. H. F. Lovett, OA 7HL, West Hobart, writes, "Rugby transmissions taken as a whole prove rather disappointing in Tasmania, chiefly due to excessive jamming, but 5SW (Chelmsford) certainly wants a pat on the back. This station is a credit to the British Empire, being by far the best long-distance 'phone station received here."

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Mis-use of Call-sign.

Mr. A. E. Livesey (6LI) writes from 15, rue d'Orleans, Paris, B.P. : "I would be pleased if you would insert a notice in Transmitters' Notes and Queries to the effect that I should like to communicate with the amateur who was transmitting on 20 metres between 9 and 10.30 p.m. on March 4th, 1928, using a call-sign which might have been taken for (E)G 6LI (my own call). I have received a report from NU 9DPB reporting having worked and called me on that date. I would state that my call 61.1 has not yet been used once from my station, and that, should nobody come forth, I shall assume that it is being used by an illicit station and the matter will be reported to the Postmaster-General immediately."

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A Personal Note.

We are frequently urged by correspondents to devote more space to these "Transmitters' Notes and Queries" and to give more items of news on the doings of amateurs, but with the best will to meet their wishes we cannot record the work of amateur transmitters unless they keep us well informed of any items of general interest. We frankly admit that of late there has been a lamentable scarcity of interesting news, from which we assume that transmitters, having achieved communication with practically every country in the world, have now nothing further to report, but are quietly pursuing their onward course and waiting till someone has established two-way communication with Mars or some other planet. We get plenty of letters asking us to identify some broadcast programme picked up or obscure call-signs, but very little news of general interest concerning the work of transmitters. The object of these notes is to record any exceptional doings by amateurs and thereby inspire others to follow their example, also to put experimenters into touch with one another.

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Forwarding Agents for QSL Cards, etc.

We give below a list of those individuals and societies who kindly undertake to forward communications to transmitters in their respective countries. As this work is generally entirely voluntary and involves considerable trouble, the services of these forwarding agents should be used as sparingly as possible, and international coupons should be enclosed to defray postage expenses. Changes often occur among those who undertake these arduous duties, and we shall be grateful to any readers who will from time to time advise us of any new forwarding agent or any correction necessary in the following names and addresses :—

Argentine.—c/o "Radio Revista," Lavelle 1268, Buenos Aires.
Australia.—c/o "Radio," 51, Castlereagh St., Sydney.
Austria.—c/o "Radiowelt," Rudengasse 11, Vienna III.
Belgium.—"Reseau Belge," 11, Rue du Congres, Brussels.
Brazil.—V. Abreu, Rua Riachuelo 80, C/4, Rio de Janeiro.
Chile.—L. M. Desmaras, Esperanza 555, Santiago.
China.—H. B. Wilson, P.O. Box 266, Shanghai.
Czechoslovakia.—Czechoslovensky Radio Club, Slovansky Ostrov 5, Prague II (under cover).
Denmark.—c/o "Radioposten," Snaregade 10, Copenhagen.
Esthonia.—O. Leesment, Aiatan 6, Parnu (under cover).
Finland.—K. S. Sainio, Merikatu 3A, Helsinki X.
France.—R. Larcher, R.E.F., 17, Rue Fessart, Boulogne-Billancourt.
Germany.—O. Kruschwitz, Richard Wagner Str. 19, Halle-a-Salle.
Holland.—R. Tappenbeck, Hoogduin, Noordwijk-aan-Zee.
Hungary.—c/o M.R.A.E., Q.S.L. Section, Buday Laszlo 5/C, Budapest.
India.—R. J. Drudge-Coates, Cambridge Barracks, Rawalpindi.
Irish Free State.—c/o Irish Radio Transmitters Society, Solent Villa, Kimmage Rd., Terenure, Co Dublin.
Italy.—c/o Assocn. Radiotecnica Italiana, Viale Bianca Maria 224, Milan.
Japan.—Shigeo Shima (J.A.R.L.), 45, Yakanawa, Minamicho, Shibaku, Tokio.
Kenya Colony.—(With Zanzibar, Uganda, and Tanganyika), c/o "The Times of East Africa," Box 318, Nairobi
Latvia.—Dr. Walter, Brivibasiela 107, Riga.
Luxembourg.—J. Wolff, 67, Avenue du Bois.
New Zealand.—Radio Transmitters Association, P.O. Box 779, Auckland.
Norway.—c/o Norske Radio Forbund, Oslo.
Poland.—J. Ziembicki, Bielowskiego 6, Lwow.
Portugal.—E. de Avillez, 15, Costa do Castelo, Lisbon.
South Africa.—c/o "South African Wireless Weekly," Carmelite House, Dock Rd., Cape Town.
Spain.—M. Moya, Megia Lequerica 4, Madrid.
Sweden.—Bruno Rolf, Hamngatan 1A, Stockholm.
Switzerland.—Dr. W. Merz, Berne-Bumplitz.
U.S.A.—c/o A.R.R.L., 1045, Main St., Hartford, Conn.
Yugo Slavia.—c/o U.J.R.A., Tuskanac 15b-22, Zagreb.

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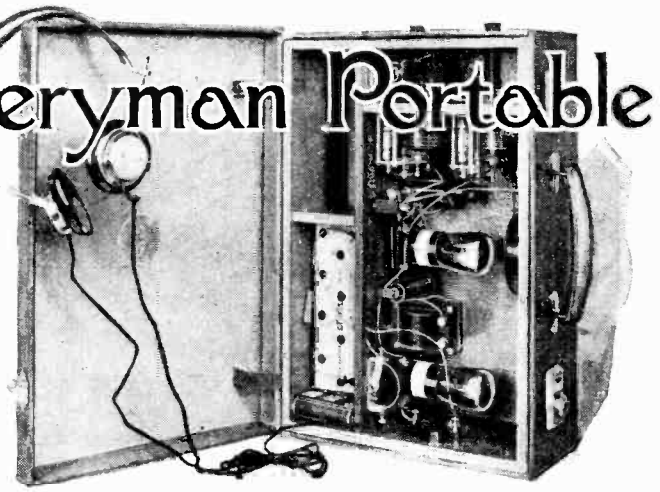
New Call-signs and Stations Identified.

6PF L. Parfitt, 85, Queen Street, Abertillery, Mon. (change of address) usually transmits on 45 metres and welcomes reports.
2AWS W. C. Spence, 44, Waterloo Sq., Lomond Grove, Camberwell, S.E.5.

