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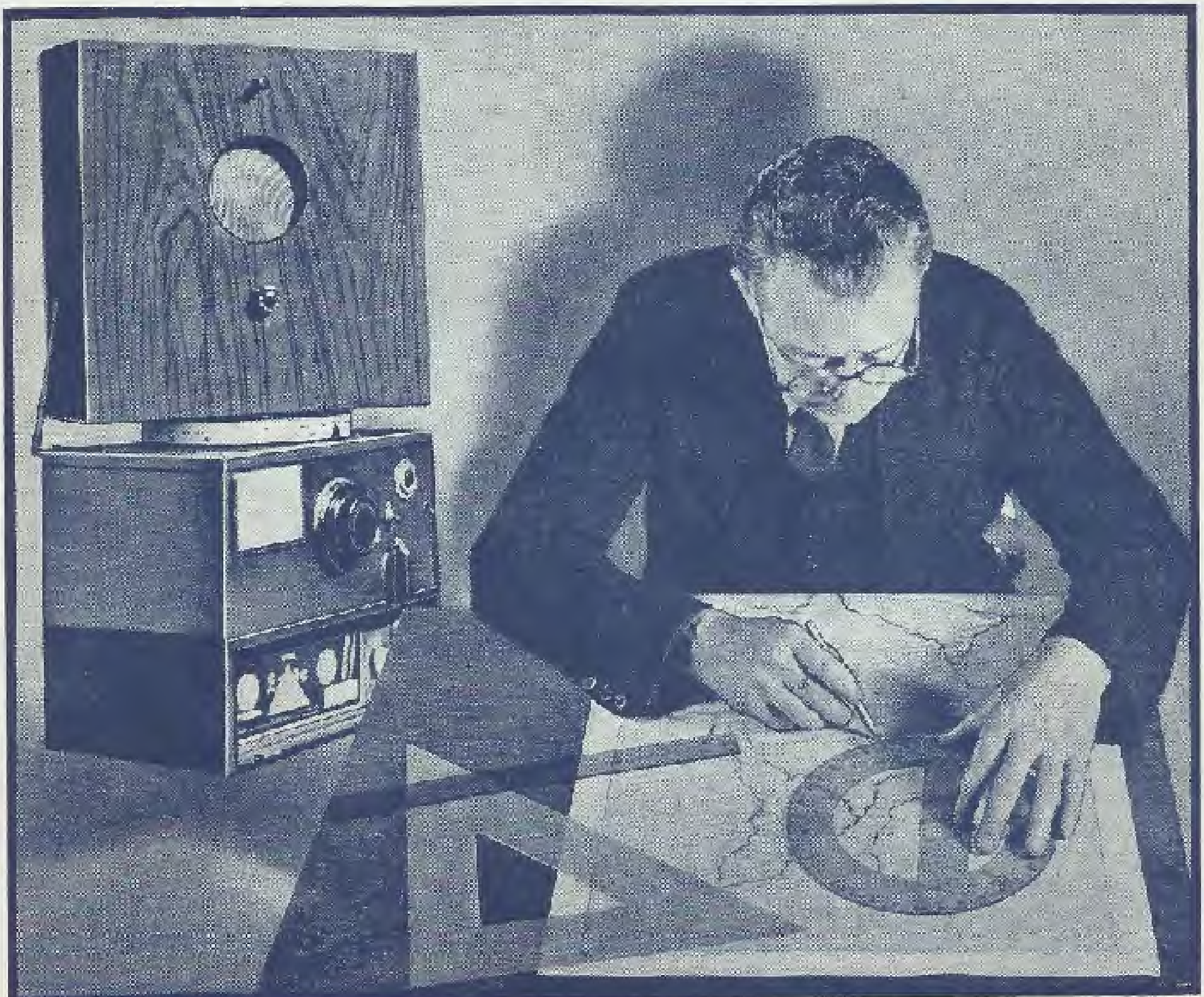

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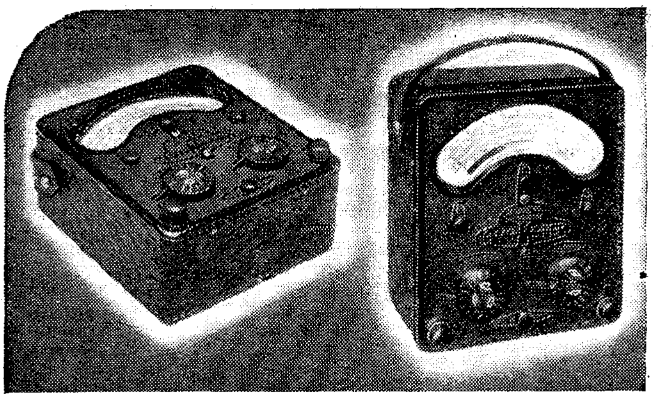

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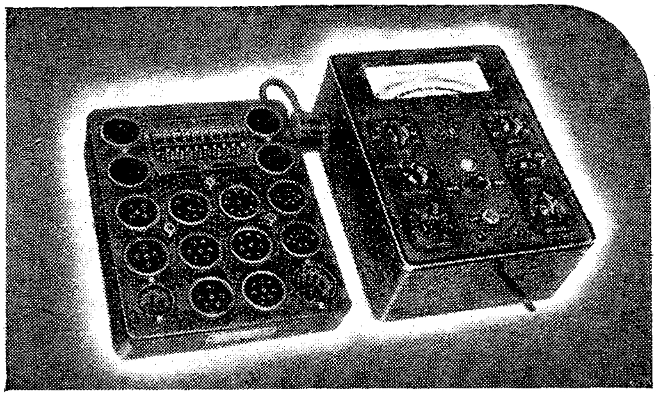

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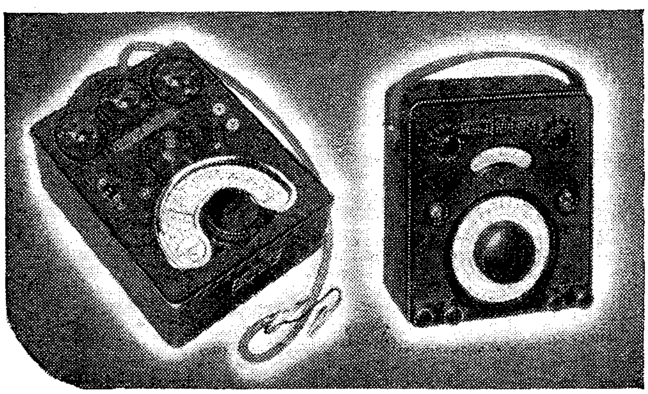
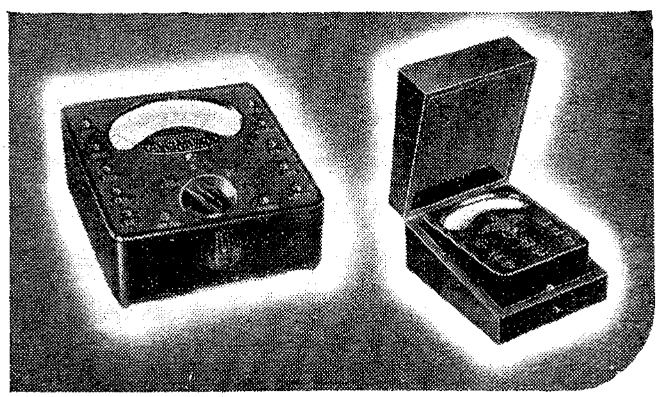
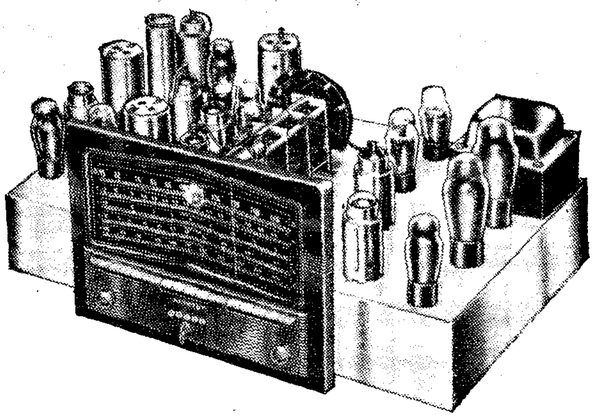


Universal AvoMinor

D.C. AvoMinor



MID-WEST RADIO



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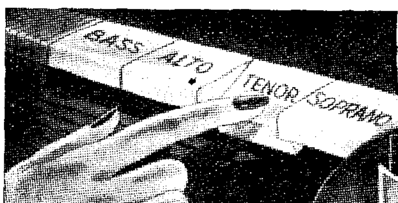
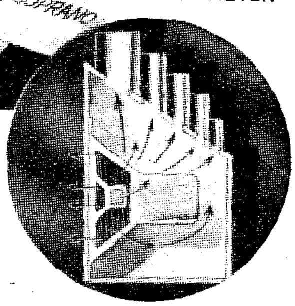
Mid-West Radio brings the world to your fireside—but that is a commonplace in these days.

Mid-West Radio achieves much more. It gives a quality of reproduction that makes ordinary radio sound like a fair-ground steam band compared with a symphony orchestra.



THE WONDERFUL *Organ-Fonic* TONE FILTER



This unique feature consists of a series of organ type resonating pipes arranged in graduated sizes. They improve reproduction beyond belief, giving to both voices and music their true naturalness, colour, vibrancy and reality. If you want to blend harmonies, to enrich the tone, to accentuate the bass or treble all you need to do is to touch the appropriate Organ Key Control. You are master of the music—"playing" the set to get the musical effects you desire and controlling the tone values as a musical director controls his orchestra.

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12 or 17 valve Chassis, 5 wavebands, 4½-2,400 metres, 10 watts output, organ fonic tone filter with dual speakers, four separate tone controls—motor or manual tuning. Selectivity approx. 3K.C. Sensitivity approx. 1½ microvolts.

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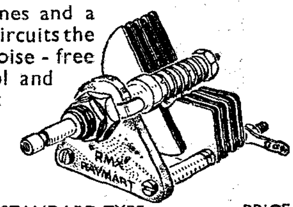

Ceramic insulation (RMX) is the latest product of the laboratories. Note how it improves at high frequencies.

Loss factor at	300 kc/s.	50,000 kc/s.
Quartz	**1.0**	**1.1**
"RMX"	**4.1**	**3.2**
Micalex	**11.9**	**18**
Porcelain	**70**	**85**
Moulded material	**100**	**260**

(Calculated from power factor with quartz taken as unity at 300 kc/s.)

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VC15X	15 mmfd.	**1/7**
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VC100X	100 mmfd.	**2/2**
VC160X	160 mmfd. (.00016 mfd.)	**2/6**
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(All types can be ganged.)

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MC7DX	Double spaced 7 p.f.	**1/8**
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Shaft turned from solid metal overall, giving accuracy not to be found in condensers where the shaft is fabricated from a drawn ¼in. rod.
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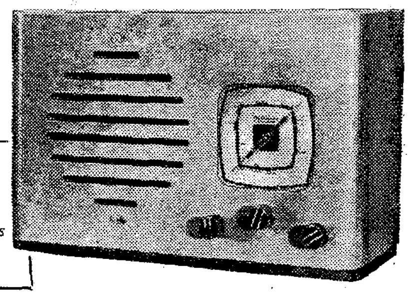

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in Walnut Cabinet.

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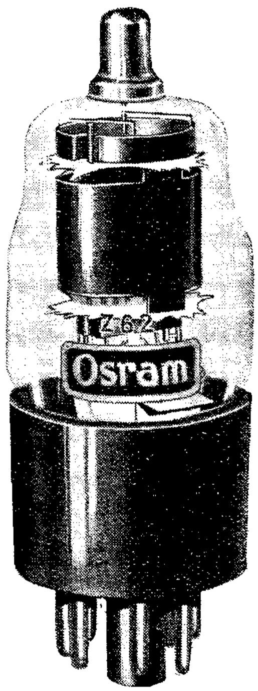

An Example.

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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.

No. 1057 Vol. XLVI. No. 9

JULY 1940

Contents

The
Wireless World

COVERING EVERY WIRELESS INTEREST

ESTABLISHED 1911

No. 1057. Vol. XLVI. No. 9. JULY 1940 Price One Shilling

Editorial Comment

Simplification and Rationalisation

DURING the early days of the war we warned readers that they might have to face a drastic simplification in broadcasting, not only in the transmissions, but also at the receiving end. That prophecy, like many another made before it was realised that many months of relatively inactive warfare were before us, seemed at first to have gone rather badly astray. But now that the *blitzkrieg* is upon us in earnest, it is realised that the broadcast receiver industry must make sweeping changes if it is to continue to supply home demands and, what is vastly more important, extend its export trade. During the last few months our correspondence from abroad has proved conclusively that more foreign importers are now interested in British wireless apparatus than ever before, and we are convinced that real opportunities exist for the industry, provided it can grasp them.

When we first raised the question of simplification it must be admitted that we were thinking solely of the home consumer; we considered that success in the export market could be attained through such aids to efficiency as standardisation of components.

A contributor in this issue carries the whole matter a stage further by proposing, for both home and export production, a more drastic simplification than has hitherto been envisaged. Briefly, it is proposed that, as a first step, British manufacturers should concentrate on a single range of valves, building around that range the best possible sets that can be devised without making inroads on supplies of vital material, and especially of imported material. But this is to be only a beginning. Our contributor goes on to make even more sweeping proposals by suggesting that, for at any rate the mass market, we might reduce the number of mains-operated valve types to three; two of these would have battery-fed counterparts. He discusses at some length the technical possibilities of designing receivers around the extremely limited series of valves. Provided that technical and other difficulties can be overcome, the attractions of such a scheme are obvious; productive efficiency should be high, and the overseas trader would find in the fact that he had only to stock three types of replacement valves a powerful argument in favour of handling British sets.

Team Work Needed

It is not intended here to discuss the scheme in detail, still less to attempt to criticise it. No plan such as that proposed can be put into successful operation without a much closer collaboration between all branches of the industry than anything it has known before. The closest team work, and, almost inevitably, a measure of sacrifice on the part of some of the interests concerned, would clearly be necessary. But the present times call for drastic action, and we believe that wireless people have, as befits those in a young industry, a greater flexibility of mind than is to be found in old-established fields of activity.

Of one thing we are certain. Even if the scheme under discussion is found on examination to be impracticable, it is only by the adoption of some other plan of an equally revolutionary nature that the British wireless industry will be enabled to make its fullest contribution to the war effort. Further, team work is needed, and wasteful competition between ourselves is a luxury for which we must wait until peace returns.

Amateur DF

DESIGN OF A SIMPLE DIRECTION FINDER

By ALEXANDER BLACK

Direction finding, in the form of the competitive field day, must obviously be shelved "for the duration," but there is no reason why this fascinating though somewhat neglected branch of amateur wireless should not still be pursued in a manner more suited to present conditions.

A VERY interesting branch of wireless experimenting for amateurs is that connected with the directional properties of frame aerials. Direction finding by wireless is primarily used by ships at sea during foggy weather and, of course, by aircraft as well. It has now reached a state of great reliability and precision in these spheres of usefulness.

Up to the outbreak of war, direction finding was an important activity of several wireless societies, notably of the Hendon and Golders Green Radio Society. Many amateurs had attained a high measure of skill, and anyone unable to take bearings within a margin of error not exceeding about two degrees stood a poor chance of winning a prize at the competitive field days that were organised periodically. It should be pointed out that this high order of accuracy was commonly obtained with relatively simple and inexpensive portable apparatus. In practice it has been found that with a fairly skilful operator and a well-made receiver bearings can be taken to within $\pm 1°$, up to a range of about 15 miles on 40 metres, therefore any error greater than this must be due to either the transmitter position in relation to the receiver or the effect of the objects in the immediate vicinity of the receiver or to atmospheric conditions. All this goes to show that amateur direction finders are far from being toys, and that the subject is worthy of the attention of anyone who treats wireless as a serious hobby.

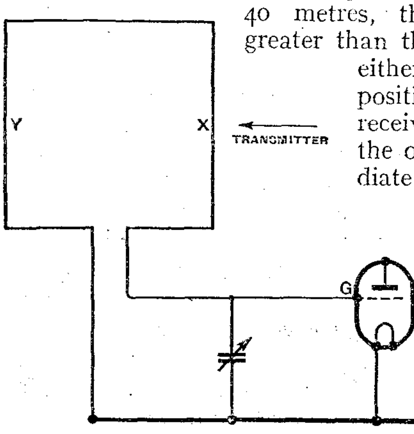

Fig. 1.—Explaining directional reception by means of a frame aerial.

Dealing now with the actual direction finding receiver and associated equipment, it is assumed that a receiving set employing a loop or frame aerial will be used, therefore let us first briefly consider the theory of the directional properties of a loop. Referring to Fig. 1, assuming the frame to be of square section, a signal from a transmitter lying in the same plane strikes the frame first at X then a fraction of a second later at Y. Then, if the dimensions of the frame are small in comparison with the signal wavelength, the voltages induced in opposite sides of the loop will be very nearly equal (the voltages induced in the horizontal portions will be zero and will have no effect on the circuit).

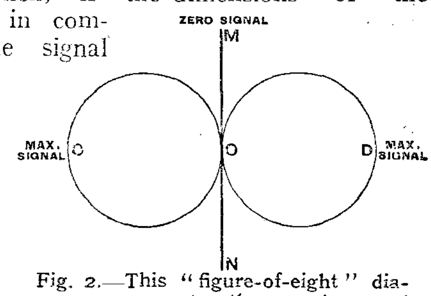

Fig. 2.—This "figure-of-eight" diagram represents the waxing and waning of signal strength that occurs as a frame is rotated through 360 degrees.