G 5ML. Owned and operated by Mr. F. W. Miles at "Rydal," Beechwood Avenue, Coventry. The transmitter uses the T-P.T-G. circuit having a Mullard DO40 oscillator valve. The receiver consists of a two-valve modified Reinartz circuit.

Notes on the Everyman Portable



Hints on Operation, Modifications, and Tracing Faults.

THE general need for a light, compact, and truly portable receiver seems to be proved by the number of queries received concerning the "Everyman Portable" described in *The Wireless World* for April 18th. In this short article it is proposed to supplement the information already given, to offer a few suggestions with regard to possible modifications, and also to describe how those small difficulties which experience shows are most frequently encountered may be overcome. Fortunately, cases of failure to obtain good results with this receiver are comparatively rare, and are generally due to fairly obvious faults.

The use of a flashlamp battery for L.T. supply is apparently completely justified as far as intermittent

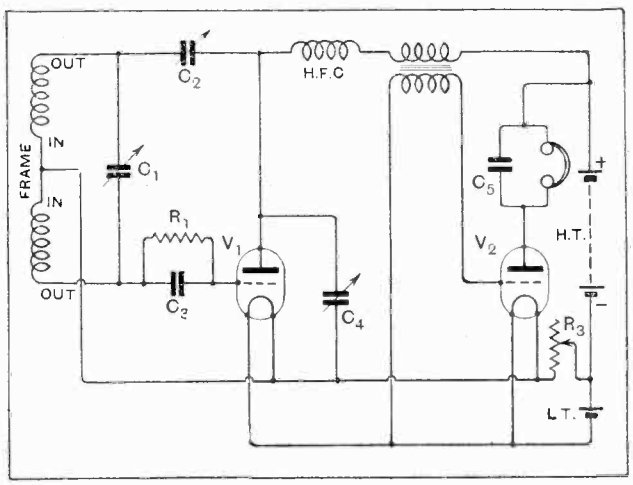


Fig. 1.—Modifications to the original circuit. It may be converted to a simple Hartley arrangement by omitting the throttle condenser C_1 and mounting C_2 in an accessible position.

working is concerned, and, after all, this is the normal function of a portable set. However, it should be emphatically stated that in cases where the set is to be used frequently and for continuous periods of listening, it is better, and certainly more economical, to substitute this battery by a single accumulator cell. Naturally, this alteration will mean abandoning the series filament connection, and also the "free" grid bias scheme. The necessary changes in this part of the circuit are shown in Fig. 1, from which it will be seen that there is no grid bias for the L.F. valve; unless H.T. voltage is increased, or, alternatively, the L.F. valve specified is replaced by one of lower impedance, this arrangement is free from serious objections.

Provision for long-wave reception will not always be required, and in such cases two possible alternatives are open to us; we can retain the throttle-controlled reaction, at the same time omitting the switch, joining together the inner ends of the frame windings, and connecting this junction point to the positive filament lead. It should be remembered that the great advantage of this form of reaction control lies in the fact that it affords an easy solution of the problem of obtaining equally good reaction control on both short and long waves, and when the latter are not needed it will be realised that construction may be simplified and expense reduced by converting it to the well-known Hartley arrangement. If this change is made, the throttle condenser C_4 will no longer be required, as reaction control will be obtained by a neutralising condenser connected electrically in place of C_2, and mounted in the position at present occupied by C_1.

An External On-off Switch.

Reverting to the question of accumulator L.T., it will be found necessary slightly to modify the wooden framework in order to accommodate the usual type of unspillable cell which will probably be used; this may most conveniently be housed in a compartment prepared for it on the extreme right-hand side, at the same time reducing the distance between the upright piece on which the condensers are mounted and the outside left-hand vertical member of the frame by some half an inch; this alteration is shown in Fig. 2, from which it will be gathered that the baseboard space available for the components is slightly reduced. However, it will be found an easy matter to accommodate them by slightly changing their positions.

It cannot be denied that the provision of an outside on-off switch is a convenience, as it enables the user to extinguish the filaments without opening the case. The addition of a small push-pull switch between the two existing control knobs is probably the best solution of this difficulty, although other means of achieving the same object in an even less conspicuous manner will probably suggest themselves.

By the exercise of a little ingenuity, and provided

Notes on the Everyman Portable.—

the components are of sufficiently small size, it is by no means difficult to reduce the overall size of the receiver, as in the design described there is ample room. However, it must be realised that the difficulties in wiring a still more compact receiver are increased, and, more important still, the pick-up efficiency of the frame is reduced as its dimensions are decreased. Similarly, there is no reason why a larger containing case should not be substituted for that described where greater bulk is not objected to; the resulting increase in the frame area will give a noticeable extension of range.

A Special Attaché Case.

It may perhaps be considered as a drawback to the present design that the projecting knobs do not afford any indication of the setting of the condensers which they control. However, consideration will show that this disability could not easily be overcome without forgoing the very real advantage possessed by the set in permitting of its operation when the lid is closed; this can hardly be retained if it is to be housed in the conventional and generally obtainable form of attaché case. However, an attractive receiver can be made up in a special form of case, shown in Fig. 3. This is on the general lines of a manufacturer's product reviewed in last week's issue. As will be seen from the drawing, the lid has a double fastening, the front flap being lifted to disclose the dials, and the catches securing the top being opened only when it is desired to remove the framework.

A word of warning should be offered against the use of fibre cases with metal bindings, which act more or less as a short-circuited turn in the frame, and almost completely spoil the performance of the receiver, in most cases preventing the obtaining of reaction effects. This trouble is occasionally encountered when there is excessive damping in the grid circuit, due either to high-resistance connections or to leakages. Very often a cure can be effected by increasing the capacity of the reaction feed condenser C_2 by connecting in parallel with it another small condenser, but, of course, it is better to get to the root of the trouble and to remove the source of damping. It may also be pointed out that the long-wave loading coil specified, in conjunction with the inductance in the frame and a 0.0003 mfd. variable condenser, tunes up to only slightly over 1,600 metres, and if slight divergences from the design are introduced it may be necessary to use a somewhat larger coil.

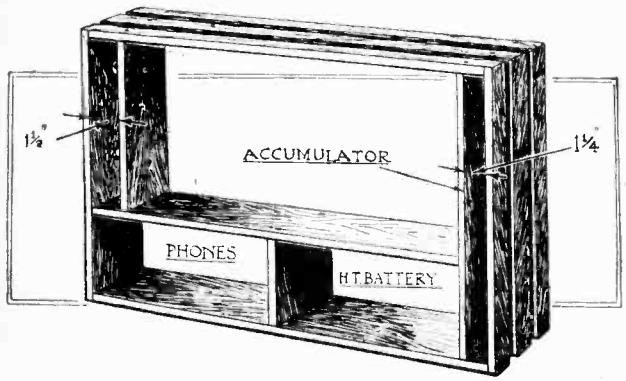


Fig. 2.—Altering the wooden framework to accommodate an accumulator L.T. cell.

After a little experience in operating the receiver, it will be discovered that the tuning is slightly altered when it is removed from the table or other support. This is due to the fact that the position of the dielectric material in the case with respect to the frame winding is altered, and to minimise this effect it is advisable to wedge the framework securely in position with thin strips of wood inserted where necessary. It will also be observed that

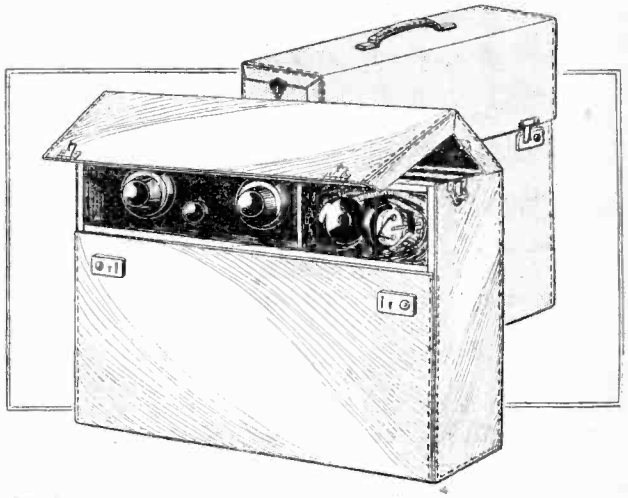


Fig. 3.—A suggestion for a special form of containing case which offers certain advantages; compact condensers and tuning dials should be chosen.

results are better if the set is raised above the ground, and, when used in a car, if it is placed as far as possible from large masses of metal. It is sometimes rather difficult to know whether the flash lamp battery feeding the filaments is delivering sufficient current to give adequate emission, but the operator will soon be able to recognise the fact that the cells are almost exhausted by noticing the effect of operating the rheostat; if the receiver seems quite "dead," with all the resistance in circuit, and shows signs of life with it "all out," it may be assumed that a new battery will soon be required.

Substituting a Larger Dry Battery.

While discussing this subject, it is well to point out that it is always advisable to obtain batteries of good quality made by manufacturers of repute; the shortcomings of many of the cheap foreign products are at once evident when they are called upon to deliver 100 milliamperes for any length of time. Moreover, there is no real reason why the user should restrict himself to the use of flashlamp batteries (except that they are universally obtainable, and he is thus relieved from the necessity of carrying a stock of spares on his journeys). The use of larger dry cells may be considered as an alternative either to the accumulator suggested above or to the smaller dry battery. With a primary cell supply it is almost invariably worth while retaining the series filament connection, as a pound weight of battery will give better service when it is supplying a comparatively small current than when a smaller number of cells, delivering twice that current, are employed.

By Our Special Correspondent

Broadcasting's New Influence.—Fewer Oscillators.—Conference on Educational Talks.—Amateur Singers in Request.—The "National" Concerts.—5GB's French Experiment.

A Power in the Land.

A notable instance of the power which broadcasting can wield over the social activities of the nation is provided by a move now on foot to establish a Manchester and Liverpool Society. The idea had its genesis at the recent debate broadcast from 2ZY on "Manchester Man and Liverpool Gentleman," the speakers being Sir Edwin Stockton (Manchester) and Sir Arnold Ruston (Liverpool).

It appears that the exchange of sentiments revealed untapped affinities between Mancunians and Liverpudlians, and the outcome will probably be the inauguration of an annual dinner to establish and maintain the neighbourly spirit.

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Smashing the Parish Pump.

"What Lancashire thinks to-day, England thinks to-morrow," so there is no reason why the example of Manchester and Liverpool should not be reflected in other parts of the country, especially in view of the rapid development of inter-city broadcasting which is likely in the next few years.

When the regional scheme comes into being all the more important towns will be provided with studios linking up with the nearest broadcasting station. What is more likely than the spread of a better understanding between the great centres of population which at present have little common intercourse?

Many of our towns are still self-sufficient colonies. They are fed and watered by a local press, and are about as interested in their neighbours as in the natives of North Borneo.

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Fewer Oscillators.

Allowing for the normal decline in oscillation as summer approaches, the B.B.C. is led to believe that the amount of oscillation is now actually less per head of the listening population than at the same period last year.

The B.B.C. attributes this happy state of affairs in part to the comprehensive questionnaire which is sent to all listeners who register a complaint. The reader may remember that some of the questions asked were quoted in these columns several months ago. From the replies received it is often quite easy to discover the offender, who is often a harmless person, with no more notion of spoiling other people's pleasure than of strangling his grandmother.

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The P.O. Vans.

Good missionary work has also been put in by the Post Office wireless vans, though these have spent most of their time in tracking illicit transmitters. I hear that at the moment they are concentrating their efforts on Scotland, though this implies no reflection on the integrity of Scots. The tour is a matter of official routine.

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A Flying Squad for Ulster.

Meanwhile the postal authorities in Northern Ireland are fitting up a similar van to patrol the Belfast area. In this case the avowed intention of the Post Office is to get on the tracks of unlicensed listeners, of whom there are believed to be a good many. It is significant that the number of wireless licences per 1,000 of the population in Belfast is only 35.3, compared with an average of 72 in the broadcasting areas of Great Britain.

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Conference on Broadcast Education.

All listeners, whether for or against educational broadcasting, will be interested in the outcome of a conference which is to discuss the report of Sir Henry Hadow's committee of enquiry into broadcasting and education at the Friends' Meeting House, Euston Road, London, on June 22nd.

The speakers will include Sir John Reith, Director-General of the B.B.C., Mr. G. H. Gater, Education Officer, L.C.C., Mr. Arthur Pugh, Chairman, Educational Advisory Committee, Trades Union Congress, Hon. Oliver Stanley, M.P., Parliamentary Private Secretary to the President of the Board of Education, and Mr. J. C. Stobart, Education Director, B.B.C.

FUTURE FEATURES.

London and Daventry.