When the voltage induced by the signal wave is a maximum in X it will be slightly less in Y. It is the difference between the voltages at X and Y which causes a current to flow round the loop, thus producing a PD across grid and filament of the valve at G. If the frame is now rotated through 90° so that the

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plane of X and Y are at right angles to the transmitter, the voltages induced in X and Y will be equal at any given moment and therefore no current will flow in the loop. If the frame is rotated a further 90° X and Y will again be in the same plane as the transmitter and current will flow, due to the difference of voltage, but as the wave will now strike Y before X the PD at G will be in the opposite phase. Rotating the frame through 360° the resultant PD at G may be plotted as the well-known figure-of-eight diagram, Fig. 2. It will be seen that the two points of minimum signal M and N are far more clearly defined than the points of maximum, hence the reason for always taking bearings on the minimum signal.

Unfortunately, the frame aerial as a whole acts as an ordinary aerial due to its capacity to earth; this pick-up effect is practically the same irrespective of the plane of the frame to the transmitter. This is known as "vertical effect." The voltage applied at G by the vertical component of the signal can be represented as in Fig. 3 by a circle AB with its centre at o. It will be realised that with the plane of the frame as in Fig. 1 the signal due to vertical effect may be in phase with, and therefore additive to, the signal received by the loop and can be shown as OE. When the frame is rotated through 180° the two signals will be out of phase and can be shown as OB. The result is that the minima M, O, N are distorted instead of being at 180° as in Fig. 2. Vertical effect also causes another trouble—that is, blunt or indefinite minima. It is possible to eliminate most of the vertical pick-up in frame aerials by connecting the centre tap to earth as in Fig. 4. The loop should always be wound as a solenoid, and for best results should have an electrostatic screen earthed to the centre tap of the loop. It will be noticed that a gap is left at A to prevent the screen forming a closed loop.

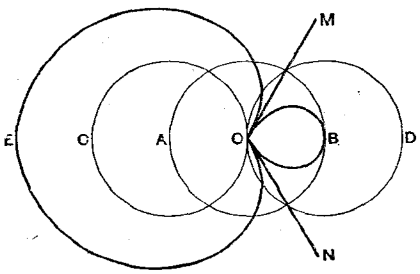


Fig. 3.—Polar diagram showing strength of signal received by a frame combined with the signal due to the action of the frame as a vertical aerial.

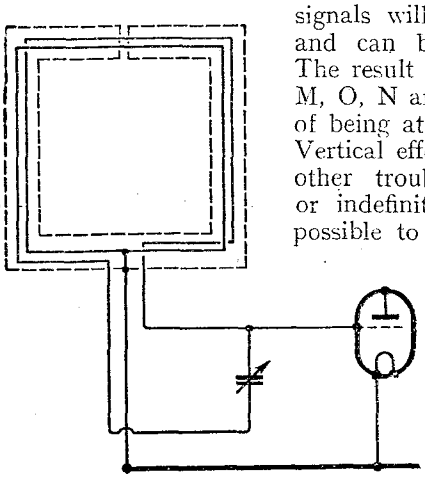


Fig. 4.—"Vertical effect," which gives rise to errors, is minimised by centre-tapping the frame and enclosing it in an almost complete screen.

Having taken the above precautions there will only be a very small amount of "vertical" to eliminate and this can be made use of to give a sense bearing, i.e., to show in which of the two possible directions the transmitter lies. If a small vertical rod aerial is coupled either to one side or the other of the frame aerial by means of a small differential condenser, as in Fig. 5, a little of the vertical component of the signal may be deliberately introduced in such a way, say, that it is in phase at one minimum position with the "vertical" signal due to the loop itself. This will cause an indefinite minimum, but if the frame is now rotated through 180 degrees the injected signal from the "open" aerial will be out of phase with the loop signal and a sharp minimum will be obtainable. Instead of rotating the frame the differential condenser can be adjusted so that the vertical aerial is coupled to the other leg of the loop; again, only one sharp minimum will be obtainable on a transmission.

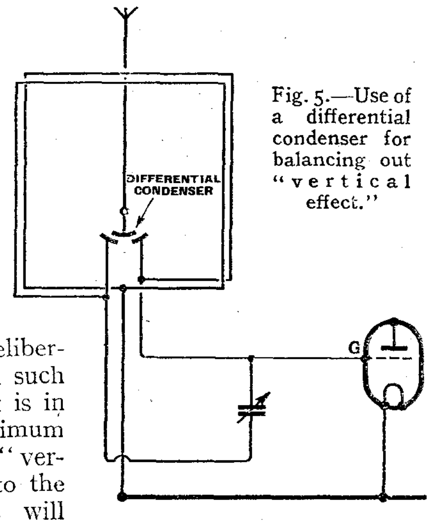
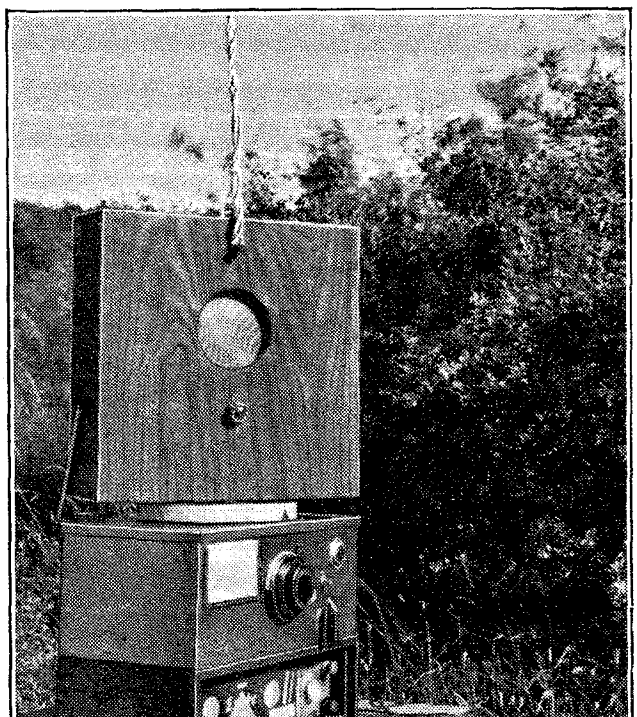


Fig. 5.—Use of a differential condenser for balancing out "vertical effect."



The author's DF unit. Note the loud speaker in the centre of the frame.

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Various types of receiving sets were used in the early days of amateur DF, but probably the most popular circuit was the Reinartz or Hartley detector followed by one or two stages of AF amplification; very little was done in the way of screening. Results, however, tended to be erratic as, owing to an oscillating frame aerial, body effects were troublesome and minima were indefinite and unreliable. Great improvements were effected by completely screening the receiver in metal and taking precautions to prevent direct signal pick-up on the headphone and battery leads. A further improvement was made by using an RF stage coupled to the detector by a tuned anode or tuned grid circuit, reaction being obtained by variable capacity coupling to the coil. The frame aerial now being non-radiating, some of the body effects were eliminated.

A Practical Design

A typical circuit for an amateur direction finder is shown at Fig. 6. It will be seen that the frame has an earthed centre tap and a small vertical aerial is coupled by a differential condenser to either end of the frame winding. The tuning condenser must, of course, be insulated from chassis when mounting. The grid leak of the detector valve is taken to a potentiometer across the filaments so that adjustment can be made for smooth reaction, which is always desirable, particularly if the set is used in an oscillating condition for taking bearings of CW stations. The detector valve may be followed by one or two stages of AF amplification. The author prefers two stages as shown; when dealing with a minimum signal for taking bearings it is a great advantage to have plenty of magnification.

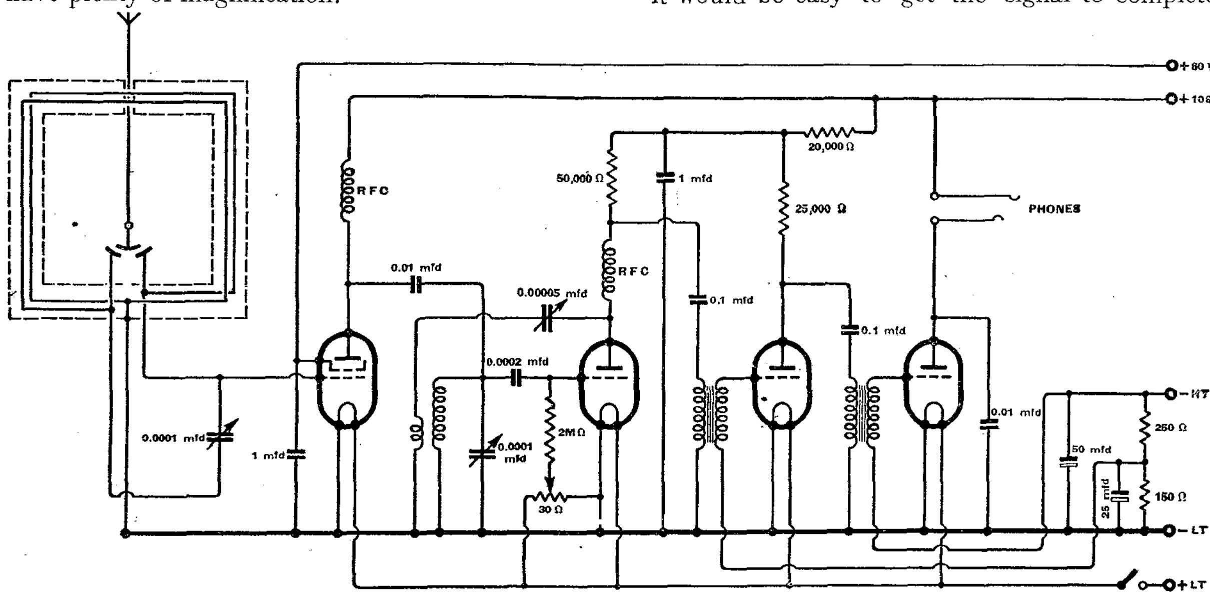
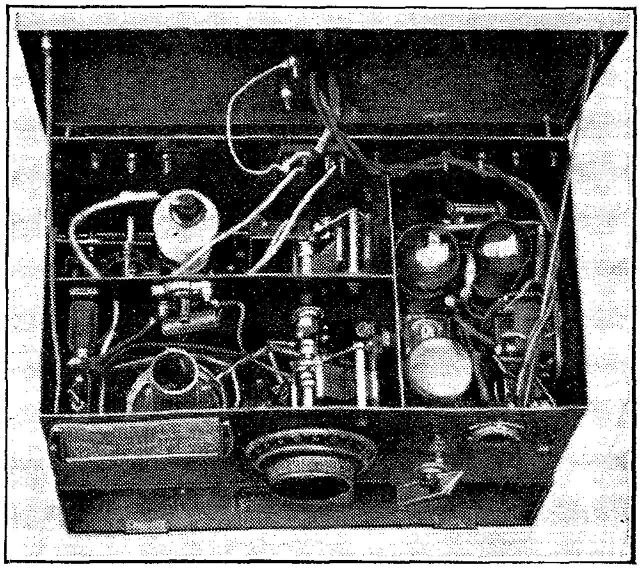


Fig. 6.—Complete circuit diagram of the author's receiver.

In the early days of DF the problem of indefinite minima was always a worry; on some occasions, as the frame was turned through 180°, the change in volume on headphones would vary from, say, R7 down to R2, and up again to R7 with no definite dip in volume to identify the minimum position of the frame. The only thing to do under these circumstances was to swing the frame backwards and forwards over the minimum and



Careful screening, as in the author's set shown here, is absolutely essential in DF work

note a position on either side on which the signal appeared to be the same volume and then take the mean position as minimum. As can be readily understood, it was very much guesswork and sometimes it was impossible to get nearer than ±10°, at other times, however, it would be easy to get the signal to completely disappear over about 1°. The author found that a compass scale fitted to the frame was a great help, as it was possible to re-check a bearing or see if the reciprocal bearing, i.e., the frame turned through 180°, coin-

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cided. The cause of the indefinite minima obtained was puzzling at first, as a receiver might be in one position for, say, four different transmitter positions and the sharpness or otherwise of minima obtained would vary greatly. It was found that the vertical component of the signal wave could vary during the day and that different transmitter positions also caused a variation. Fitting a small vertical aerial as shown in the circuit overcame this trouble.

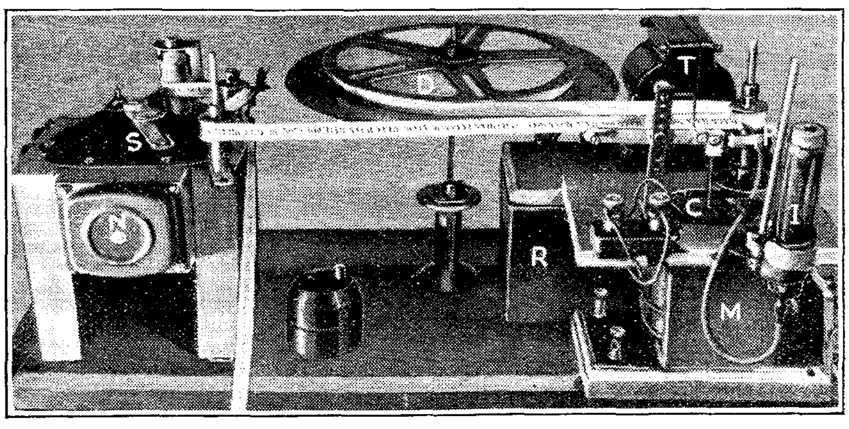
For 40 metres, four turns on a 10in. square is suitable for the frame, with a spacing of $\frac{5}{16}$in. between each turn. The author prefers a wooden box type frame, as it is mechanically rigid and protects the winding. When winding the aerial great care must be taken to see that the wires are taut and that the plane of each turn is parallel to the side of the frame case. The electrostatic screen should be at least $1\frac{1}{4}$in. away from the winding of the frame. The screen can be made of copper foil bent into channel section approximately 3in. wide with $1\frac{1}{4}$in. sides; the gap at the top need only be about $\frac{1}{8}$in. The frame itself can be made of $\frac{1}{2}$in. wood, outside dimensions being 14in. square by 4in. The copper foil screen is fixed by drawing pins. To the bottom of the frame is fixed a piece of wood $7\frac{1}{2}$in. in diameter $\frac{3}{4}$in. wide, which is marked out 0-360; a pointer is fixed to the lid of the set.

The set itself is completely enclosed in a copper box with the battery compartment below. It is important that the wires connecting each end of the loop to the set are individually run in screened tubing, earthed, or something similar, in order not to upset the tuning whilst swinging the frame. Similarly, if a loud speaker is fitted in the centre of the frame as in the writer's set, the leads to it must be screened.

It is hoped to deal in a subsequent article with the best way of operating the set and taking bearings.

Home-made Morse Recorder

THIS apparatus, made by Mr. Cecil H. L. Andrew, will record signals from any radio receiver of reasonable output at any speed up to 80 words per minute, the only limiting factor being the prevailing noise level. It is composed of a gramophone induction motor (shown on the right) which has two adapted rubber rollers to act as a tape puller. The magnet of the "writer" in this case is an old mains-energised field coil, although a permanent magnet could be used. The magnet face plate is turned down to give extra space, and working in this is a cardboard coil former wound with 500 turns or less of No. 42 enamelled wire. Connected to this is a pivoted lever operating a pen made of thin brass tubing connected by a very thin rubber tube to the ink-well, made of an old glass syringe body. The moving coil must be matched by a suitable transformer to the optimum load of the output valve. Interposed between transformer and coil is a Westinghouse rectifier, Type LB13. The ink used is made from methylene-blue $\frac{1}{4}$ oz., hot distilled water 1 pint, 20 per cent. methylated spirits, filtered. Key to photograph: N, induction motor; S, speed regulator; D, paper drum; T, transformer; R, rectifier; C, moving coil; P, pen; M, magnet and field coil; I, ink-well.



Henry Farrad's Problem Corner

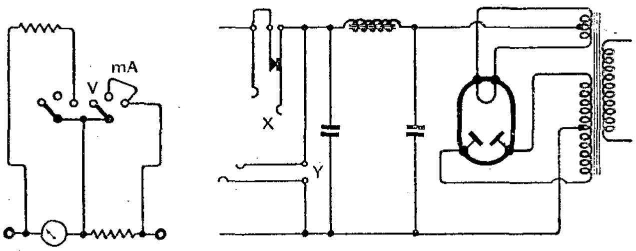
No. 48.—A Question of Current

An extract from Henry Farrad's correspondence, published to give readers an opportunity of testing their own powers of deduction:—

Howell House,
Keston.

Dear Henry,

Here is another little problem to bother you with. I drive my receiver by an entirely conventional type of power unit, as you can see from the diagram. The only special feature is that I have fitted jacks for measuring the output current and voltage. The current-measuring jack X is of the type that short-circuits itself when the meter is unplugged; the other, Y, naturally is not.



The real reason for fitting these jacks is a burst of enthusiasm resulting from the construction by me of a combined volt-milliamp meter using a 0-1 mA instrument. When the switch is in one position there is a high series resistance, giving a range of 0-500 volts; in the other, this resistance is shorted and a shunt is connected, giving a range of 0-100 mA. There is also a switch position without the shunt, giving the original 0-1 mA range.

The trouble is that recently the current taken by the receiver has been increasing to a varying extent. I have examined everything in the receiver, and no explanation of this increased current is forthcoming. The voltage, by the way, is perfectly normal. Can you suggest anything?