JUNE 3RD.—Military Band Concert.
JUNE 4TH.—Danish National programme.
JUNE 5TH.—Vaudeville programme.
JUNE 6TH.—"The Crossing," a play for broadcasting by Holt Marvell and Cyril Lister.
JUNE 7TH.—"La Bohême," Acts 2 and 3 from Covent Garden.
JUNE 8TH.—Variety programme (including Rota Artist).
JUNE 9TH.—Light Orchestral Concert.

Daventry Experimental (5GB).

JUNE 3RD.—Chamber Music.
JUNE 5TH.—"Turandot," Act 1, from Covent Garden.
JUNE 6TH.—"A Love Passage," a comedy in one act by W. W. Jacobs.
JUNE 7TH.—Concert relayed from the Arts Theatre Club.
JUNE 8TH.—An Old Folks' Programme.
JUNE 9TH.—Popular Orchestral programme.

Cardiff.

JUNE 3RD.—An Instrumental Concert by the National Orchestra of Wales.

Manchester.

JUNE 6TH.—"The East through Western Eyes," orchestral and vocal programme.

Newcastle.

JUNE 8TH.—Speeches at the annual dinner of the Allotment Holders' Congress, relayed from the Grand Hotel, West Hartlepool.

Glasgow.

JUNE 5TH.—The Radioptimists in a Variety Entertainment.

Aberdeen.

JUNE 7TH.—A Wagner programme.

Belfast.

JUNE 8TH.—"The Romantic Young Lady," a comedy in three acts by Martinez Sierra.

A New Chorus.

For a considerable time the B.B.C. has felt the need of a substantial chorus which would obviate the necessity of "borrowing" members of the leading choral societies when a big choral work is to be broadcast in public. At national concerts in the past it has been the custom to enlist the services of members of the Stock Exchange Choir and the Civil Service Choir, besides pupils of the Royal Academy of Music.

The B.B.C. will probably be more independent next winter, as an idea is taking shape for the establishment of a Wireless Choir of 250 singers.

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A Field for Amateur Singers.

The present choral work at Savoy Hill is carried out by the Wireless Chorus, with 26 members, the Wireless Choir, with 18 members, and the Wireless Singers, who number 8. The new venture will therefore mark a big development in the Corporation's vocal resources.

The chorus will rely on amateur talent, but this does not mean that entry will be easy. Prospective members will undergo an audition test, and only those who have had an accredited training will be eligible. No attempt will be made to entice singers from the other choral societies.

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Rehearsals : A Record?

The "amateurs" who join will belong to that extensive class of enthusiasts for whom choral singing is an engrossing "hobby," and who are to be found in the ranks of the Royal Choral Society and the Handel Festival Choirs at the Crystal Palace. Generally speaking, they sing without fee for the joy of singing, receiving a small honorarium to cover expenses.

More labour is spent in rehearsals than in actual performance, and in this connection it is interesting to note that the Wireless Chorus at Savoy Hill has a rehearsal every day, though its actual performances are limited to one or at most two per week! This is probably a world record.

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No More "National" Concerts.

By the way, I hear that the so-called National Concerts will flourish under another name next winter. The term "National" is certainly rather vague when applied to concerts which embrace the music of a variety of countries; moreover, confusion has arisen between these concerts and those national concerts which have been devoted to the music of a particular nation.

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A Romance Recalled.

Those two popular microphone artists, Maurice Cole (pianist) and Winifred Small (violinist), whose marriage crowned one of the earliest broadcasting romances, will give a concert from 5GB through the Birmingham studio on June 13th.

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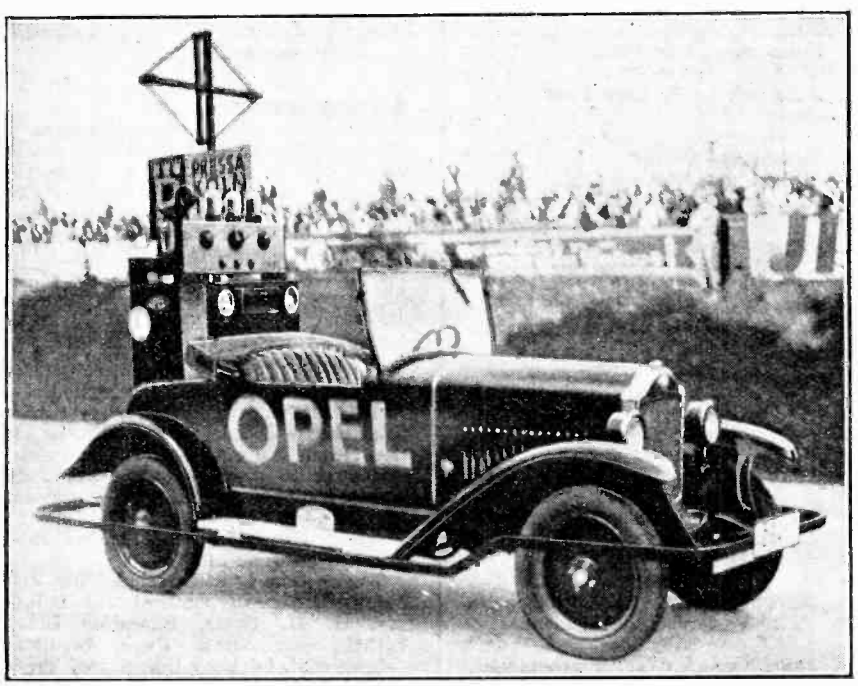
Broadcasting in French.

An innovation in B.B.C. programmes will be the broadcasting from 5GB on June 14th of the well-known one-act comedy in French, entitled "Rosalie," by Max Maurey. It will be presented by Mlle. Alice Gachet.



WIRELESS ON THE CAR : NEW STYLE. The appearance of this radio-controlled car surprised the spectators at a recent race meeting in Germany. By means of sensitive relays the car responds to signals received on the frame aerial, the throttle, gears and steering all being under the control of the distant operator. Note the surrounding buffer, which is probably very necessary!

Polish Music.

A national programme consisting of Polish music and talks will be broadcast from 2LO and 5XX on June 4th.

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"Golden West" and a Brave Singer.

"The Girl of the Golden West," an opera which Puccini wove round the first Californian gold rush, will be broadcast on June 11th and again on June 13th.

By the way, I hear that Joseph Farrington, who is in the cast of the opera, hopes to give us some songs in Welsh in a future broadcast, and for this purpose he is making a special study of the Welsh language.

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From the Holiday Resorts.

Concerts from several of the leading holiday resorts in the North are to figure in the programmes of Manchester, Liverpool, Sheffield, Leeds, and Hull during the next four months. They will include municipal concerts from Southport on Wednesday afternoons, orchestral concerts from Buxton on Thursday afternoons, evening concerts from Scarborough, Llandudno, and Harrogate, and revue entertainments from Blackpool.

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Radio Heart Throbs.

Sunday afternoons in Boston, Mass., have been getting rather gloomy of late, according to the folks who have to live there, and they ought to know. At all events WBZ, the broadcasting station at the local Hotel Statler, believes that a little more pep would help to dissipate that post-Sunday-dinner feeling.

Enter, therefore, Mr. Chapple, who will do his best to dispel the dullness by "delving into various poetic moods" under the title of "Radio Heart Throbs." The pattern of this broadcast, which will have a distinctly sentimental colour, will be made up of music "as well as the poetic bits which Mr. Chapple will introduce in four seven-minute periods."

Boiled down, this means that Mr. Chapple knows his business, and would never think of insulting an audience by giving them "Poetry Readings." On the other hand, he knows that all sensible people will respond to "Heart Throbs," and he is also aware that a rose by any other name, etcetera.

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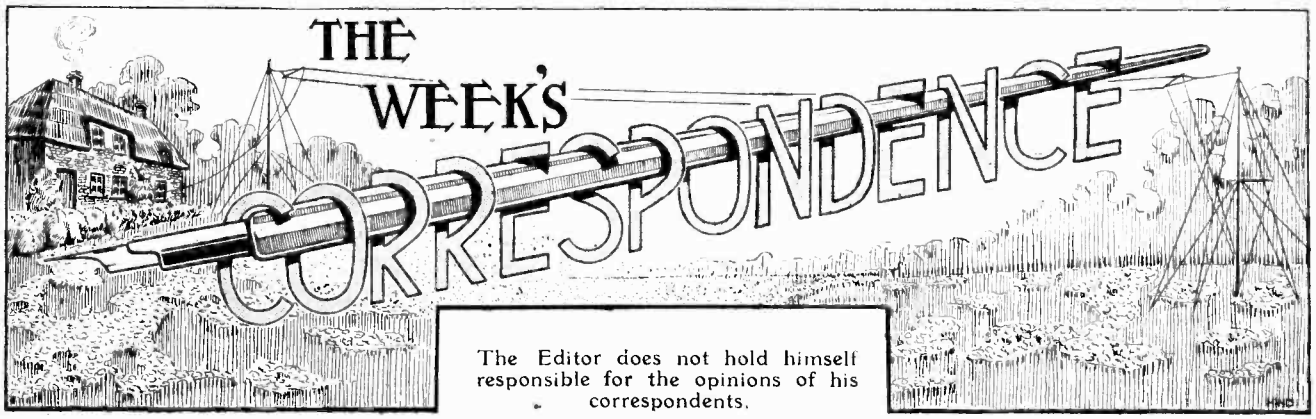
How to Boom Talks.

What a difference it would make if the B.B.C. were to hand out a little of the same sort of camouflage.

After all, it's the titles that count. Instead of "Literary Criticism" call it "Tips by the Bookie," and all Britain would listen. "Economics" would draw many worshippers under the title "Put and Take," and there is no saying what a rush would follow the announcement of a History talk provided it were labelled "'Orrible Murder in the Tower" or "Havoc at Hastings."

We can sure learn something from Boston, Mass.



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.

THE B.B.C. AND DISTORTION.

Sir,—With reference to the controversy about quality which has been raging in your columns for some weeks past, it would seem that most of your correspondents have overlooked some essential points.

Various B.B.C. stations have been condemned and foreign ones approved on the score of quality, and the letters have been phrased as if the blame for the troubles experienced lies directly at the door of the B.B.C. staff. How many of your correspondents have realised that fading and interference between direct and indirect rays have a very pertinent bearing on the bad quality they have suffered (subject, of course, to their own receivers being continuously stable and capable of unimpeachable quality). I notice that a Lancashire correspondent this week rails at 5GB. Is he aware that even the B.B.C. only claim about 100 miles as the maximum range without fading for this station, and has he ever listened to 5GB at a post within that range? If not we can warn him that the quality within that range, with comparatively rare exceptions, is uniformly good and the abnormalities only appear at greater distances. I know of two places three miles apart in Leeds at one of which 5GB is at fair strength and fading is rare. The other has high speed fading to an abnormal extent with a big maximum strength.

In Leeds we are able, on a powerful set, to get 2LO at tremendous strength in daylight. After the sunset period 2LO is subject to fading, and such bad interference between direct and reflected rays that music and speech are utterly unintelligible. Would your correspondents say that the B.B.C. are responsible for this? I am afraid they, quite wrongly, would.

I could quote examples like this for pages.

As for the foreign stations. At greater distances up to several hundred miles fading may be bad, but ray interference may frequently be less than at the lesser distances. The so-called better quality of many of the continental stations is due to deeper modulation. At minor ranges this is productive of what we should call appalling quality, though it is easier to resolve at greater distances. Remember the greater modulation for reaching purposes employed by the B.B.C. during the strike. But even at these distances it is often easy to recognise the bad quality due only to over-modulation: in fact, twice this week a colleague and I have had particular occasion to remark on it (on Langenberg).

There is one point, however, in which, in my humble opinion, the continental, and particularly the German, stations excel, and that is in the use of echo. I believe the B.B.C. claim that the listener should supply the echo to suit the conditions under which he is listening. If you go to a band you listen to the echo as it is, you do not have to imagine it. The listener knows that he cannot have a band in his own home, and if he could successfully imagine it he would probably be removed to an asylum. So he imagines it under the conditions which he knows, *i.e.*, public conditions, and the transmission lacks truth because the echo is not there.

With regard to the control mentioned in another letter. I understand that the B.B.C. have, to my mind, a nasty habit of putting on musicians to control during important musical items. These sit with the score in front of them and laboriously twist control handles for pianissimo, etc. The nett result is a completely spoilt transmission, lacking in individuality of either composer, conductor, or controller. The conductor is primarily responsible for the execution of the work being performed, and he determines degrees of light and shade, the orchestra following his ruling. Now the chief function of control is to stop over-modulation, or blasting, and to bring speech as compared with music up to the proper level. If the execution of a work has varying "score" control impressed upon the played work—as distinct from a watch for blasting—the interpretation is ruined. Even those of us who do not claim to be musicians can usually tell when an engineer is controlling—the execution and quality are infinitely superior in rendition and we either shut off or else lose our tempers when the "musician" starts dipping into the side of technical details he knows absolutely nothing about.