Yours gratefully in anticipation,
PHILIP COWE.

(*Henry Farrad's solution is on p. 326.*)

Principles of Fault-tracing

Part II.—APPLYING BASIC IDEAS TO SPECIFIC CASES

By W. H. CAZALY

In the opening instalment the author discussed the general principles of fault-tracing, and stressed the need for logical and systematic procedure. He now goes on to deal with the location of specific faults, such as "no signal," weak signal and distortion.

IN last month's instalment so much time was spent in stressing the need for logical methods in fault-tracing that we got no farther than establishing the goodness of the primary mains circuit of the receiver under discussion, the circuit diagram of which was given in Fig. 1 last month. We can now proceed at greater speed. The next step taken by a methodical fault tracer would probably be to test for a S/C (short-circuit) between HT + and chassis. He would do this before plugging the mains lead into the nearest mains point, because if a S/C did exist, the ruin of the receiver by a burnt-out mains transformer or stripped rectifier valve might be completed during the time the set was running with a S/C across HT and chassis while the tester was preparing his meter and leads for work.

Now a little thought will show that the complete silencing of the receiver by a S/C could be brought about by S/Cs only in two places: across both L2 and L3, and across C1. If S/Cs occurred in any part of the circuit on the aerial side of the speaker field winding L4 they would not stop current flowing in this winding, and this current would give rise at least to residual hum in the speaker. C1, L2 and L3 can be tested for S/C very easily through the rectifier valve-holder sockets. (References are to Fig. 1, last month's issue.)

Step-by-step Tests

If, as in the present case, no S/Cs were shown on the meter, the next step would probably be to plug into the mains point, switch on the receiver, and test for positive potentials at such convenient points as valve-holder sockets and soldering lug terminals on the speaker field and output transformer. A moment's thought will show that O/Cs could cause complete silence if they occurred only in three places. These places are (1) L2 and L3; (2) LT supply windings, and (3) L4, the speaker field. Again an eliminative process can be easily carried out by simple continuity tests. This would reveal L4 as the defective part of the circuit.

Assuming for the sake of illustration that L4 were found intact, there would remain only one possibility—that L5 or L6 were O/C. The investigation of these possibilities would probably be left to the last because they demand the dismantling of the speaker and its accessories in the majority of sets.

The preceding may seem a long-winded description of what is a very elementary example of fault-finding. It is valuable, however, on two accounts. First, it shows that by logical deduction it is possible to avoid wasting time (which is usually money in commercial servicing) in making unnecessary tests. Secondly, it has demonstrated the applications of a fundamental aphorism and a basic rule in all fault-tracing.

The aphorism may be stated thus: "Any defect is either a short-circuit, or an open-circuit, or a functional maladjustment." The rule is as follows: "Select the minimum number of possibilities that would account for the appearance of the symptoms and then eliminate them one after the other by direct experimental test."

These may seem truisms, but that is only because they are so constantly and inevitably applicable in fault-tracing that they are taken for granted. Their value becomes apparent as soon as they are neglected, as any inexperienced fault-tracer will speedily find out.

Now that the basic ideas in fault-tracing have been set out, it will be interesting to see how they can be applied to special cases. To review the process—the symptoms suggest the general line of approach to the problem, the aphorism states in general terms what has to be looked for, and the rule suggests how to do it.

Symptom No. 2, "no signal," is one, again, the cause of which is usually quite easy to find. By "no signal" is meant a condition in which residual field hum is heard in the speaker, but apparently no signals derived from aerial pick-up are transferred through the set to the speech coil. The first and most obvious conclusion is that at some stage in the circuit, the signal is being either by-passed straight to earth or chassis, or is not being handed on by some coupling or amplifying device to the following stage. The solution of the problem therefore divides into two parts, of which the first is to find at what stage the loss of signal is occurring, and the second is to find which of the components comprising this stage is at fault.

The first part of the solution may be done, often, during the preliminary tests for anode voltages, goodness of valves, etc. For example, when putting the test lead of the meter on valve anodes for voltage checking, clicks will be heard in the speaker (or, perhaps, the howling of instability provoked) if the circuit subsequent to the point tests is in order, so far as the conveying of simple current or voltage disturbances is concerned. To make the point clear: if, in Fig. 1 of last month's instalment, a click is heard when the anode of V2 is touched by the test lead of the meter, but no click is heard when the anode of V1 is touched, plainly the coupling between these two valves is defective. Having thus confined the probable area of the fault, it remains to list the possibilities of defect in this area and then to eliminate them by direct test, one by one. There are, it must be remembered, only S/Cs, O/Cs and maladjustments to be thought of. One possibility of the first nature is contact between the two plates of the trimmer condenser across L14. A possibility of the second nature is that R10, the screening grid feed resistor of V2, is O/C. The only maladjustment possible is that of the trimmer condenser of T5, i.e., the IF tuning may be very badly out.

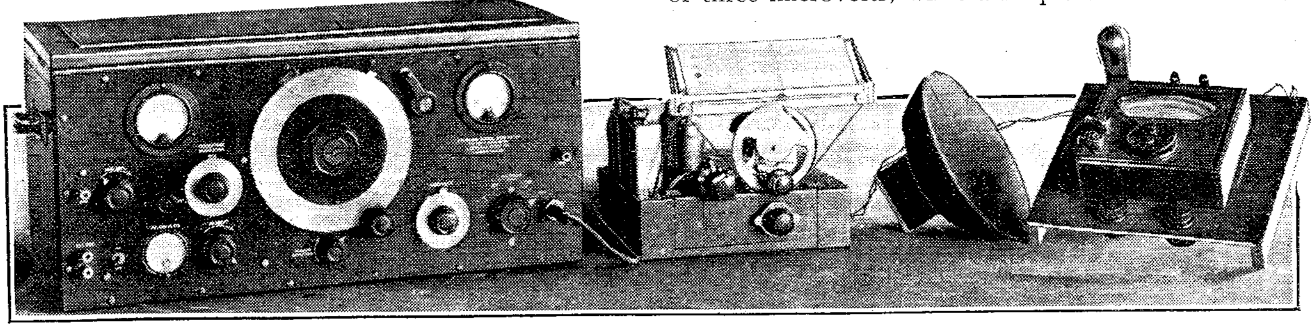
Already it may have become clear that fault-finding, which is 80 per cent. of radio repairing, is one of the things that can be studied "on paper." This is, of course, contrary to the cherished beliefs of "practical men" who are rather regrettably under the impression that theoretical knowledge is of little use to anybody but "highbrows." It should be obvious, however, that a man who is able to perceive the interactions of electrical effects from paper diagrams is likely to deduce the location of a defect much more readily and quickly than the man who prods blindly about looking for something he can grip with pliers. There is so much in radio that cannot be gripped with pliers.

The above may explain something of what may be going on in the mind of a fault-finder engaged with a receiver exhibiting Symptom No. 2. While examining the aerial, he would be listening to hear if its removal and replacement caused clicks in the speaker. While checking anode voltages, he would again be listening for clicks. If he found all voltages present and correct and clicks at each tested point, he would suspect, offhand, a maladjustment of tuned circuits, especially those of the local oscillator section.

This is a convenient point at which to mention test oscillators—which rise in the social scale and become "signal generators" if they cost more than a few pounds and are fairly accurate. In their simplest form they consist of little more than a one-valve reacting receiver made to oscillate and which can be home-built for a few shillings. Even in this elementary form they have the advantage over broadcast transmissions in that they can be used at any time and at any frequency. There is a good deal of literature about them, and they are mentioned here only in connection with maladjusted tuned circuits. Their signal, fed into RF or IF stages, replaces the "click test," which is only good enough to test the general continuity of transference of signal through the set. They are practically essential for the correct adjustment of tuned circuits in superheterodyne reception, a subject that has been helpfully treated in *The Wireless World* on more than one occasion.[1]

Lack of Sensitivity

The search for the cause of Symptom No. 3, "weak signal," may involve the use not only of a reliable test oscillator, but also of an output meter. This is a vague sort of symptom, rather like the "pain in my tummy" of the doctor's child patient. What seems a weak signal to one person may be a deafening row to another. For this reason, professional fault-finders prefer to have definite standards based on instrument readings against which they can compare performances of the receivers they have to deal with. Even in the quiet of a set-owner's home, the intensity of the sound output of the speaker is a difficult thing to judge accurately by ear alone. Another name for "weak signal" is "lack of sensitivity." The term sensitivity then has to be defined. Putting it in very general terms, the sensitivity of a receiver is a measure of the voltage that must be developed across the aerial and earth terminals in order to obtain a standard output from the output stage. The standard output is usually taken as 50 milliwatts of AF power developed in the anode circuit of the output valve or valves. To obtain this output, so many microvolts, modulated at such and such a frequency to a given depth—usually 400 c/s, 30 per cent. depth—must be put into the aerial-earth terminals. Thus a powerful communication receiver may be said to have a sensitivity of the order of two or three microvolts, while a simple detector-two-AF set may have a sensitivity of 1 volt. Hence, before it is possible objectively to decide that the sensitivity of a set is below normal, one must know what its normal



Set-up for checking sensitivity, alignment, etc. A modulated test oscillator or signal generator is practically indispensable in professional servicing. Some operations cannot be performed without it, and in other cases it saves hours of laborious direct testing of components. It may be home-built for a few pounds or be bought for anything up to two hundred guineas.

[1] "Superhet Alignment." *The Wireless World*, June 16th and June 23rd, 1938.

sensitivity is, in terms of volts or millivolts input to the aerial-earth terminals for a given, say, 50 milliwatts, output. Knowing this, it is possible to check the sensitivity of a set with a calibrated output meter in the anode circuit of the last valve and a calibrated attenuator controlling the output of a test oscillator feeding the aerial-earth terminals.

Not many people care to go to the trouble and expense of such testing for sensitivity. They use their ears as output meters and the more distant broadcast stations as sources of test signal, with the result that they seldom notice any falling off in sensitivity until it becomes so obvious that it points to some gross breakdown in the receiver, and is accompanied by some other symptom such as noise or distortion. In such forms it is not difficult to trace its causes. It is rare for signals to be merely weak and neither distorted nor accompanied by noise, unless a general, overall deterioration of the set has taken place—valves past their prime, components worked to their limit of safe load going slightly below par. This is very often the case when an elderly or at least ripely middle-aged receiver begins to dissatisfy the family and is not rejuvenated even by new valves. If a very thorough examination were made of all the components of such a receiver and its aerial-earth system, small departures from optimum values would be found in the constants of a number of components. Together, they would give rise to overall fall in sensitivity and signal-noise ratio. It is possible, however, for the deterioration to be somewhat localised around one stage or another. This is where the calibrated test oscillator and output meter come in.

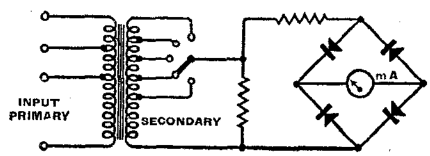


Fig. 2.—Essential circuit of an output meter. By taps on the primary and secondary of the transformer, the instrument may be matched to various valve and line impedances. The meter itself may be simply an AC voltmeter connected externally, if only comparative readings are required. If permanently incorporated, the meter may be calibrated in volts or milliwatts with a permanent load resistance across the secondary.

A Standard of Comparison

Much can be done even with a very simple oscillator and an uncalibrated output meter if access can be had to another receiver of the same make and type and known to be in good order. Then the gains obtained at each stage can be compared and the weak stage thus found. The manufacturer's service-man has the advantage over the set owner or local service-man in this matter in that he has a large number of exactly similar receivers to deal with and is able to make a table of the gains he expects to get from each stage. He can set his oscillator output attenuator knob, for example, to a certain figure for the IF, and if, on feeding this signal into, say, the primary of the second IF transformer, he does not get an expected deflection on his output meter, he knows that a least the fault lies in the circuit towards the speaker end and probably not towards the aerial end. So he can test each stage individually by these comparative methods, without expensively calibrated apparatus, until he finds the stage at which lack of gain is occurring.

To sum up a rather inconclusive dissertation it may be said that the symptom "weak signal" really means "loss of sensitivity," and that, as usual, the first step is to find out at what stage normal gain is not being obtained. This can only be found by actually feeding a signal into that stage and measuring the resulting output. This in turn implies a standard input and a standard output. If these standards are unknown or ignored, the affair becomes a rather crude hit-and-miss attempt to get the loudest possible sound out of the speaker for any convenient form of input signal and estimating very roughly by ear whether or not a stage is doing its bit towards that loudness. This is the method beloved by the majority of present-day service-men and set owners.

Distorted signal, Symptom No. 4, is another comparative fault involving subjective factors which are extremely hard to analyse. As a matter of fact, some form of distortion is usually introduced deliberately into the reproduction of commercial domestic receivers to make them acceptable to the public, and not only would a conscientious radio engineer find it extremely expensive and laborious to remove these distorting factors from the performance of the average home radio receiver, but when he had done so, he would probably be accused of having "ruined the tone" of the set by the annoyed owners. In the matter, indeed, of distortion the adage about one man's pick-me-up being another's allergic is so true that, strictly speaking, distortion is merely part of the vast subject of realistic reproduction with which we are here only indirectly concerned.

But there are certain forms of distortion that everybody finds intolerable. These may be classified under the two heads of (1) resonance effects, and (2) disagreeable alteration of wave-form. Each class of such distortion may be due to either (a) electrical or (b) mechanical properties of receiver parts. As an example of (1) there is the orchestral piece in which one particular note, each time it sounds, has a piercing quality making it stand out from the rest of the sound pattern; this effect may be due to either (a) some peculiarity of an inductive circuit giving excessive amplification at that frequency, or (b) some property of the speaker cone, or of the cabinet in which the speaker is housed, or even some acoustic peculiarity of the room or hall in which the speaker is sounding. As an example of (2) there is the harsh reproduction that occurs when the HT battery of a Q.P.P. output receiver is running down or when the speech coil is badly centred.

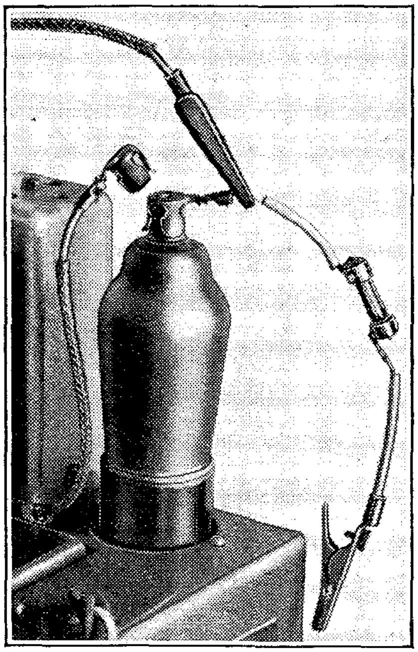
Cause and Effect

Now it is very seldom easy to distinguish certainly between the effects produced by these widely differing types of fault. The list of possibilities is bound therefore to be rather large. Elimination of each possibility, however, in turn, is not so difficult. A number of them will be disposed of during the preliminary basic checks of voltage, etc. It must be borne in mind during these checks that single tests can often form the starting points of quite long chains of reasoning. The fault-finder's mind must therefore be constantly on the alert for clues as he works. For example, if the anode voltage of V3, the double-diode-triode in Fig. 1, were found abnormally low, at least three possibilities could exist: (a) R2 might have "gone high;" (b) C4 might be S/C; (c) C5 might be S/C. Any one of these would by itself account for the distortion of the signal. All could be easily checked through the valve-holder sockets—the elimination process. If the anode voltage, on the other hand, were found abnormally high, the reasoning would be thus: high voltage at the anode means small voltage drop through R2—which means small anode current through V3—which means either loss of emission of V3 or excessive negative bias on the grid—which latter means that R6 has gone high. . . This is the kind of thinking that must be going on continually in the fault-finder's mind; it is very hard work.

Speaker Tests

However, if the preliminary tests have revealed no abnormality, it will be as well to make sure next that the speaker is in good order. Undoubtedly the best way of doing this is to connect a test speaker in place of the set speaker. If the distortion occurs only when the volume is turned to maximum and the output is such at that level that a pretty hefty speaker is needed to handle it without trouble, a good scheme for making use of a small, cheap speaker is to use a good attenuator for feeding the output to the small test speaker: *The Wireless World* Diary gives on page 73 a useful attenuator "volume control" circuit that might be used for this purpose. If, however, the speaker is found not to be the source of distortion, there remain two courses open. One is to trace the signal as it goes through the receiver from stage to stage, and try to pin down the stage at which distortion is occurring.

This involves the use of some device for listening to the signal in AF form at each stage, and the use of almost any such device will introduce factors into circuit conditions that will seriously upset performance. Thus, to pick up the signal in the HF or IF stages, a metal or diode rectifier—"detector"—must be used, coupled by inductive or capacitative means to those circuits; this will mistune those circuits or cause instability without laborious precautions. In the AF stages, placing 'phones across load impedances will again upset performance, unless some valve-input device is employed to feed the 'phones. Almost as cumbersome a method is to provide a special modulated signal to feed into each stage in turn: this special signal must itself be above suspicion as regards distortion and it must be made suitable in intensity and output impedance for the stage to which it is to be fed.



Checking for sensitivity, IF tuning, etc. The clip is removed from the top grid connection of the frequency-changer and replaced by a temporary arrangement connecting the grid to chassis through a 0.25-megohm resistance. This avoids leaving the grid "free" while the signal from a test oscillator is applied to the grid. If AVC is to operate on the frequency-changer, the earthy end of the resistor must be taken, not to chassis, but to the normal source of AVC voltage for this valve.