Leeds. C. S. V. WILKINS.
May 5th, 1928.

L.S.5 BRIGADE.

Sir,—I have been greatly interested in your correspondence under the above heading, and beg to be allowed to add yet another opinion on the subject.

Referring back to the source of this discussion I would like to comment on "Flux's" statement: "The greatest bugbear of the gramophone is that the volume is so grossly excessive as to make listening a strain without pleasure."

Now, in the case of an ordinary piano playing loudly in a small room, although the overall intensity of the piano is probably many times that of a band reproduced by the average gramophone under the same conditions and using "loud" needles, we do not find the intensity anything like sufficient to introduce aural strain. The reason is fairly obvious.

Even the best small modern gramophones suffer from resonances, and an almost complete dearth of really low notes. Increasing the bass in the recording gives the impression of bass, but the fundamental notes are, of course, still lacking. Due to these resonances the amplitudes of certain groups of notes may be hopelessly out of proportion, while the overall intensity is brought up by compensating for the lower and fundamental notes with an excessive higher register. The result is intense aural discomfort—especially in the case of the older models—unless the volume is cut down.

We may, then, modify the statement and say that the greatest bugbear of the gramophone is that it does not give an even response.

Now, in the case of the average loud-speaker exactly the same applies; the horn type being, in most cases, the worst offender. A badly-designed reed-driven cone without a baffle is very

nearly as bad, and in order to reduce aural discomfort we must again cut down the volume.

On the other hand, a good coil-driven cone, with a large baffle, such as described by *The Wireless World*, has a pretty uniform response, and, since it does not depend on resonance for its volume, a full orchestra can be reproduced (using an L.S.5A) at sufficient strength to make the whole floor vibrate in sympathy with the rolling of the drums, or the bowing of double-bass, and yet there is not the slightest strain in listening, nor has my hearing begun to fail yet as in the case of Mr. Bailey!

Under these conditions coversation is, of course, impossible, but one might well ask, "Why go to a concert hall in order to carry on a conversation?" If we are sufficiently keen musicians as to require perfect reproduction, then we certainly will not worry about carrying on a conversation at the same time. However, if we merely require a light background of music then realistic reproduction is hardly an important factor.

At any rate, as Mr. Turner suggests, let us have a high-power set which can deal with large volumes and really *reproduce* music when we want to hear it as we would at a concert hall.

As regards the sensitivity of a coil-driven cone, from actual experience I find that even with a small field current it is quite as sensitive as a "reed" type, and even without a baffle results are amazingly superior. F. H. E. READ.

Cambridge.
April 28th, 1928.

GRAMOPHONE REPRODUCTION.

Sir,—I note with interest, in a recent issue of *The Wireless World*, a letter from Mr. Webb raising the question of needle-track alignment in gramophones. This problem has received considerable attention from gramophone experts, notably from Mr. P. Wilson, who has devised a protractor for measuring the error of alignment, and I believe that this protractor may be obtained from the offices of the "Gramophone" for the sum of one shilling.

Since, as Mr. Webb suggests, faulty needle tracking may cause serious damage to records, the following simple method of testing the alignment may be of interest to him and to other readers: Having drawn a straight line down the centre of a sheet of ruled foolscap, so that it shall be accurately perpendicular to the rulings, punch a hole on this central line near one end, and place it over the spindle of the turntable. Now fix a needle in the soundbox, and place it in the position it would occupy when starting to play a 12in. record, first turning the paper so that the point of the needle rests on the centre line. The rulings will now indicate the direction of the record groove at the needle point, and it is a simple matter to determine with a protractor the angle between this and the plane of the soundbox face (and therefore the direction of the needle).

The tone arm is then swung inwards until the needle point is about two inches from the central spindle, corresponding to the inner limit of playing; the paper is twisted until the needle point again rests on the centre line, and the angle of alignment error is again read off as before.

In order to correct the alignment, the tone-arm mounting is unscrewed from the baseboard and moved either towards or away from the turntable spindle until the error of alignment is zero at a point about midway between the inner and outer extreme positions of playing. Under favourable conditions, the maximum error will not be more than 2°.

It is interesting to note that for correct tracking, the plane of the soundbox should *not* pass through the point about which the tone arm swings, but should make an angle of between 35° and 40° with the line joining this axis to the needle point. This is for tone arms of the usual dimensions.

Having now adjusted the position of the tone arm so as to give the best possible track alignment, we are still only half-way towards our objective, for, owing to the angle at which the soundbox is set with respect to the axis of the tone arm, the drag on the needle when playing exerts a turning movement on the tone arm which tends to make it swing inwards, and thus forces the needle against the inner side of the groove. In order to counterbalance this inward swing, the whole gramophone must be so tilted that the weight of the tone arm tends to make it swing outwards. To this end, the turntable is set in motion and the needle run on the smooth outer rim of the record. When the needle runs indefinitely on this rim, without swinging inwards or outwards, the machine may be considered as "levelled" If this desideratum is attained too easily, the tone-arm mounting should be suspected of stiffness!

It is essential to observe the above precautions in order to do justice to a modern soundbox or pick-up; and if, also, fibre needles are used, as they should be, record wear will be practically eliminated. H. P. MARKS.

London, N.10.
April 22nd, 1928.

Sir,—I am surprised that the very interesting and significant article which you published on March 14th ("Gramophone Pick-ups") has not brought about more correspondence.

Taking this article together with my limited experience of these devices, I can only come to the conclusion that one would be wise to leave gramophone reproduction severely alone until the makers of pick-ups have evolved a less destructive device than that which they now supply. The figures given in the table on page 280 serve, I think, to condemn the present pick-ups, with the exception of one, the make of which is unfortunately not given.

I have experimented with three makes. The first gave very poor reproduction, owing to marked resonances. The second was fairly good, but exceedingly expensive. The third was good, except for a bad "buzz." This last fault was rectified by the makers, with the result that the reproduction is now quite good.

I bought a number of new records in order to enjoy what is certainly remarkably good music as turned out by a moving coil speaker, and proceeded to congratulate myself that I had got a very satisfactory outfit. However, I soon began to notice that the records were getting very scratchy, and one, in particular, was literally torn up after some ten playings. This sample I took to the local depôt of The Gramophone Co., who immediately explained that the trouble was due to the rigidity of my pick-up. As I was somewhat sceptical, they showed me their modern reproducer, on which the needle is very flexibly mounted, and, to settle the matter conclusively, they produced a duplicate of the actual record I had taken to show them, and which had been played some eighty times on their own standard machine. This record was practically perfect.