Accessory Circuits

On the whole, it will probably be more convenient to go through with an eliminative process by direct test of components. This need not be so laborious, after all. If anode voltages and currents are found to be in order—anode current usually tells a long tale—the fault must plainly be in some accessory circuit, such as the AVC network which is quiescent unless the receiver is handling a signal. If definite data can be obtained relative to the AVC voltages to be expected for given signal carrier strengths, these voltages can be directly checked up by measurement with a valve-voltmeter. But if they are not obtainable, the components making up these networks must be individually tested. (AVC networks only are mentioned; but the principles apply to all accessory circuits, such as ATC, negative feed-back, etc.)

Here it is necessary to digress in order to deal with certain practical difficulties that may arise in testing these accessory circuits. It is all very fine to say "Test the components . . ." on paper, but in practice, the fault-finder may discover that it is not so easy to measure high resistances, low capacities, and voltages developed across circuits of such high impedance that bridging them with anything else but a valve-voltmeter completely upsets them. It is easy to measure high resistance directly with a 500-volt megger, or small capacity with a bridge,[2] but these instruments are normally rather expensive and hardly justified as stock in small workshops. It is possible, however, to use a valve circuit which is cheap and simple to make up and which gives readings of sufficient accuracy for fault-tracing. An instrument of this type will be described in the next instalment; in addition to its uses in checking resistances, it provides for measurement of various AC and DC voltages, and inductance and capacity measurements.

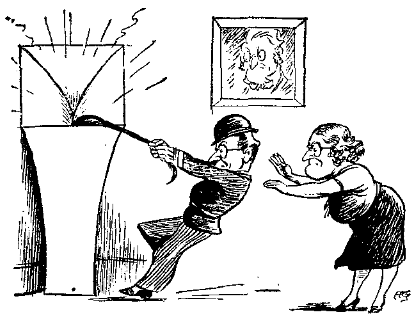
[2] An inexpensive but reliable bridge for resistance and capacity measurements was described in *The Wireless World*, for June 16th, 1938.

Unbiased

By FREE GRID

Realism Run Riot

I DON'T think that the most biased person among you could ever accuse me of having been on terms of undue cordiality with the B.B.C. at any time during my career. This is largely due, I think, to the fact that I have a certain amount of Scottish blood in my veins, having once been the grateful recipient of a transfusion from a Highlander when in a very low state



A firm grip on its tail.

after listening to a chamber music concert. Like all people of Scottish extraction, I believe in getting my full ten shillings-worth of value for, after all, in spite of the arguments of the purists to the effect that the ten shilling licence is a tax and not payment for entertainment, the B.B.C.'s income is inextricably bound up with the number of licences issued, and fluctuates with it.

At any rate, whatever be the source of my feeling of antipathy to the B.B.C. and all its works, this feeling has, as the result of one of their recent broadcasts, now widened into an open breach. I refer to the broadcast which they gave recently of the singing of the nightingale, when the wandering microphone took us from wood to wood in the stilly watches of the night. As a result of their efforts, I find myself faced with a bill for a new loud speaker, and the possibility of a police court charge at the instance of one of the animal protection societies.

My house, like that of any other real wireless fan, has, of course, each room equipped with a first-class loud speaker, every one of which has had to be designed and built by myself to suit the acoustic properties of the particular room in which it is used. This fact, coupled with the extraordinary realism of this particular B.B.C. broadcast, is the cause of all my present troubles, as, at the time of the nightingale broadcast, one of Mrs. Free Grid's innumerable feline friends (four-legged variety), which uses my house as an hotel to eat and sleep in the intervals between its nocturnal wanderings, happened to be the sole occupant of a room which contained one of my most successful exponential horn designs.

The result was that as soon as the nightingales piped up the cat took it as an invitation to a gargantuan feast, and took a headlong dive into the horn, where it promptly became stuck, and its howls of dismay quickly brought Mrs. Free Grid and myself on the scene. Unfortunately, the horn was of the vertical type, and the force of gravity, coupled with the cat's struggles, only served to wedge it more firmly in. All my efforts to extract it by a firm grip on its tail merely made matters worse, and its howls of indignation, coupled with those of Mrs. Free Grid, caused a perambulating policeman to appear on the scene.

In the end, the loud speaker horn had to be demolished with an axe and, apart from having to expend considerable time and labour in replacing it, to say nothing of the cost of materials, I find myself liable to be hauled up before a court of so-called justice on a charge of cruelty to animals. The only bright spot in the whole sorry business is that this incident once and for all disposes of the old canard about the B.B.C. using gramophone records for these nightingale broadcasts; it was far too realistic for that, for no cat can be deceived by a gramophone record, as I have since proved by experiment.

Things to Come?

ONE day many years ago, when journeying across the desert, whither I had gone in order to test out a patent Chemical Wireless Earth for the Editor of this journal, I was invited home by an aged Eastern Seer who regaled me with a sumptuous repast of hashish served by an army of houris.

I speedily found out that the sole reason for this lavish hospitality was that he was a reader of *The Wireless World* and was in trouble with a crystal set which he had constructed. In return for my help he gazed into his crystal and warned me that ere

An aged Eastern Seer.

long a dark and ominous shadow would cross my path, and although I laughed this prophecy off it was only a few weeks later that Mrs. Free Grid first loomed up menacingly over the horizon of my life.

He has now sent me the mystifying message to "make ready the magic mirror, for ere long it will shine forth once again." I wonder if any of you pukka sahibs who have lived out East can tell me what he means. Perhaps you may be able to recognise him from the accompanying photograph.

Letters to the Editor

THE EDITOR DOES NOT NECESSARILY ENDORSE THE OPINIONS OF HIS CORRESPONDENTS

Broadcast Receivers for a Blitzkrieg

SPEAKING from recent experience of difficult active service conditions in the field, I should like to give my views of the requirements of radio for overseas troops. Sets may be divided into two main classes: those required to entertain comparatively large bodies of men—say, up to 70 or 80—in barns and similar billets; and those required by smaller bodies and by units strenuously engaged in field work. The first type of set should be a modification of "car radio"—i.e., a sensitive set using mains-type valves and deriving its power from a vibratory HT unit which can be plugged in to the nearest lorry or car accumulator: It is possible for the complete car-radio outfit to be housed in a simple wooden structure with a carrying handle, but the vibratory unit must then be very thoroughly screened and a screened cable well earthed should be used to connect with the car battery. Such a system gives plenty of output without the troubles arising from dry HT batteries. The second type *must* derive its LT and HT from dry cells; accumulator charging is usually almost impossible.

Frame-aerial portables are not advisable, unless they are of the "transportable" superhet type and very strongly constructed with facilities for wedging the accumulator and HTB firmly in position. Nor are straight sets with reaction at all suitable, as oscillation is liable to give away one's position to the enemy—even if such sets are sensitive enough to pick up English broadcasts. For individuals or very small groups of a few enthusiasts, headphones can be used, saving the power and space and weight required for speaker operation.

Aerials and earths present no difficulties—an iron spike in wetted ground for an earth, and a well-insulated cable flung over a tree or roof-top for aerial, are far better than frame aerials, and a minor trouble to fix under field conditions. The whole subject bristles with problems which will not be solved as simply as those with no active service experience may imagine.

"TIFFEY."

"Constant Potential Rectification"

IN your June issue, your correspondent "Ich Dien" has endeavoured to carry the comparison of the relative ease of smoothing of normal single-phase rectifiers and "Westat" and "Noregg" rectifiers a stage further. In doing so, he has assumed that the smoothed constant potential output is required only for communication systems, and although this application is admittedly important, it does not by any means constitute the whole field of application.

For many other applications, which are perhaps of more interest to readers of *The Wireless World*, the relative "ease of smoothing" ratio given in the article will hold good.

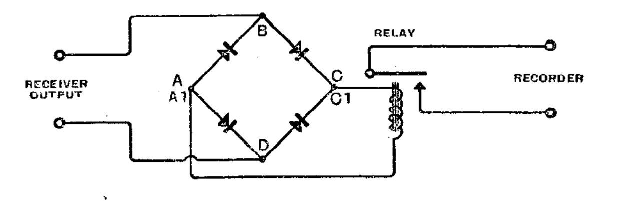
As regards the particular application to telephone communication systems, while it is of course true that the residual ripple after smoothing should be judged on a basis of reduction in articulation efficiency caused in such a system, it then becomes essential to consider the full harmonic content of the ripple. This point has been overlooked by "Ich Dien," who has incorrectly assumed the output ripple of a single-phase rectifier to be entirely at a frequency of 100 c/s, and that of a three-phase bridge rectifier to be entirely at a frequency of 300 c/s. An analysis of these wave-forms will show that the single-phase rectifier ripple is very rich in higher harmonics, and further, that the harmonics at 300 and 600 c/s are, in fact, exactly equal to the two largest ripple components of the output of a three-phase rectifier, which occur at these frequencies. The apparent disadvantage of the three-phase rectifier is therefore actually non-existent.

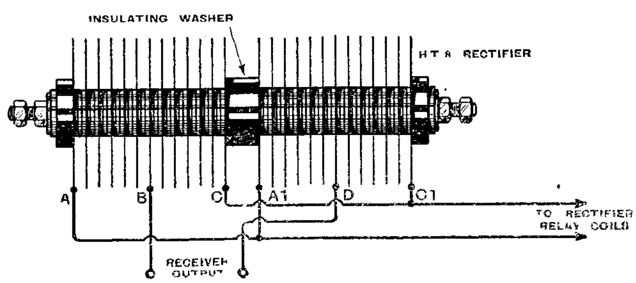
Your correspondent further argues that since the ripple output of a "Noregg" or "Westat" rectifier varies progressively with load changes, the filter must be designed to deal with the worst condition, and that little advantage can therefore be taken of the low ripple which occurs when the rectifier is fully loaded. Fortunately, this apparent difficulty is easily overcome by suitable design of the inductance elements of the filter, so that the filter has the maximum effectiveness toward light loads when the rectifier ripple is greatest, and is gradually reduced in effectiveness as the load is increased and the rectifier ripple decreases. By this means it is possible to effect a considerable saving in the cost of the filter.

S. A. STEVENS.
A. H. B. WALKER.

Morse Recording

WITH reference to the morse inker described in the March issue of *The Wireless World* I would like to add that morse signals can be recorded direct from





a wireless receiver by adding another old-type G.P.O. glass topped-relay into which the output of the receiver

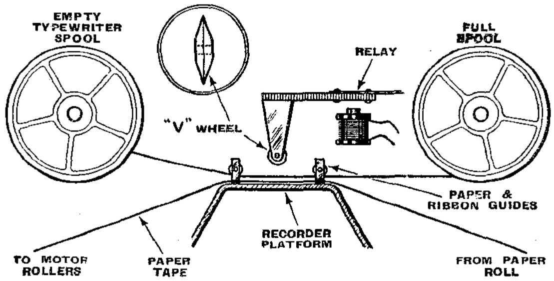
Letters to the Editor—

is fed by means of a full wave rectifier. A Westinghouse type HT8 can be adapted for this purpose by slipping off half of the elements and fitting an insulating washer.

To test, the rectifier unit is connected to the recorder and receiver, the latter being tuned to a good strong signal. The rectifier relay contacts are then adjusted and simultaneously the receiver volume control decreased until the relay armature is working nicely on quite a small signal.

K. J. SALMON
(Technical Dept., Alexander Black, Ltd.).
London, S.W.1.

I HAVE been experimenting for several years on paper tape machines, and perhaps the following details would assist *Wireless World* readers who are working on this type of instrument. In the place of messy inks, and very careful adjustments of stylus, which is necessary in this type of instrument, I have used for some time a small "V" wheel in conjunction with a black typewriter ribbon. A message can be recorded by hand



keying or from an R6 signal received on a 2-valve short-wave set.

Wireless Operator, F. W. SMITH.
H.M.T. Lacennia.

Dynatron Oscillator

I SHOULD like to get into touch with any reader who has constructed the AF Dynatron Oscillator described by M. G. Scroggie in his "Radio Laboratory Handbook," and who has modified the design for a larger output stage with negative feed back. J. POTTER
27, Kingsfield Drive,
Didsbury, Manchester, 20.

From the World's Journals

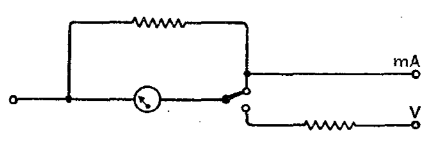
THE increasing difficulty of obtaining journals from abroad in the present circumstances has considerably enhanced the value of the Abstracts and References section of our sister journal, *The Wireless Engineer*. In the current issue, which was published on the 1st of the month, some 400 articles on wireless and allied subjects which have recently appeared in the technical journals of the world are abstracted or referred to. Another monthly feature is the summary of nearly 50 recently accepted wireless patent specifications.

In addition to these regular features, the June issue, which is obtainable through newsagents or direct from the Publishers, Dorset House, Stamford Street, London, S.E.1, at 2s. 8d. post free, contains articles describing a means of determining the residual parameters of variable air condensers, and electro-acoustic reactions, with special reference to quartz crystal vibrators.

Henry Farrad's Solution

(See page 319)

A VARYING output current and a constant voltage are contradictory, so far as a power unit of the type mentioned is concerned. The internal resistance, due to choke, valve and transformer, ensures that if the current rises the voltage falls, and vice versa. Therefore, either current or voltage or both are being wrongly measured. As the voltage is unvarying, while the current is not, suspicion falls first on the current measurement. Examining the meter circuit, a likely cause can be seen. It is the switch contact bringing in the shunt. The resistance of the shunt must be approximately one-hundredth of that of the meter itself (to convert the range from 1 to 100 mA); so, assuming a normal meter resistance, the shunt must be a fraction of an ohm. A poor switch contact might very appreciably increase this, altering the effective range of the meter and increasing the reading. A similar bad contact in the other part of the switch, connecting the series resistance, would be altogether negligible compared with half a megohm, and therefore an error in voltage reading is very unlikely.



If switches are included at all in meter-shunt circuits they should be of very special low-resistance type. To be quite safe it is better to avoid them altogether and insert the switch in the comparatively high-resistance meter circuit. One way of doing this is shown.

Another disadvantage of Philip Cowe's arrangement is that as the switch does not close the shunt circuit before the shorting circuit the meter may possibly be damaged by excessive current.