I naturally took the matter up with the makers of my pick-up, and was met with the not uncommon half-denial, half-admission which manufacturers so often dish out when in a difficult situation. The only useful suggestion was that I should use "soft" needles or fibre ones (the latter will not fit the pick-up). I tried the "soft" needles, but found that they were not successful, the tone of the reproduction lacking the brilliance which is so marked with a normal needle.

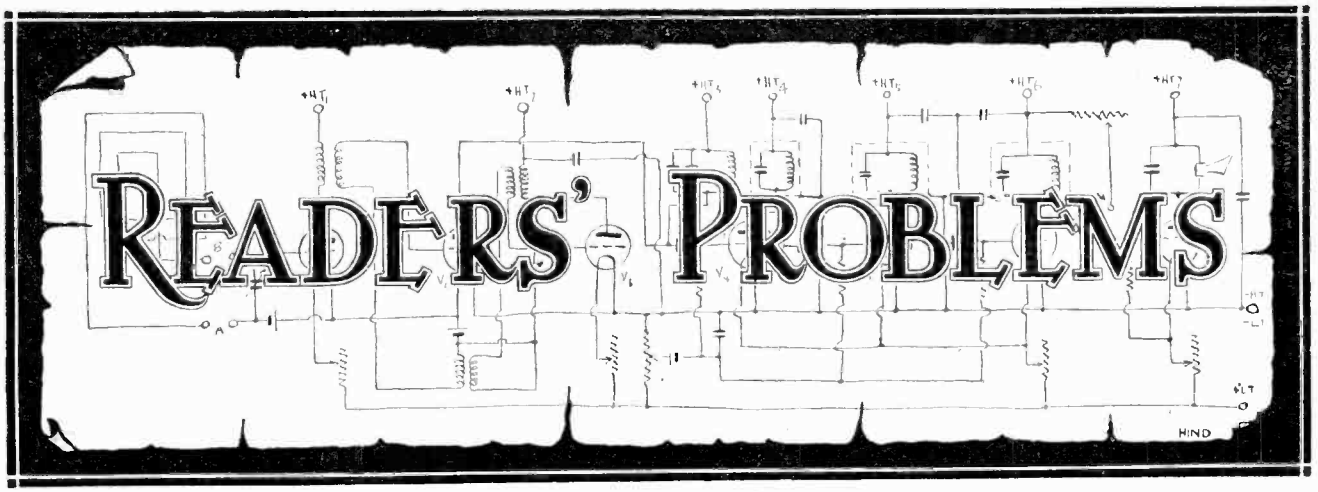
The result of all this is that I have wasted a good deal of money on a defective pick-up, and more on some excellent records, which are badly damaged.

It seems to me that the only sensible thing to do is to wait till some enterprising manufacturer publishes sufficient information about his instrument to convince one that it is not going to ruin records. Alternatively, one could experiment with every device on the market and a new set of records for each. This is rather expensive.

I was very interested in Mr. H. R. Webb's letter in your issue of April 18th. I think his suggestion may effect an improvement, but I do not think it will be a cure. On modern records the deviations of the groove are so extensive and sudden that the needle must be more or less free to follow them. If it has to drag about five ounces along with it, the grooves cannot stand up to the loads imposed.

In conclusion, I think it is not too much to say that the manufacturers have shown great carelessness in this matter, and have misled the public in putting on the market a device which, even though it be good in itself, is liable to cause serious damage in use. C. H. S.

Wolverhampton.
April 20th, 1928.



"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interests of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter

A Long-wave Set.

In this locality there is a good deal of interference (mostly from ships) on the medium broadcast waveband, and for my ordinary domestic reception I have decided to concentrate on Daventry 5XX. I have noticed from time to time it has been suggested that a tuned aerial circuit is highly recommended where maximum efficiency on the long waves is desired. As I should like my set to be as good as possible, and do not wish to forgo reception of the Continental long-wave stations, will you, please, tell me if you consider that the additional complication of a tuned aerial circuit is really worth while? J. B. L.

Yes, we consider that the slight extra trouble and cost involved in fitting a loosely-coupled and separately-tuned aerial circuit will be well repaid by improved results in a receiver such as that you describe. There is no doubt that the "untuned" and "direct" methods of aerial connection are not as effective on the long wavelengths.

o o o o

Too Many Volts?

Failure of the rectifying valve used in my eliminator is a source of very great expense to me. I find I have had to replace it several times during the last four months. Do you think that there is anything wrong with the eliminator itself, or have I been unfortunate in obtaining defective valves? R. A. D.

Modern rectifying valves have quite a long life, and we think it certain that something is wrong, most probably with your eliminator transformer. Failure of the valve may be due to the application of an excessive filament voltage, or possibly of an excessive anode voltage, but we think that the former is more likely.

If you have not access to A.C. measuring instruments, we suggest that you should fit a filament rheostat (if there is not one at present) and then temporarily disconnect the filament winding of the power transformer, substituting in its place a six-volt accumulator. Now adjust the rheostat until the voltmeter connected across the filament shows the full rated voltage, and then observe the rectified anode current as indicated by a milliammeter connected in series with the potential divider, or with a suitable load if this is not included in the design. Then remove the accumulator and replace the transformer connections, adjusting the rheostat until the anode current is the same as when the accumulator was in use. The filament voltage will now be correct.

Are you sure that your eliminator is designed to operate at approximately the voltage of your mains?

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Un-neutralised H.F. Amplifiers.

With reference to the "Selectivity Unit" described in your issue for April 25th, I should like to know if it would comply with the condition laid down when used with the "B.B.C. Quality Four." The condition referred to is the ability of the set to stabilise with the aerial lead removed. C. E. G.

The "B.B.C. Quality Four," described in our issue for May 4th, 1927, does not include a neutralised H.F. stage, stability being obtained partly by the insertion of a variable resistance in the grid circuit of the H.F. valve and partly by aerial loading. No doubt with the resistance set at a comparatively high value stability would be obtained, but we do not think that the "Selectivity Unit" would show up to best advantage when used with this receiver.

o o o o

The Better Way.

Two alternative positions are available for the installation of my receiver. The first will necessitate a long aerial lead (it will have to be run for some distance along a corridor), while in the second position a still longer loud-speaker extension wire must be provided. I am told that both these are undesirable, and, of the two evils, which do you think is the least objectionable? E. L. T.