Short-wave Broadcasting Stations

ARRANGED IN ORDER OF FREQUENCY

Station	Call Sign	Mc/s	Metres	kW
49-Metre Band (6.000 - 6.200 Mc/s)				
Moscow (U.S.S.R.)	RNE	6.000	50.00	20-100
Pretoria (South Africa) ..	ZRH	6.007	49.94	5
Zeesen (Germany)	DJC	6.020	49.83	5-40
Moscow (U.S.S.R)	RW96	6.030	49.75	20-100
Boston (U.S.A.).. ..	WRUL	6.040	49.67	20
British Oversea Service ..	GSA	6.050	49.59	10-50
Cincinnati (U.S.A.)	WLWO	6.060	49.50	50
Philadelphia (U.S.A.)	WCAB	6.060	49.50	10
Motala (Sweden)	SBO	6.065	49.46	12
Lima (Peru)	OAX4Z	6.080	49.34	15
Tirana (Albania)	ZAA	6.085	49.30	—
Rome (Italy)	—	6.097	49.20	25-100
Cape Town (South Africa) ..	ZRK	6.097	49.20	5
Belgrade (Yugoslavia)	YUA	6.100	49.18	10
British Oversea Service ..	GSL	6.110	49.10	10-50
Saigon (French Indo-China) ..	FZR	6.110	49.10	12
Wayne (U.S.A.)	WCBX	6.120	49.02	10
Lahti (Finland)	OFD	6.120	49.02	1
Hsinking (Manchukuo).. ..	MTCY	6.125	48.98	20
Pittsburgh (U.S.A.)	WPIT	6.140	48.86	40
Winnipeg (Canada)	CJRO	6.150	48.78	2
Wayne (U.S.A.)	WCBX	6.170	48.62	10
Schenectady (U.S.A.)	WGEO	6.190	48.47	100
Vatican City	HVJ	6.190	48.47	25
Rome (Italy)	IAC	6.355	47.20	25-100
Radio Nations (Switzerland)	HBQ	6.675	44.94	20
Valladolid (Spain)	FET1	7.070	42.43	—
41-Metre Band (7.200 - 7.300 Mc/s)				
British Oversea Service ..	GSW	7.230	41.49	10-50
Tokio (Japan)	JVW	7.257	41.34	50
British Oversea Service ..	GSU	7.260	41.32	10-50
Lisbon (Portugal)	CSW8	7.260	41.32	10
Zeesen (Germany)	DXM	7.270	41.27	5-40
Paris Mondial (France).. ..	TPB7	7.280	41.21	12-25
Zeesen (Germany)	DJI	7.290	41.15	5-40
Moscow (U.S.S.R.)	RWG	7.360	40.76	20-100
Moscow (U.S.S.R.)	RKI	7.520	39.89	20-100
Cairo (Egypt)..	SUX	7.865	38.14	10
Bangkok (Thailand)	HSP6	7.968	37.65	10
Moscow (U.S.S.R.)	RIA	8.070	37.17	20-100
Budapest (Hungary).. ..	HAT4	9.125	32.88	5
Bucharest (Rumania) ..	—	9.280	32.33	—
Radio Nations (Switzerland)	HBL	9.345	32.10	20
Ankara (Turkey)	TAP	9.465	31.70	20
St. John's (Newfoundland) ..	VONG	9.482	31.64	—
31-Metre Band (9.500 - 9.700 Mc/s)				
Chungking (China)	XGOY	9.500	31.58	35
Bangkok (Thailand)	HS8PJ	9.500	31.58	10
Mexico City	XEWW	9.500	31.58	10
Lahti (Finland)	OFD	9.500	31.58	1
Belgrade (Yugoslavia)	YUC	9.505	31.56	10
British Oversea Service ..	GSB	9.510	31.55	10-50
Moscow (U.S.S.R.)	RW96	9.520	31.51	20-100
Paris Mondial (France).. ..	TPC13	9.520	31.51	12-25
Pretoria (South Africa) ..	ZRG	9.523	31.50	5
Schenectady (U.S.A.)	WGEO	9.530	31.48	100
Moscow (U.S.S.R.)	—	9.530	31.48	20-100
Treasure Island (U.S.A.) ..	KGEI	9.530	31.48	20
Calcutta (India)..	VUC2	9.530	31.48	10
Tokio (Japan)	JZI	9.535	31.46	50
Motala (Sweden)	SBU	9.535	31.46	12
Zeesen (Germany)	DJN	9.540	31.45	5-40
Schenectady (U.S.A.)	WGEA	9.550	31.41	25
Vatican City	HVJ	9.550	31.41	25
Bombay (India)..	VUB2	9.550	31.41	10
Zeesen (Germany)	DJA	9.560	31.38	5-40
Pittsburgh (U.S.A.)	WPIT	9.570	31.35	40
Millis (U.S.A.)	WBOS	9.570	31.35	10
Madras (India)	VUM2	9.570	31.35	10
Montevideo (Uruguay).. ..	CXA2	9.570	31.35	5
British Oversea Service ..	GSC	9.580	31.32	10-50
Melbourne (Australia)	VLR	9.580	31.32	2
Huizen (Holland)	PCJ	9.590	31.28	60
Cincinnati (U.S.A.)	WLWO	9.590	31.28	50
Delhi (India)	VUD2/3	9.590	31.28	10
Philadelphia (U.S.A.)	WCAB	9.590	31.28	10
Athlone (Ireland)	—	9.595	31.27	—
British Oversea Service ..	GRY	9.600	31.25	10-50
Moscow (U.S.S.R.)	RAL	9.600	31.25	20-100
Zeesen (Germany)	DXB	9.610	31.22	5-40
Cape Town (South Africa) ..	ZRL	9.606	31.23	5
Sydney (Australia)	VLQ	9.615	31.20	[illegible]
Budapest (Hungary)	HAT5	9.625	31.17	5
Rome (Italy)	I2RO3	9.630	31.15	25-100
Taihoku (Taiwan)	JFO	9.636	31.13	—
Zeesen (Germany)	DJW	9.650	31.09	5-40
Wayne (U.S.A.)	WCBX	9.650	31.09	10
Perth (Australia)	VLW2	9.650	31.09	—
Vatican City	HVJ	9.660	31.06	25
Manila (Philippine Islands) ..	KZRH	9.660	31.06	—
Buenos Aires (Argentine) ..	LRX	9.660	31.06	7
Rome (Italy)	I2RO9	9.670	31.02	25-100
Zeesen (Germany)	DJX	9.675	31.01	5-40
Paris Mondial (France) ..	TPA4	9.680	30.99	12-25
Radio-Teheran (Iran)	EQC	9.680	30.99	14
Sydney (Australia)	VLQ5	9.680	30.99	—
Moscow (U.S.S.R.)	RW96	9.684	30.98	20-100
British Oversea Service ..	GRX	9.690	30.96	10-50
Buenos Aires (Argentine) ..	LRA1	9.690	30.96	10
Lisbon (Portugal)	CSW7	9.740	30.80	10
Rome (Italy)	IRF	9.835	30.52	25-100
Madrid (Spain)	EAJ7	9.860	30.43	10
Bandoeng (Java)	PMN	10.260	29.24	1.5
Zeesen (Germany)	DZC	10.290	29.16	5-40
Ruysselede (Belgium) ..	ORK	10.330	29.04	—
Buenos Aires (Argentine) ..	LSX	10.350	28.99	12
Lisbon (Portugal)	CSW6	11.040	27.17	10
Radio Nations (Switzerland)	HBO	11.402	26.31	20
Moscow (U.S.S.R.)	RIC	11.640	25.77	20-100
Rome (Italy)	IQY	11.673	25.70	25-100
25-Metre Band (11.700-11.900 Mc/s)				
Motala (Sweden)	SBP	11.705	25.63	12
Paris Mondial (France).. ..	TPA4	11.720	25.60	12-25
Winnipeg (Canada)	CJRX	11.720	25.60	2
Huizen (Holland)	PHI	11.730	25.58	20
Vatican City	HVJ	11.740	25.55	25
British Oversea Service ..	GSD	11.750	25.53	10-50
Rome (Italy)	I2RO15	11.760	25.51	25-100
Zeesen (Germany)	DJD	11.770	25.49	5-40
Hsinking (Manchukuo).. ..	MTCY	11.775	25.48	20
Saigon (French Indo-China) ..	FZR	11.780	25.47	12
Boston (U.S.A.)	WRUL	11.790	25.45	20
Tokio (Japan)	JZJ	11.800	25.42	50
Zeesen (Germany)	DJZ	11.801	25.42	5-40
Rome (Italy)	I2RO4	11.810	25.40	25-100
British Oversea Service ..	GSN	11.820	25.38	10-50
Wayne (U.S.A.)	WCBX	11.830	25.36	10
Perth (Australia)	VLW3	11.830	25.36	—
Lisbon (Portugal)	CSW5	11.840	25.34	10
Paris Mondial (France) ..	TPB8	11.845	25.33	12-25
Melbourne (Australia)	VLR3	11.850	25.32	2
Zeesen (Germany)	DJP	11.855	25.31	5-40
British Oversea Service ..	GSE	11.860	25.29	10-50
Sydney (Australia)	VLQ2	11.870	25.27	—
Pittsburgh (U.S.A.)	WPIT	11.876	25.26	40
Paris Mondial (France) ..	TPA3	11.885	25.24	12-25
Chungking (China)	XGOY	11.900	25.21	35
Moscow (U.S.S.R.)	—	11.900	25.21	20-100
Moscow (U.S.S.R.)	RNE	12.000	25.00	20-100
Zeesen (Germany)	DZH	14.460	20.75	5-40
Radio Nations (Switzerland)	HBJ	14.538	20.64	20
Rome (Italy)	IQA	14.795	20.28	25-100
19-Metre Band (15.100-15.350 Mc/s)				
Moscow (U.S.S.R.)	RKI	15.040	19.95	20-100
Rome (Italy)	I2RO12	15.100	19.87	25-100
Zeesen (Germany)	DJL	15.110	19.85	5-40
Vatican City	HVJ	15.120	19.84	25
Paris Mondial (France).. ..	TPB6	15.130	19.83	12-25
British Oversea Service ..	GSF	15.140	19.82	10-50
Motala (Sweden)	SBT	15.155	19.80	12
Tokio (Japan)	JZK	15.160	19.79	50

Station	Call Sign	Mc/s	Metres	kW
Moscow (U.S.S.R.)	RW96	15.180	19.76	20–100
British Oversea Service	GSO	15.180	19.76	10–50
Lahti (Finland)	OIE	15.190	19.75	1
Ankara (Turkey)	TAQ	15.195	19.74	20
Zeesen (Germany)	DJB	15.200	19.74	5–40
Chungking (China)	XGOX	15.200	19.74	35
Pittsburgh (U.S.A.)	WPIT	15.210	19.72	40
Lisbon (Portugal)	CSW4	15.215	19.72	10
Huizen (Holland)	PCJ2	15.220	19.71	60
Podébrady (Bohemia)	OLR5A	15.230	19.70	15–30
Paris Mondial (France)	TPC5	15.240	19.68	12–25
Boston (U.S.A.)	WRUL	15.250	19.67	20
British Oversea Service	GSI	15.260	19.66	10–50
Wayne (U.S.A.)	WCBX	15.270	19.65	10
Zeesen (Germany)	DJQ	15.280	19.63	5–40
Delhi (India)	VUD3	15.290	19.62	10
Buenos Aires (Argentine)	LRU	15.290	19.62	7
Rome (Italy)	I2RO6	15.300	19.61	25–100
British Oversea Service	GSP	15.310	19.60	10–50
Schenectady (U.S.A.)	WGEA	15.330	19.57	25
Zeesen (Germany)	DJR	15.340	19.56	5–40
Zeesen (Germany)	DZG	15.360	19.53	5–40
Budapest (Hungary)	HAS3	15.370	19.52	5
Moscow (U.S.S.R.)	RW96	15.410	19.47	20–100
16-Metre Band (17.750–17.850 Mc/s)				
Zeesen (Germany)	DJE	17.760	16.89	5–40
Paris Mondial (France)	TPC3	17.765	16.88	12–25
Huizen (Holland)	PHI2	17.770	16.88	20
Pittsburgh (U.S.A.)	WPIT	17.780	16.87	40
Bound Brook (U.S.A.)	WNBI	17.780	16.87	35
British Oversea Service	GSG	17.790	16.86	10–50
Chungking (China)	XGOX	17.800	16.85	35
British Oversea Service	GSV	17.810	16.84	10–50
Rome (Italy)	I2RO8	17.820	16.83	25–100
Wayne (U.S.A.)	WCBX	17.830	16.83	10
Athlone (Ireland)	—	17.840	16.82	—
Zeesen (Germany)	DJH	17.845	16.81	5–40
Paris Mondial (France)	TPB3	17.850	16.81	12–25
Radio Nations (Switzerland)	HBF	18.450	16.26	20
Bangkok (Thailand)	HS6PJ	19.020	15.77	10
13-Metre Band (21.450–21.750 Mc/s)				
Boston (U.S.A.)	WRUL	21.460	14.00	20
British Oversea Service	GSH	21.470	13.97	10–50
Schenectady (U.S.A.)	WGEA	21.500	13.95	25
Rome (Italy)	I2RO16	21.510	13.95	25–100
Philadelphia (U.S.A.)	WCAB	21.520	13.94	10
British Oversea Service	GSJ	21.530	13.93	10–50
Pittsburgh (U.S.A.)	WPIT	21.540	13.93	40
British Oversea Service	GST	21.550	13.92	10–50
Wayne (U.S.A.)	WCBX	21.570	13.91	10
Schenectady (U.S.A.)	WGEO	21.590	13.89	100
British Oversea Service	GRZ	21.640	13.86	10–50
11-Metre Band (25.600–26.600 Mc/s)				
Boston (U.S.A.)	WRUW	25.600	11.70	—
St. Louis (U.S.A.)	W9XPD	25.900	11.58	—
Cincinnati (U.S.A.)	W8XNU	25.950	11.56	—
South Bend (U.S.A.)	W9XH	26.050	11.52	—
Superior (U.S.A.)	W9XJL	26.100	11.49	—
Nashville (U.S.A.)	W4XA	26.150	11.47	—

Stations of which the names are "indented" are working outside the regular broadcasting bands.

Short-wave Receiving Conditions

PROSPECTS FOR JULY

(COMMUNICATED BY THE ENGINEERING DEPARTMENT OF CABLE AND WIRELESS, LTD.)

PROPAGATION conditions on short waves during May were particularly stable for the first ten days, but deteriorated during the latter part of the month as a result of ionosphere storms on the 18th and 22nd to 28th (inclusive). A sudden return to normal conditions was experienced during the last three days of the month.

Atmospherics were above normal on the following dates: May 1st-3rd (inclusive), 8th, 10th, 15th, 16th, 21st, 23rd and 25th to 29th (inclusive). The general rise in the average level of atmospherics may be attributed to the greater thunderstorm activity associated with summer months.

Sudden ionosphere disturbances of the "Dellinger" type were experienced in this country as under: (a) May 14th, 1750 GMT; its effect was mainly confined to South American stations. (b) May 17th, 1350 GMT; most stations were affected.

Particulars of the broadcast bands which, it is considered, are likely to prove most reliable during July on five selected routes are given below; these may serve as a guide when considering reception from places other than those mentioned. All times are GMT, on the 24-hour clock notation.

Tokio: 0800/1200, 16 m; 1200/1600, 16 or 19 m; 1600/midt, 19 or 25 m.

The time at which the longest wavelength is expected to be most necessary is about 1900, i.e., one hour before sunrise at Tokio. Echo signals are likely to occur around 2000.

Melbourne: 0800/1000, 19 or 25 m. Westward (via Pacific); 1500/2000, 25 m. Eastward (via Calcutta); 2000/midt, 25 m. Eastward.

Towards midnight reception should be possible on most days on both the Eastward and Westward routes on 25 metres, and frequently also on 19 metres. The period 1100/1400 is a difficult one at this season on account of extreme differences in conditions at the two ends of the route.

Bombay: 0800/1600, 16 m; 1600/2000, 16 or 19 m; 2000/midt, 19 or 25 m.

Buenos Aires: 0800/1000, 25 or 31 m; 1000/1200, 16 or 19 m; 1200/1600, 13 or 16 m; 1600/2000, 16 or 19 m; 2000/midt, 19 or 25 m.

Echo signals may be expected around 2000. The most difficult period is likely to be from 0800/1000 when it is daylight here but later winter night at Buenos Aires.

Montreal: 0800/1000, 19 or 25 m; 1000/1200, 16 or 19 m; 1200/1600, 16 or 19 m; 1600/2000, 13 or 16 m; 2000/midt, 16 or 19 m.

Towards midnight slight echo may be discernible. During magnetic disturbances wavelengths longer than those mentioned may be found to be preferable, particularly during the morning and late evening periods.

In summer (northern hemisphere) it is generally found that the period of maximum daylight over a route is not necessarily that for which the shortest wavelength may be used. The reason for this is that at this season the critical frequency of the controlling layer towards sunset frequently exceeds that at noon; thus, in the case of transatlantic routes, the maximum usable frequency during the evening may be greater than that during the early afternoon, notwithstanding the greater daylight involved during the latter period.

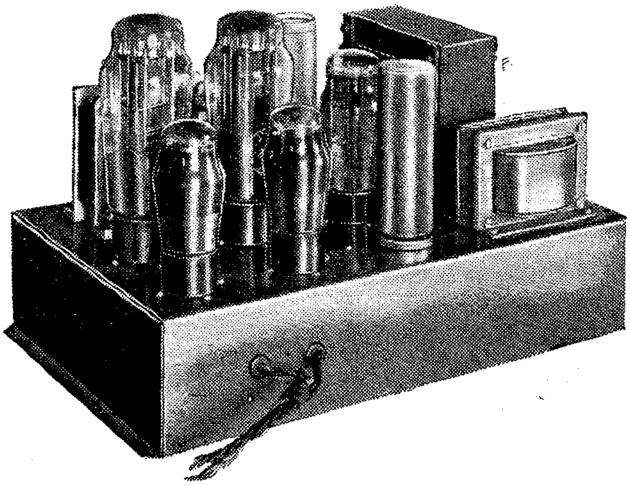
Atmospherics are likely to be troublesome during the afternoons in July; the average intensity on the 16-metre band, for example, may be expected to increase from its noon value to a peak at about 1800.

If the present trend of magnetic activity continues, the most favourable conditions for long-distance reception during July will probably be during the last week.

Apparatus Reviewed

McClure Model ACA16 Amplifier

THREE STAGE 15-W PUSH-PULL UNIT FOR AC MAINS

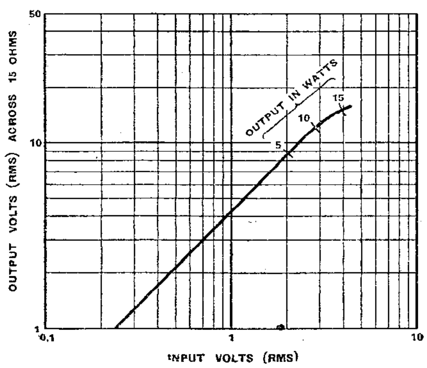


DESIGNED to work in conjunction with feeder units of the type reviewed in our March issue, this amplifier is fitted with a five-pin socket for supplying the necessary filament and HT current and connecting the input from the receiver.

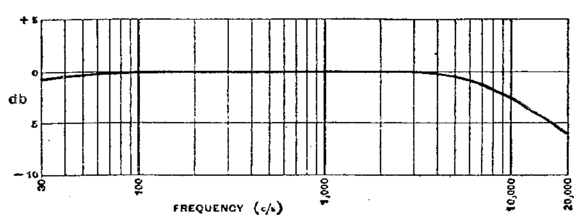
The circuit comprises a first AF stage, a resistance-coupled phase-splitting stage and a final push-pull stage. Triodes are used throughout (Tungsram LL4s in the first two stages and P27/500s in the output stage).

On test the amplifier showed no visible trace of distortion on the cathode-ray oscilloscope up to 10 watts, and the amount present at 15 watts was not serious. Under normal conditions in the average house the amplifier will handle peaks with an ample margin in hand, as with a loud speaker of normal efficiency the average output called for will rarely exceed 4-5 watts.

Input/output curve of McClure 15-watt amplifier. Full output is given for an input of 3.9 volts RMS.



(Below) Frequency response of McClure Model ACA16 amplifier.



The frequency characteristic is very good, particularly in the bass, where the loss at 30 c/s is only 0.7 db. At the other end of the scale the 2.7 db drop at 10,000 c/s would not be noticed, and at 20,000 c/s the loss is only 6 db. These figures include the output transformer which in the model tested was wound for an output impedance of 15 ohms. Other values can be supplied.

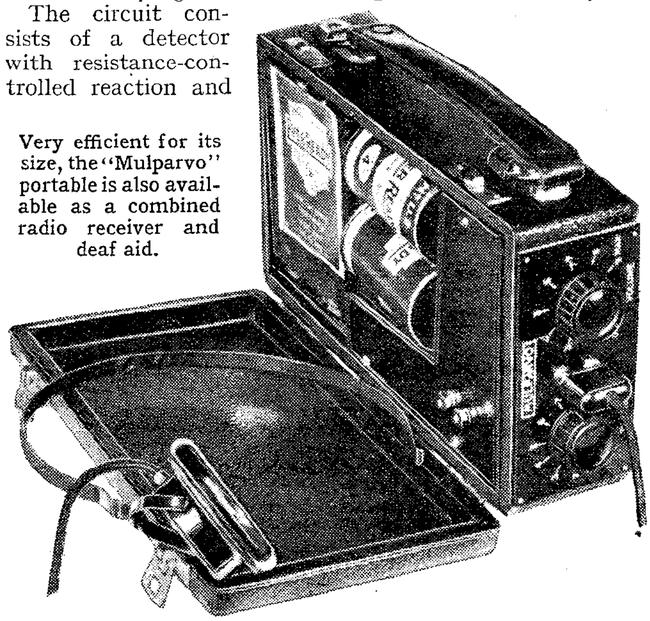
The iron-cored components are all of generous design and the workmanship and finish are excellent. Complete with valves the ACA16 costs £8 18s. 6d., and the makers are John McClure, Ltd., Erskine Road, London, N.W.3.

"Mulparvo" Portables

RADIO RECEIVERS, DEAF AIDS AND COMBINED INSTRUMENTS

FITTING into a leather case measuring about 8½×4½×2½in., and weighing under 3lb., the "Mulparvo" portable is a very efficient little receiver, with ample range on its self-contained frame aerial for the reception of the Home and Forces programmes in most parts of the country.

The circuit consists of a detector with resistance-controlled reaction and two transformer-coupled AF stages. Standard dry batteries of the deaf-aid type are used, and the valves are Hivac midgets (XD in the first two stages and XL in the output stage). The receiver gives an unexpectedly high performance for its size, and this is no doubt accounted for by the smooth reaction control backed by an AF gain above the average. Reception of Continental stations is well within the range of the receiver when a short aerial is connected to the terminal provided.



Very efficient for its size, the "Mulparvo" portable is also available as a combined radio receiver and deaf aid.

The finish and general construction of the set are very good indeed, and it should make the ideal "personal" set either for the civilian or the soldier. The price is £5 10s., and the leather case is £1 extra.

A combined radio set and deaf aid is also available. This instrument, which weighs 3½lb., and measures 9½ × 5 × 2½in., makes use of a high-grade crystal microphone, and gives excellent reproduction with the slight increase of high fre-

Apparatus Reviewed—
quencies which most deaf people find beneficial. The price of the combined instrument is 14 guineas, or the deaf aid may be obtained separately at 10 guineas. A single earpiece of good characteristics is included with each type.

The makers are Mulparvo, Ltd., 17, Gillingham Street, London, S.W.1.

The Wireless Industry

WE have received a copy of List No. 163, the 1940 catalogue of A. F. Bulgin and Co., Ltd., By-pass Road, Barking, Essex. The components illustrated show no diminution in scope and variety and the firm are to be congratulated on their efforts to maintain adequate supplies for the experimenter.

An illustrated catalogue dealing with battery chargers and industrial rectifiers has been produced by The Electrical Construction Co., Ltd., Lamport Hall, Northampton. The elements used are of the selenium type.

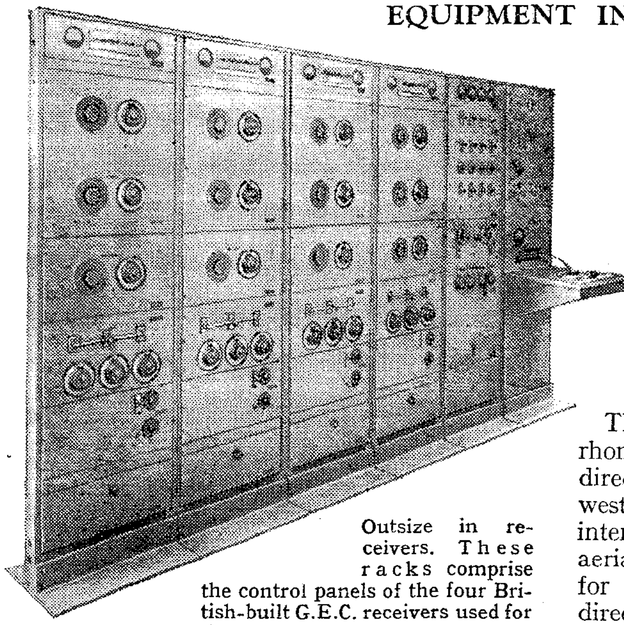
Those engaged in research or production involving high-vacuum technique will be interested in a leaflet published by W. Edwards and Co. (London), Ltd., Southwell Road, Loughboro' Junction, London, S.E.5, describing three new Metrovac rotary pumps. These are Metropolitan-Vickers products and will fill the gap left by the stoppage in the supply of German pumps.

Mr. C. O. Hamer, formerly technical adviser and works superintendent of British Ozaphane, Ltd., and E. H. Scott Radio Laboratories, Ltd., has now been elected managing director of these two companies.

Mr. Sidney Angell, formerly a director, and Mr. J. Silver sales manager, are no longer associated with these two companies.

Diversity Receivers

EQUIPMENT IN SOUTH AFRICA

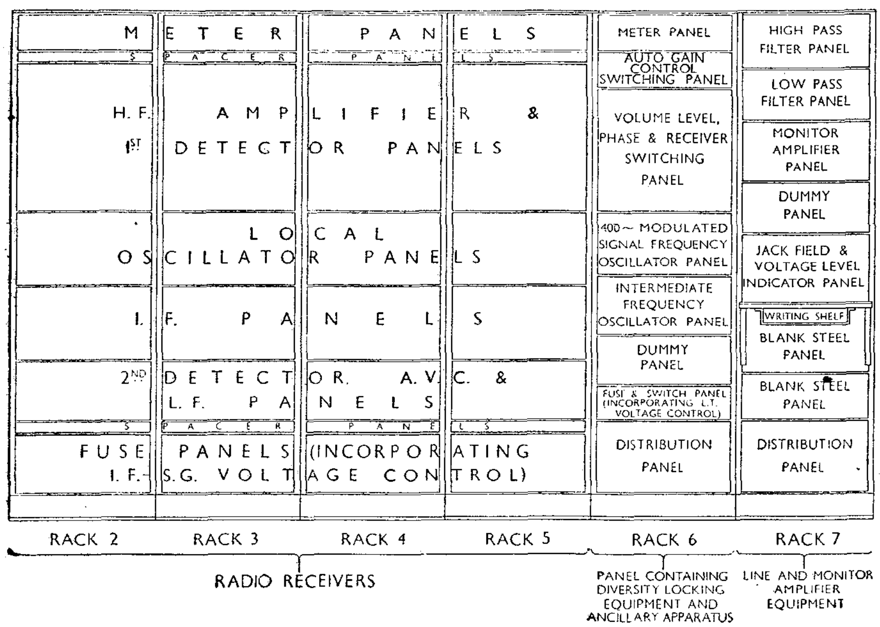


Outsize in receivers. These racks comprise the control panels of the four British-built G.E.C. receivers used for the reception of European programmes for rebroadcasting in South Africa.

THE Panorama receiving station of the South African Broadcasting Corporation was described at some length in the March issue of this journal. Thanks to the manufacturers of the receivers, the General Electric Company, it is now possible to supplement that description with a photograph and additional details of the equipment.

There are at present three rhombic aerials, which are directed on central and western Europe, but it is intended that additional aerials shall later be set up for reception from other directions. The station is mainly intended for dealing with signals on wavelengths between 13 and 30 metres, though it works quite effectively up to 49 metres.

Each of the three main G.E.C. receivers is an eight-valve superhet, and, in order to ensure precise syntony of all circuits, there is no ganged tuning; the three RF and three IF circuits of each set are individually tuned, though, of course, the latter do not require frequent readjustment. In accordance with the well-known principle of diversity reception, the receiver which is at the moment receiving the best signal from its aerial temporarily takes charge of operations, the grids of the amplifying valves of the others being automatically biased back to such an extent as to render them almost—or possibly entirely—inoperative. A fourth receiver, mounted on the same rack, acts as a stand-by.



This key shows the functions of the various panels of the "diversity" receiving equipment illustrated in the photograph.

Current Topics

RECENT EVENTS IN THE WORLD OF WIRELESS

CAR RADIO: P.M.G.'s Embargo

THE Postmaster-General announced at the end of May that a Defence Regulation had been issued which provided that, apart from certain authorised exceptions, "no person shall use or have in his possession or under his control any wireless receiving apparatus installed in any road vehicle." Special attention is drawn to the fact that the announcement states that "any wireless receiving apparatus shall, notwithstanding that *it is not fixed in position* (for example, a portable set), be deemed for the purposes of the regulation to be installed if it is in the vehicle in circumstances in which it can be used or readily adapted for use."

All ordinary receiving licences for road vehicles were cancelled on May 31st, when it was announced that all apparatus (including aerials) installed in motor cars or other road vehicles had to be removed by June 2nd whether the vehicle was at present in use or laid up.

The licences in respect of these vehicles are to be retained by the owners. Whilst no refund of the licence fee is to be made, the question whether an allowance can be granted in respect of the unexpired period will be considered when the present embargo is lifted.

A similar defence regulation has been in force in France since early this year.

The Postmaster-General states that he is unable to give a general exemption to persons or firms engaged in the supply or conveyance of radio sets to customers or the collection of receivers for repairs. In this connection, no difficulty would appear to arise in regard to mains-operated receivers which could not be used in a vehicle. In the case of battery operated sets, whether "portable" or not, it should be arranged if possible that the battery is carried on another occasion or alternatively is kept separate from the receiver, and is securely wrapped and sealed.

R.A.O.C. RECRUITMENT

THE Royal Army Ordnance Corps has introduced a voluntary recruitment scheme for men with special technical qualifications or knowledge, to be enlisted as storemen and clerks. Applications are required from men between the ages of 20 and 50, who are well grounded in the principles of commercial organisation, especially the reception, control and issue of various stock, including wireless parts. The particular need is for men with supervisory experience, and recruits of this calibre stand a good chance of early promotion.

An unmarried private in the R.A.O.C. receives 19s. 3d. per week, which rapidly rises to £1 13s. 3d.

Application forms may be obtained from The Chief Ordnance Officer, Royal Arsenal, Woolwich, London, S.E.18.

TELEVISION STANDARDISATION

R.C.A. Statement

THE Radio Corporation of America, in defence of its adoption of the American R.M.A.'s television standard of 441 lines 30 frames, has issued a statement saying that it believes these standards incorporate the best features that have been developed in the United States, England, Germany and the rest of the world.

During the course of a recent F.C.C. investigation, the suggestion was made that television receivers should be manufactured that would be able to receive transmissions from stations operated under other standards as well as under those of the R.M.A. Whilst being prepared to build such receivers in order to overcome the present deadlock, the R.C.A. does not believe that the adoption of such a suggestion would prove to be of advantage either from an engineering, economic or public service standpoint.

COLONIAL WIRELESS CHAIN

THE setting up of a chain of Colonial wireless telegraph and telephone installations by Cable and Wireless was announced by Sir Edward Wilshaw, chairman, at the recent general meeting. In anticipation of the Government's approval of the scheme, which was proposed last year, the sets had been ordered and were therefore ready for despatch in the early days of the war.

"As an auxiliary service in cases of emergency or the interruption of the cables," said Sir Edward, "they should add greatly to the flexibility of our system, bringing to the Colonial empire the advantages already existing on what I may describe as the main lines of our traffic."

LISTENING TO SWITZERLAND

IN summer, those in the more distant parts of Europe find reception of the Swiss national medium-wave stations difficult; often it is only possible at night, and even then is subject to interference. The Swiss P.T.T. accordingly decided that the rebuilt Schwarzenburg S-W station should include, apart from the directional transmitters, an "all-round" transmitter to serve Europe. This station is now carrying out daily test transmissions from 12.0 noon to 1.45 p.m. (B.S.T.) on 6.165 Mc/s (48.66 metres). Reports will be greatly welcomed by the Short Wave Section of La Service de la Radiodiffusion Suisse, Neuengasse 30, Berne, Switzerland.

RATIONING RADIOGRAMS

AN order came into force on June 6th restricting the supply to the home market of a large number of articles commonly used but not essential. Radiogramophones are scheduled as controlled goods, but wireless receivers, amplifiers, and loud speakers are excluded.

The order required all manufacturers of and wholesale dealers in controlled goods to apply to the Board of Trade for registration before June 20th. Under the order manufacturers and wholesalers will be permitted to supply to retailers during the six months to November 30th approximately two-thirds of the value of their pre-war requirements.

ENEMY ALIENS' RECEIVERS

THE Home Secretary announced on June 6th that an Order had been made prohibiting enemy aliens from having in their possession, or under their control, any wireless transmitting or receiving apparatus. Any enemy alien who is in possession of such apparatus must dispose of it

Current Topics—

forthwith. No part of the wireless licence fee will be refunded.

It was learned on enquiry at the G.P.O. that relay apparatus installed in subscribers' houses does not come under this ban because the subscriber has no control over the apparatus.

THE U.I.R.

IN an earlier issue it was stated that the war having so restricted the activities of the International Broadcasting Union (U.I.R.), the Geneva office would probably be transferred to the Control Centre of the Union at Brussels. In view of the recent invasion of Belgium, it will be evident that this rumoured removal did not take place. It was agreed at a meeting in April that, in spite of the difficulties, the work both at Geneva and Brussels should be carried on.

It is not yet known whether the Brussels checking station will be in a position under Nazi rule to continue its work of policing the ether.

FROM ALL QUARTERS

Tribute to Radio Officers

MR. H. A. WHITE, chairman of the Marconi International Marine Communication Company, at a recent meeting paid tribute to the endurance and continuous heroism of the radio officers in the company's service, twenty-three of whom had lost their lives, including three who were serving on the *Rawalpindi*.

WLWO Testing

THE recently completed 50-kW transmitter of the international short-wave broadcasting station WLWO of the Crosley Corporation, Cincinnati, U.S.A., is now conducting test transmissions on 9.590 Mc/s (31.28 metres) and 6.060 Mc/s (49.50 metres). The higher frequency is generally employed for transmissions between 4.0 and 8.0 a.m. and 11.45 a.m. and 9.0 p.m., whilst the lower frequency is used between 9.0 p.m. and 4.0 a.m. (B.S.T.).

Business as Usual?

IN the April issue of *QST*, a note from a German amateur is published in which he states that a number of German amateur transmitters have been relicensed and are operating in the usual manner. "Very subtle propaganda this, calculated to impress the neutrals, especially the Americas," comments the *T. & R. Bulletin*.

Philips

SINCE the invasion of Holland it has been announced that the registered office of the Dutch Philips companies at Eindhoven has been transferred to Curaçao in the Dutch West Indies.

Amateur F-M Transmissions

THE Federal Communications Commission recently modified the rules governing amateur stations to make available to American amateurs the band from 58.5 to 60 Mc/s for radiotelephone frequency-modulation transmissions. Previously amateurs were permitted to use radiotelephone frequency modulation in all amateur bands above 112 Mc/s. The change will provide a greater opportunity for experimental F-M transmissions since equipment is generally available for the lower band.

Naming Scientific Instruments

IN view of the confusion which exists over the naming of scientific instruments, a suggestion that there should be set up an authoritative body to whom the proposed name for an instrument could be submitted for approval will be received with interest. It is one of several such suggestions put forward by Mr. J. W. Williamson (formerly secretary of the British Scientific Instrument Research Association) in an article in the May issue of *The Journal of Scientific Instruments*, published by the Institute of Physics.

Patent Licences

IT is announced that arrangements have been made by the British Licensing Pool whereby the patents controlled by A. C. Cossor within the scope of the A5 Licence are available to licensees without payment of additional royalty.

N.P.L. Superintendent

DR. E. H. RAYNER retired from the post of superintendent of the Electricity Department of the National Physical Laboratory on March 31st, having attained the normal age limit. He has been succeeded by Mr. R. S. J. Spilsbury, formerly principal scientific officer in the department.

Radio Therapeutic Apparatus

"THE Application of Short Waves to Medical Science," is the subject of the address to be given by Dr. P. P. Dalton at the meeting of the British Institution of Radio Engineers, at 7 p.m. on Friday, June 21st, at the Federation of British Industries, 21, Tothill Street, Westminster, S.W.1. Readers of *The Wireless World* wishing to attend should apply for tickets beforehand to The General Secretary, Duke Street House, Duke Street, London, W.1.

B.B.C. European News Service

NEWS bulletins in English are radiated by the B.B.C. in the European short-wave service at the following times (B.S.T.):—

From GSA, 6.050 Mc/s (49.59 metres), and GSW, 7.230 Mc/s (41.49 metres), at 12.30, 1.30, 7.15 and 9.0 a.m., and 12.45, 2.15, 5.0, 7.0 and 11.0 p.m.

From GRX, 9.690 Mc/s (30.96 metres) at 12.30, 1.30, 7.15 and 9.0 a.m., and 7.0 and 11.0 p.m.

From GSE, 11.860 Mc/s (25.29 metres), at 12.45, 2.15 and 5.0 p.m.