There can be no doubt that it is best to instal the set in the position where the aerial lead-in will be short and direct; provided reasonable precautions are taken, there is no reason why a moderately long loud-speaker extension should introduce any undesirable effects

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RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

Using the House-lighting Battery.

My H.T. battery is rated at 120 volts, and this pressure is applied to each of the four valves of my receiver. With a view to increasing its undistorted output, I am considering the possibility of using my house-lighting system (50 volt accumulator battery) in conjunction with the other source of supply for feeding the last valve only. If you can recommend this idea, I should be glad if you would give me a diagram of connections, bearing in mind the fact that I do not wish to increase the voltage applied to the first three valves. S. C. S.

Your proposed scheme is quite a good one, and we give in Fig. 1 a diagram showing how it may be put into operation. You will observe that the H.T. accumulator battery supplies the first three valves, and that the house-lighting battery is connected in series with it for

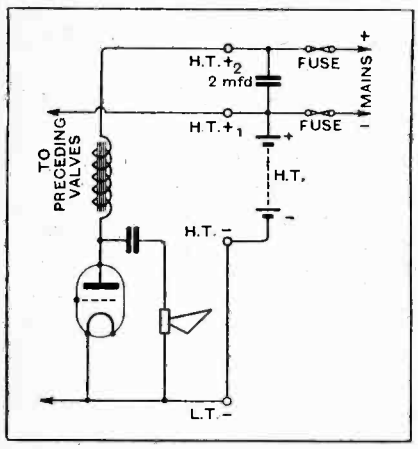

Fig. 1.—An accumulator house-lighting system used in conjunction with an H.T. battery.

the last valve anode. This scheme seems to be the best, as it will equalise the discharge of the H.T. cells; but, to avoid any possibility of a short-circuit, you must make sure that the filaments are not "earthed." If you do not use an isolated coupled aerial circuit, it will be necessary to connect a condenser in the earth lead. We realise it is quite possible that your house-lighting system has no direct earth, but it may be that there is an accidental connection, or, at any rate, there is the possibility of the development of one.

o o o o

No Cause for Alarm.

It is noticed that the glass bulb of my super-power output valve becomes appreciably warm after the set has been running for a few minutes, although the other valves are quite cold. Does this indicate that anything is wrong? G. L. C.

It must be remembered that the filament current taken by a super-power valve is nowadays generally two or three times that consumed by the valves used elsewhere in a receiver, while the dissipation of energy in the anode circuit is many times greater. It is quite normal that the valve should become warm, and, provided it is not really hot, we do not think you need be concerned.

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Modifying the A.C. Receiver.

Would it be possible to adapt the general arrangement of the "Indirectly Heated Cathode Receiver" described in "The Wireless World" for March 7th, but to replace the A.C. valves used in that set by those of the ordinary type? I ask this question because I have no electrical supply, and fear that the consumption of these special valves would be excessive in my particular circumstances if I connect the heaters to an L.T. battery. At the same time, I should like to try the arrangement. J. H. H.

This receiver would work quite well with ordinary valves, but would give less magnification than that obtainable with the special type included in the original set. You should also remember that the impedance of the detector valve will be very much higher (you will probably use one normally rated at 20,000 ohms), so we suggest that the primary of the coupling transformer should have a lower ratio than that specified.

o o o o

De-coupling Resistances.

My "Everyman Four" set is fed with anode current from dry batteries, and, as I, naturally, do not discard these until the voltage drops very considerably, it is assumed that their internal resistance is considerable, and may account for the fact that the quality of reproduction is not always as good as it might be. I have, therefore, decided to fit the anode feed resistance scheme as discussed in your issue of April 25th, and would be obliged if you would suggest suitable values for the resistors. The set is exactly to specification, and the valves are of the types recommended. I generally apply a maximum H.T. voltage of slightly over 120. F. B. C.

We suggest that you should join together all your H.T.+ terminals, and apply the maximum voltage available, inserting feed resistances in series with the detector and first L.F. anodes. The first resistance might have a value of 100,000 ohms, and the second 20,000 ohms.

o o o o

Improvised Output Chokes.

Is it permissible to use an out-of-date and discarded L.F. transformer as an output choke, and, if so, which winding should be connected? J. D. R.

At the time when valves of extremely low impedance were not in general use, it was often suggested that a discarded transformer should be used in the way you desire. Nowadays, however, we think that this course is not to be recommended, as in all probability the windings will have an excessive D.C. resistance in relation to their inductance.

o o o o

A Question of Cost.

It occurs to me that it would be possible to design a four-valve receiver using indirectly heated cathode valves (of the type consuming 1 ampere at 4 volts) in a four-valve receiver operated entirely from 220-volt D.C. mains, but I am not clear as to the upkeep cost of this arrangement. Do you recommend it? F. P. H.

We consider that your proposed arrangement is somewhat extravagant. Assuming the "heaters" of the four valves to be connected in series, the consumption from the mains will amount to 220 watts, and thus you will use nearly a quarter of one unit per hour. It will largely depend on the price you pay for your current as to whether this consumption is too great to be economically practicable.

o o o o

Balancing Loud-speaker Outputs.

Can you tell me how the output from two loud-speakers can be equalised in a simple and inexpensive manner? I have two of these instruments—one a cone, and the other a horn-type, the latter being the more sensitive. They are connected in series in the usual choke-filter arrangement. The result is that the volume from the horn is excessive, while the intensity given by the cone instrument is of barely comfortable strength. S. H. L.

The use of a variable resistance connected across the horn

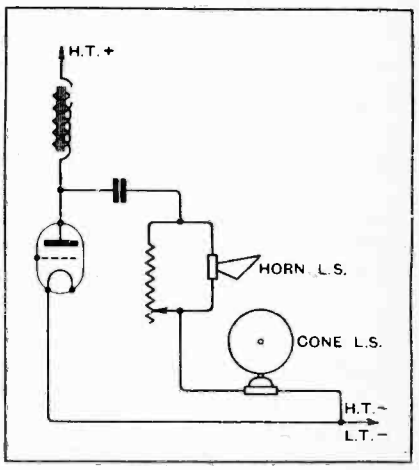

Fig. 3.—How to obtain equal volume from two dissimilar loud-speakers.

loud-speaker, as shown in Fig. 3, offers the simplest solution of your problem. It should be adjusted so that the apparent volume from each instrument is the same.

Resistances variable between zero and about half a megohm are obtainable commercially, and would do quite well, although half this maximum value would almost certainly be more than sufficient.