I.E.E. Wireless Section

No nominations having been received other than those proposed by the Wireless Section Committee of the I.E.E. for the vacancies which occur on the committee on September 30th, the following have been duly elected for the year 1940-41: Chairman, Mr. W. J. Picken (Marconi's W.T. Co.); vice-chairman, Mr. T. E. Goldup (Mullard); ordinary members, Messrs. L. W. Hayes (B.B.C.), T. H. Kinman (B.T.H.) and R. P. Ross (Signals Experimental Establishment) and Dr. R. L. Smith-Rose (N.P.L.).

Cossor Export Receivers

WE learn that A.C. Cossor, Ltd., have in course of production a high-performance short-wave broadcast receiver for operation from a 6-volt car battery. The circuit will be similar to those of the Model 396 EXZ and Model 396 EXU, which work from AC and AC/DC mains respectively. In these receivers there are three wavebands (13.6-40, 40-110 and 195-560 metres), and the 5-valve+rectifier circuit includes an RF stage. Voltage adjustment is provided for 100-125 and 200-250 volt mains in the case of the AC set, and 200-250 volts in the universal set. The permissible latitude in mains frequency is 40 to 100 cycles.

Valves in Part Exchange

IT was recently announced in Berlin that listeners wishing to purchase new valves would have to give an old valve in part exchange. A similar scheme is already in operation in regard to gramophone records.

A Coming of Age

CANADA'S pioneer radio station, CFCF at Montreal, celebrated its twenty-first anniversary on May 1st, when new studios and offices were officially opened. CFCF, which from 1918-22 used the call sign XWA, is owned and operated by the Canadian Marconi Company.

Export Enquiry

Y. T. WEN, Radio Service Engineer, 47, Marshall Road, Singapore, asks British firms to send catalogues of replacement parts, accessories, testing instruments, short-wave tuning units, etc.

Illegal Transmitter

AN eighteen-year-old Sedgley, Staffordshire, youth was recently fined £50 on a charge of possessing an unlicensed transmitter. The prosecution stated that the operator, using a call sign allotted to the R.A.F., was frequently heard transmitting messages to his friends. The transmissions, however, were in no way harmful to the country.

Identifying Troop Carriers

GERMAN troop carriers is the subject of the latest identification chart issued by *Flight*, Dorset House, Stamford Street, London, S.E.1. Priced at sixpence, post free, nine views of troop carriers as well as views of the German type of parachute are given on a conveniently folded card measuring $12\frac{1}{2} \times 10$in.

NEWS IN ENGLISH FROM ABROAD

REGULAR SHORT-WAVE TRANSMISSIONS

Country : Station	Mc/s	Metres	Daily Bulletins (B.S.T.)
America			
WNBI (Bound Brook)	17.780	16.87	5.0, 6.0.
WCAB (Philadelphia)..	6.060	49.50	11.45 (Tu., Wed. and Fri), 12.0 midnight†.
WCAB	9.590	31.28	11.45 (Mon., Th. and Sat.).
WCBX (Wayne) ..	15.270	19.65	8.30‡, 10.50§‡.
WCBX	17.830	16.83	1.0, 2.0†, 3.0†, 3.15§‡, 4.0*†, 4.30§‡, 6.0, 6.30§‡, 7.55†.
WGEO (Schenectady) .	9.530	31.48	8.30†, 9.55§‡, 11.25‡.
WGEA (Schenectady) .	15.330	19.57	1.0, 2.0‡, 9.55§‡.
WPIT (Pittsburgh) ..	15.210	19.72	6.0.
WRUL (Boston) ..	6.040	49.67	4.15 a.m.§‡, 12.0 midnight‡.
WRUL	11.790	25.45	4.15 a.m.§‡, 9.30§‡, 12.0 midnight†.
WRUL	15.250	19.67	9.30§‡.
WLWO (Cincinnati) ..	6.060	49.50	7.25 a.m.
WLWO..	9.590	31.28	7.25 a.m.§‡, 1.15.
Australia			
VLQ (Sydney).. ..	9.615	31.20	9.15 a.m.
VLQ2	11.870	25.27	9.15 a.m.
VLR (Melbourne) ..	9.580	31.32	10.0 a.m., 2.50.
VLR3	11.850	25.32	9.50.
China			
XGOY (Chungking) ..	9.500	31.58	10.30.
XGOY	11.900	25.21	11.30 a.m., 12.10, 10.30.
Finland			
OFD (Lahti)	6.120	49.02	} 12.15 a.m., 8.55 a.m., 7.15, 10.15.
OFD	9.500	31.58	}
France			
TPC13 (Paris-Mondial)	9.520	31.51	2.30 a.m., 5.45 a.m., 7.30 a.m.
TPA4	9.680	30.99	9.15 a.m., 8.30.
TPA4	11.720	25.60	2.30 a.m., 5.45 a.m.
TPB8	11.845	25.33	2.30 a.m., 5.45 a.m., 4.45, 8.30.
TPA3	11.885	25.24	8.30.
TPB6	15.130	19.83	9.15 a.m., 4.45.
TPC5	15.240	19.68	2.0.
TPB3	17.850	16.81	12.0 noon.
French Indo-China			
FZR (Saigon)	11.780	25.47	12.0 noon, 4.45.
Germany			
DJC (Zeesen)	6.020	49.83	8.15, 11.15.
DJI	7.290	41.15	11.15.
DJA	9.560	31.38	7.15.
DJD	11.770	25.49	8.15, 11.15.
DJL	15.110	19.85	10.15 a.m., 2.15, 6.30, 7.15, 8.15, 9.15, 10.15.
DJB	15.200	19.74	5.15, 8.15, 9.15, 10.15.
Hungary			
HAT4 (Budapest) ..	9.125	32.88	1.30 a.m.§.
HAT5	9.625	31.17	12.15 a.m.‡, 12.30 a.m.†.
HAS3	15.370	19.52	3.55†.

Country : Station	Mc/s	Metres	Daily Bulletins (B.S.T.)
India			
VUC2 (Calcutta) ..	9.530	31.49	4.20 a.m.
VUM2 (Madras) ..	9.570	31.35	4.20 a.m.
VUD2/3 (Delhi) ..	9.590	31.28	4.20 a.m., 9.0 a.m., 1.30, 4.50, 6.30.
VUD3	15.290	19.62	4.20 a.m., 9.0 a.m.
Italy			
I2RO3 (Rome) ..	9.630	31.15	4.0 a.m., 7.35 a.m., 7.28, 10.15‖.
I2RO9	9.670	31.02	12.30 a.m.
I2RO4	11.810	25.40	4.0 a.m., 4.40, 8.25.
I2RO6	15.300	19.61	4.0 a.m., 7.35 a.m., 12.15, 8.25.
I2RO8	17.820	16.84	12.15, 4.40.
Japan			
JZJ (Tokio)	11.800	25.42	9.5.
JZK	15.160	19.79	9.5.
Manchukuo			
MTCY (Hsinking) ..	11.775	25.48	7.30, 10.0.
Rumania			
Bucharest	9.280	32.33	10.0.
Russia			
RW96 (Moscow) ..	6.030	49.75	9.0, 10.30, 11.0, 11.30.
RWG	7.360	40.76	10.30.
RKI	7.520	39.89	10.30, 11.30.
RIA	8.070	37.17	11.30.
RW96	9.520	31.51	9.0, 10.30, 11.0, 11.30.
RAL	9.600	31.25	1.0 a.m., 9.0, 10.30, 11.30.
RIC	11.640	25.77	12.0 noon.
—	11.900	25.21	12.0 noon.
RNE	12.000	25.00	1.0 a.m., 4.0†, 11.30.
RKI	15.040	19.95	1.0 a.m.
RW96	15.180	19.76	1.0 a.m., 9.0 a.m.
Spain			
FET1 (Valladolid) ..	7.070	42.43	8.50.
EAJ7 (Madrid) ..	9.860	30.43	12.30 a.m.
Sweden			
SBO (Motala)	6.065	49.46	10.45.
Turkey			
TAP (Ankara) ..	9.465	31.70	8.15.
TAQ	15.195	19.74	1.15.
Vatican City			
HVJ	6.190	48.47	8.0 (Tu.).
HVJ	11.740	25.55	2.30 (Mon.).
Yugoslavia			
YUA (Belgrade) ..	6.100	49.18	8.30, 10.30.

The times of the transmission of news in English for Europe from the B.B.C. short-wave station are given on the opposite page.

REGULAR LONG- AND MEDIUM-WAVE TRANSMISSIONS

Country : Station	kc/s	Metres	Daily Bulletins (B.S.T.)
Finland			
Lahti 1	166	1,807	12.15 a.m., 8.55 a.m., 7.15, 10.15.
France			
Radio Paris	182	1,648	10.15.
"Radio 37"	832	360.6	6.45, 9.15, 10.45.
L'Ile de France ..	1,204	249.2	6.45, 9.15, 10.45.
Germany			
Bremen 2	224	1,339	10.15 a.m., 2.15, 5.15, 8.15, 9.15, 10.15.
Bremen 1	758	395.8	12.15 a.m., 10.15 a.m., 2.15, 5.15, 7.15, 8.15, 9.15, 10.15, 11.15.
Hamburg	904	331.9	12.15 a.m., 10.15 a.m., 2.15, 5.15, 7.15, 8.15, 9.15, 10.15, 11.15.
Hungary			
Budapest 1	546	549.5	11.10.

Country : Station	kc/s	Metres	Daily Bulletins (B.S.T.)
Ireland			
Radio-Eireann.. ..	565	531	6.45‡, 10.10 (10.5 Sun.).
Italy			
Rome 1	713	420.8	12.30 a.m., 7.28, 10.15‖.
Milan 1	814	368.6	12.30 a.m., 7.28.
Latvia			
Madona	583	514.6	10.0 (Tu. and Fri.).
Kuldiga	1,104	271.7	10.0 (Tu. and Fri.).
Rumania			
Bucharest	823	364.5	12.15 a.m., 2.30, 10.50‖.
Russia			
Moscow 1	172	1,744	11.0, 11.30.
Sweden			
Falun	1,086	276.2	10.45.

All times are p.m. unless otherwise stated. * Saturdays only. § Saturdays excepted. † Sundays only. ‡ Sundays excepted. ‖ Approx. times.

Morse Key Manipulation

CONTROL OF MUSCULAR MOVEMENT : AVOIDING FATIGUE

By H. F. JONES

Controversy has arisen in our correspondence columns over the right method of manipulating a morse key. Here is an article by an instructor of long experience that throws light on the subject, and shows how the human machine may be used to best advantage

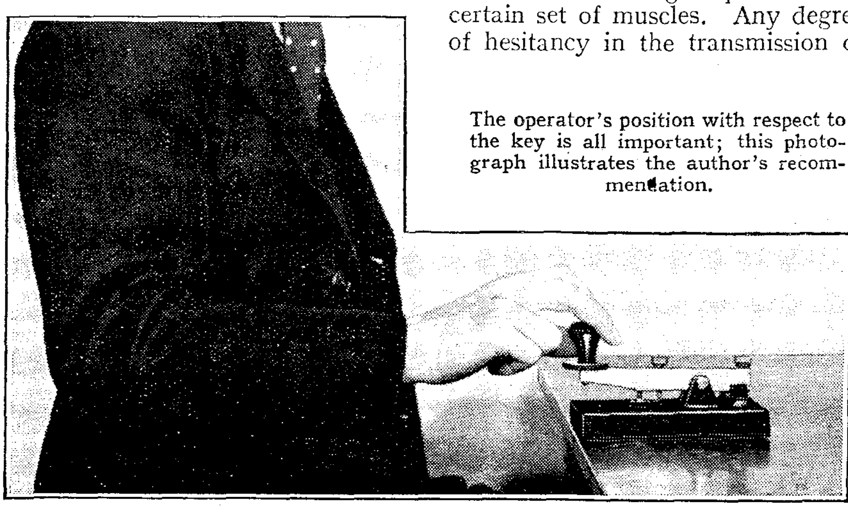
IN view of the many hundreds of recruits to the morse key, and of the various opinions held regarding its manipulation, it is hoped that the following suggestions may prove of assistance to the beginner. They are the result of twenty years' experience of morse operating with British and American keys.

I am afraid that there will always be a difference of opinion on this subject, probably for the very good reason that hands also differ considerably as regards physical proportions. Moreover, British made keys are found in such a variety of shapes and sizes, with an equal variety of movement, that I am somewhat hesitant in recommending a definite line of attack. I am confident, however, that the following explanations will help to throw a light on most of the important points on which there is disagreement, at the same time offering substantial help and guidance to the beginner.

The question of muscular control possessed by the individual with regard to wrist movement has a most important bearing to each case. The pianist, for example, endeavours to develop complete muscular control over finger action and wrist movement throughout the entire length of the keyboard. Similarly, the correct manipulation of a morse key can only be accomplished by absolute control of wrist muscle movement. The beginner must realise at the outset that every movement of the morse key should be the result of deliberate, definite, predetermined wrist action. Close attention to detail in the preliminary stages is essential.

I propose to give, in the first place, a brief consideration to muscular movement in relation to wrist action as far as it concerns the manipulation of a morse key.

It is common knowledge that every movement of the body is accomplished by muscular action, the muscles receiving stimulation from the nervous system. They may be regarded as consisting of contractile tissues. That is, tissues which have the power, when stimulated, of instantly changing their shape. The nervous system controls and co-ordinates the working of all the various parts of the body. A wrist movement, for example, is accomplished by the brain and the nerves transmitting impulses to a certain set of muscles. Any degree of hesitancy in the transmission of these impulses will obviously result in uneven action of the wrist. It is therefore important to concentrate on manipulating the morse key if perfect morse characters are to be produced. There must be complete and perfect co-ordination between the brain, nervous system and the muscles; and no undue strain placed on any part of the system. Concentration, however, must be closely accompanied by a state of relaxation. The necessity for this is in order to avoid bringing into action various sets of muscles that are not directly responsible for wrist action, and only result in a state of fatigue.



The operator's position with respect to the key is all important; this photograph illustrates the author's recommendation.

Ease of Posture

It is of the utmost importance when taking up a position before the key to endeavour to hang the arm (from shoulder to elbow) loosely at the side. The top of the arm fits into a shallow cup in the shoulder blade, forming a ball-and-socket joint. It thus has a wide degree of movement. A variety of muscles are brought into action when the arm is moved. It is therefore reasonable to suppose that if the arm is hung loosely at the side no unnecessary muscular movement takes place, and therefore no fatigue can possibly come from that source.

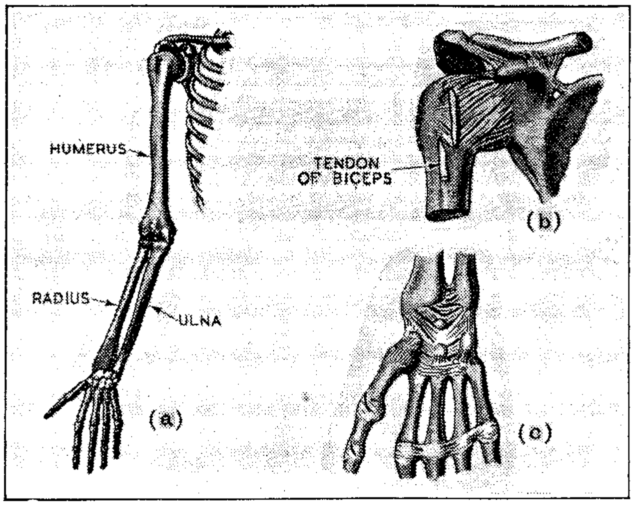
The forearm (from elbow to wrist) consists of two bones, the radius and the ulna. These combine with the lower end of the arm and form a hinged joint. When the forearm is raised in order to place the fingers on the key two important muscles are stimulated. The biceps, situated in front of the arm, and the triceps, behind the arm. The forearm should be on a plane approximately

Morse Key Manipulation—

parallel with the table, so that the elbow is neither above nor below this level. In this manner, the strain on the muscles is fairly evenly balanced.

The wrist contains eight small cubic shaped bones, bound with ligaments and connected to the muscles by means of tendons. These bones articulate with the radius and ulna, to form a guiding joint, which is controlled by no fewer than twelve individual muscles. Each one of these muscles has its own separate connection to the nervous system. If, therefore, the rest of the body is in a state of relaxation, the ultimate control of the wrist will be so much more definite.

If the wrist is inclined to be awkward in movement, simple exercises may be profitably practiced. Moving the hand backwards and forwards and with a circular motion will do much to loosen up the muscles. Massage, in obstinate cases, will also help considerably. It will be found advantageous to commence manipulation practice by placing the first two fingers on the edge of a table and work the wrist to correspond with the morse characters. This will also have the effect of loosening the wrist, and will tend to create a feeling of familiarity with the key even before it is handled.



The bones of the human arm, as well as the small bones of the wrist mentioned in the test, are shown at (a). Articulations and dispositions of ligaments of shoulder joint and wrist are illustrated at (b) and (c).

The beginner is strongly advised to practice for a week, on the table, before touching the key. I can positively assure him it is time well spent, and it may be the means of saving much weary labour at a time when it can be ill-afforded.

The actual method of holding the key may depend upon physical proportions; whether one's fingers are long and slender, or short and stumpy. In either case the position of the thumb should not vary. There is usually a groove at the side of the key knob, the thumb should be placed in this groove, and should remain there throughout the entire period of movement. The first two fingers should be slightly bent and placed on top of the key. If, however, the fingers are long and slender, they may be placed slightly over the knob of the key, with the first joints just bearing on the outer edge. The wrist should be made to fall and rise to correspond with the morse characters. Groups of dots comprising such characters as "I," "S," "H" and the figure "5" must be crisp, well defined, deliberate characters. The characters "C," "Q," "Y," "F" and "L" must also be well defined and deliberate groups. On no account rush the dots. It is such a common failing in the preliminary stages for the beginner to produce dots at a terrific speed, and the rest of the morse characters at a slow, uneven rate, the whole resulting in complete lack of style, and being quite unreadable. It is my firm opinion that the first month of key practice should be confined to developing a good style in manipulating the key. Once style is achieved, speed will follow of its own accord in a perfectly natural manner. It is suggested that

Morse Key Manipulation—
particular attention be paid to the following points, especially the first, which is exceptionally important.

1. One of the secrets of successful key manipulation is in relation to spacing. At the completion of a letter character practice slightly raising the first two fingers from the key, just an eighth of an inch is sufficient. This will give the necessary space between the letters. On completion of a word, lightly touch the table to the right of the key. This will afford the correct space between words. Maintain this style of practice for at least a month; after which you will have developed the habit of automatic spacing. This style will never leave you; even at speeds of twenty-five words per minute the spacing will be well defined.

2. The key spring tension is important. It should be adjusted so that the contacts are separated by this tension, and not by the action of the wrist. No excessive effort, however, should be expended in "making" the key contacts. Otherwise the muscles will suffer from fatigue to the detriment of style.

3. Keep the thumb in permanent contact with the side of the key, but do not go to extremes and apply pressure to it.

On no account manipulate the key at a greater speed than you can comfortably manage. Speed will come with practice; and in any case, more harm is done, and valuable time taken in correcting the mistakes which could so easily be avoided by careful training in the preliminary stages. In these difficult days of abbreviated training, time will be saved, and progress achieved rapidly, if a good sound foundation be laid during the first month.

This article would not be complete without a brief survey of the American method of morse key manipulation. They favour a small morse key, very light and smooth in movement. It is usually fitted approximately eighteen inches to two feet from the front edge of the table. The forearm actually rests on the table, the movement is essentially a wrist movement. It cannot possibly be anything else. The results are not, in my opinion, sufficiently outstanding to justify recommending that we change our method in favour of the American. But I have grown wiser with the years, and have no intention of inviting a howl of righteous indignation from any of the various schools of thought.

Test Report

The "Double-Decca"

COMBINED AC/DC AND "ALL DRY" BATTERY PORTABLE (4 VALVES+RECTIFIER). PRICE: 10½ GUINEAS

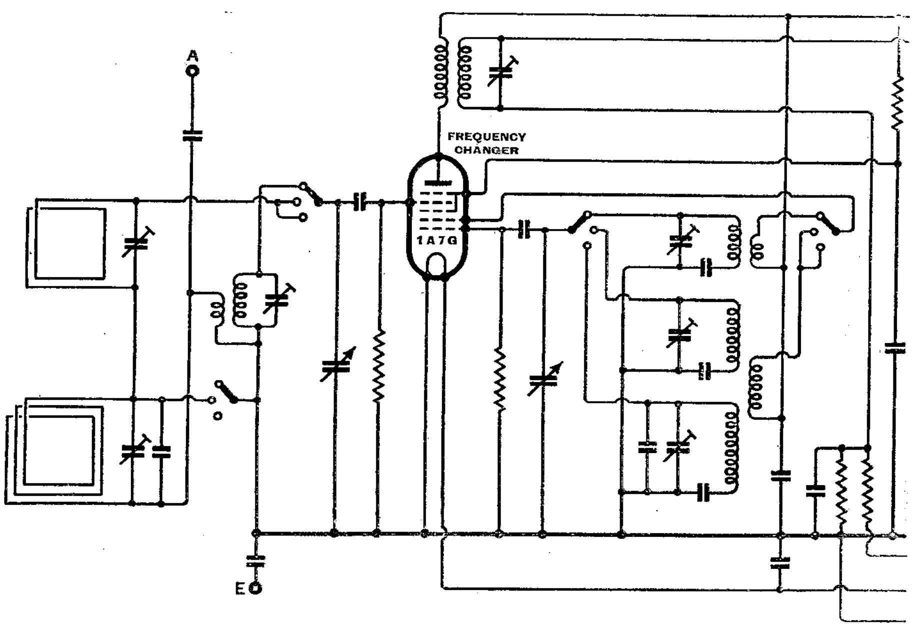
THE title of this set is singularly appropriate, for it is virtually two sets rolled into one. Its small size, neat appearance, and the fact that it can be operated entirely from dry batteries gives it the status of a modern portable, while the ability to receive short waves when coupled to an outdoor aerial enables it to play the part of a permanent domestic receiver.

The duality is further emphasised in the power supply circuits, where the option is given of working from either mains or batteries.

Circuit.—Frame aerials wound with Litz wire are used for medium- and long-wave reception, and these are mounted, together with the short-wave aerial transformer, on the back panel of the set. The medium- and long-wave windings are not shorted on the lowest waveband, and serve as a small-capacity aerial for the reception of the more powerful short-wave stations. The normal aerial input for the short-wave band is via a capacity leading to the top of the short-wave primary winding.

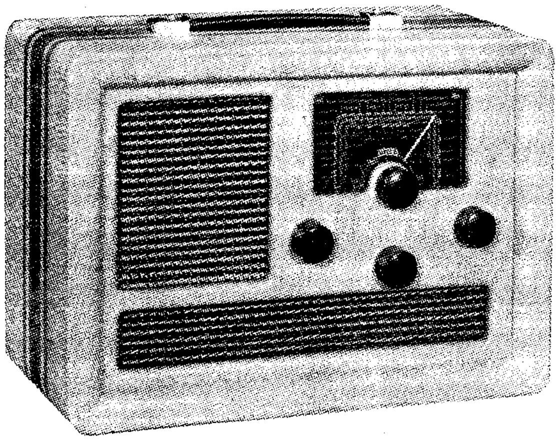
As far as the main course of the signal through the receiver is concerned, the circuit follows the standard practice of all-dry battery portables and makes use of a heptode frequency changer, pentode IF amplifier, single-diode-triode signal and AVC rectifier and first AF stage, and a pentode output valve. AVC is applied only to the IF stage.

The change-over from battery



Circuit diagram of the Double Decca portable. On mains, a rectified and smoothed supply is provided for the filaments. The intermediate frequency is 380 kc/s.

to mains operation, although not automatic, is foolproof. A multiple switch connects the filament in parallel for battery operation and in series for mains. As the filaments are directly heated, it is necessary to rectify and smooth the supply current from the mains. This is effected by a combination of choke and resistance smoothing filters using electrolytic condensers of high capacity. The pilot lamp is connected in series with the rectifier valve heater.

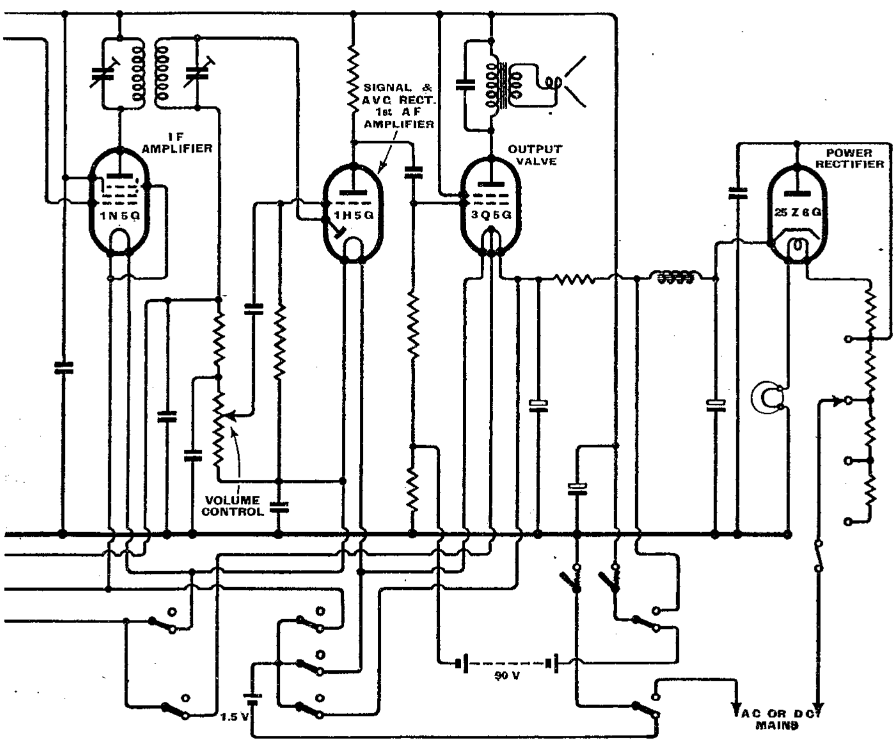


Performance.—The sensitivity on medium and long waves is excellent and gives many foreign stations in addition to the B.B.C. Home Service when using the set on the internal frame aerials. Selectivity is good and there is a commendable absence of self-generated whistles.

The more powerful short-wave stations are just audible without an external aerial, but the latter is really essential for listening on the 16-49-metre band. The performance is then comparable with that given by a normal table model superhet without an RF stage, but it is generally necessary to leave the volume control at maximum for all but the more powerful European short-wave broadcast stations. Tuning is somewhat critical near the bottom end of the waveband, and there is some tendency to "pulling" between oscillator and aerial circuits, but this did not prevent the successful reception of American stations under none too favourable propagation conditions.

Quality of reproduction is good if due allowance is made for the lack of bass inseparable from the use of a small-diameter loud speaker diaphragm (4 inches) and the compact dimensions of the cabinet. The efficiency in the middle and upper parts of the musical scale is high, and all programme material, including speech which calls for clarity rather than a broad bass response is dealt with faithfully.

Constructional Features.—The cabinet design has been well thought out, and the front panel has been recessed so that the control knobs do not project beyond the edges of the case. Indirect illumination against a black background is provided for the tuning dial when the set is used on mains.



WAVERANGES

Short ...	*16-49*	*metres*
Medium	*200-550*	*metres*
Long ...	*1000-2000*	*metres*

The chassis consists of a flat plate screwed parallel to the front of the cabinet on distance pieces, and the tuning condenser and volume-control spindles pass through this plate at right angles. The valves are mounted horizontally.

Access to the combined LT and HT dry battery is obtained by lifting a hinged flap at the back of the set. Space is provided at the side of the battery for stowing the mains lead. This contains the resistances for feeding the valve filaments, and should not be reduced in length.

The HT consumption in the particular receiver tested was 13.5 mA with a new battery.

MULTICORE SOLDER

MANY technical improvements are to be found in this product of Multicore Solders, Ltd., Bush House, London, W.C.2. Instead of the usual single core of rosin, there are three cores of smaller diameter distributed evenly in the body of the solder.

The flux used is chemically similar to rosin, but is treated to ensure uniformity of melting point and greater fluxing action at soldering temperatures. It is non-corrosive and has been approved for use by the G.P.O. and the A.I.D.

A wide range of alloys is available for different purposes, and the wire may be obtained in gauges from 10 to 22 SWG.

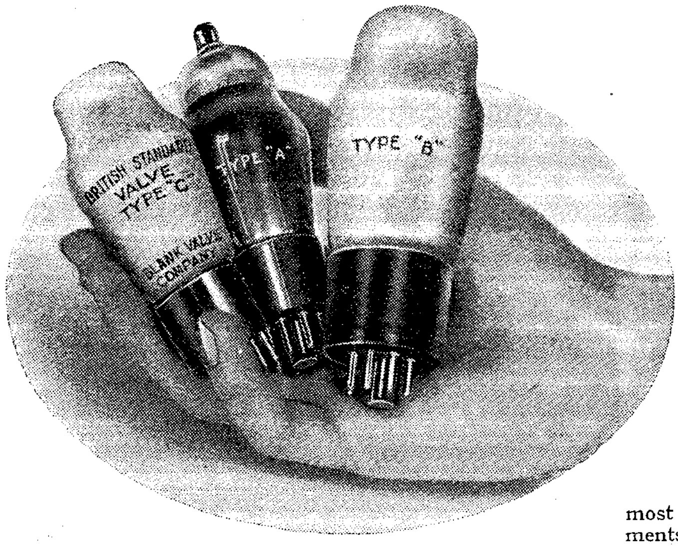
Full details and some very interesting general information on solders and fluxes is contained in a well-prepared booklet which has been recently issued by the Research Laboratories of the firm.

Rationalising Broadcast Receivers

ECONOMY IN LABOUR AND MATERIAL: SUGGESTIONS FOR A "TOTAL WAR" PLAN

By J. A. SARGROVE, N.C.Mech.E., F.T.S.

A plan for furthering the war effort, both by increasing export and by releasing technicians for direct war work. The author proposes a drastic simplification of valve types, together with standardisation of components and appropriate changes in receiver design.



The author suggests that three mains valve-types would satisfy most of the requirements of receiver design.

THAT there are two schools of thought amongst radio engineers on the subject of standardisation was well brought out in the discussion that followed Mr. P. R. Coursey's lecture before the I.E.E. some weeks ago. Those who wish to standardise all parts of a radio receiver appear to be in the majority, but many fear that any form of standardisation would be impracticable, or even that it would have harmful results.

At subsequent meetings of the Standardisation Committee at the British Institution of Radio Engineers a much greater agreement in favour of standardisation was observable, and at the meeting held on Empire Day, May 24th, the scheme put forward by the author was seriously discussed and the proposals generally approved.

Aiding the War Effort

It was generally felt that in times like this every possible effort must be concentrated on placing the radio industry on a rational basis so that not only can it adequately satisfy home demand but increase our power of export, at the same time releasing for other more vital war industries highly skilled technicians and in particular jig and tool makers and tool designers, whose task would be considerably simplified and reduced by the scheme outlined below.

In addition, considerable amounts of raw material could be saved, thus making good to some extent the loss of essential import materials. In addition, the proposed standardisation would very greatly reduce service engineering difficulties.

Let us start with valves, amongst the bewilderingly large numbers of which even a well-trained valve engineer finds it difficult to retain his sanity, there being well over a thousand types in existence. One has only to glance through *The Wireless World* 1940 valve issue, in which only the principal six British valve makers' lists are shown, to come to the conclusion that there is something seriously wrong with our industry.

It will be generally agreed that there are only some twenty-five basic functions which valves have to fulfil and that the vast multiplicity of types has arisen mainly through such causes as the adoption of various heater ratings, various valve bases, and different conceptions as to whether the anode or the grid should be brought out to the top cap or not.

The British radio industry must look at the world market as a whole, as we are blessed with the greatest potential market of all, that of the British Empire, which we have hitherto sadly neglected. It will be generally admitted that by following divergent directions the radio industry has not made it easy to achieve our right place in this market.

In trying to put our house in order we must concentrate on a few basic facts, forgetting for the moment about specialised requirements for which it is quite obvious that specialised types of valves will always be required. We must concentrate on meeting those demands that represent the main bulk of radio valve applications, and we shall all agree that twenty to twenty-five types would be more than adequate to meet the requirements of any designer of radio receiving or allied apparatus. We must also avoid becoming too enthusiastic about the recently developed economy heaters of very low wattage but which have the undeniable disadvantage that they are thin and more fragile. Hence their reliability can never be so high as those of the more thoroughly tried thicker heaters.

One Range of Valves

Looking down the formidable range of British, International, American, and other types of valves, we shall find that the generally most useful and most widely used range is the so-called International series of 6.3 volt 0.3 amp. indirectly heated valves having the American octal type of base. Five out of six British valve manufacturers possess in their range an adequate number of types of this series, so that the general adoption of

Rationalising Broadcast Receivers—

the proposed scheme need not cause any great upheaval to the valve industry.

Of course, the higher voltage 0.3 amp. series heater types, such as rectifiers and output valves, must be included in the twenty to twenty-five types contemplated as the first step towards standardisation.

Turning from valves to receivers, it is suggested that further simplification can be readily effected by avoiding unnecessary duplication at present practised by practically every set maker in manufacturing both AC and

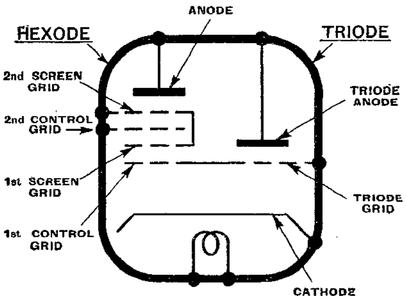


Fig. 1.—Electrode arrangement of the type of triode-hexode suggested by the author as a general-purpose valve.

AC/DC sets, between which there is no great difference in performance. This is a truly redundant state of affairs, since the typical AC/DC set is not seriously outclassed by the pure AC set. Even the difference in output volume is hardly appreciated by the general public, which, in the estimation of the writer, is generally unable to differentiate between volume levels of less than 10 db.

In present circumstances the proposed scheme therefore visualises the production of AC/DC sets for all normal requirements. They would have an output of the order of 2 watts, which is adequate for the home and most other uses.

Thus something like half a million mains transformers would be saved in a year. The main constituent parts of these (the high-quality soft iron) originates to a large extent in Sweden, whilst much of the copper wire has hitherto been obtained from Belgium.

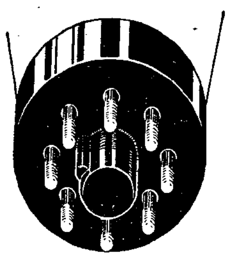
In addition, in the smaller mains receivers, such as midgets, we can also dispense with the smoothing choke by the simple expedient of passing the semi-smoothed rectified supply to the anode of the pentode or beam tetrode output valve, and smoothing by means of a resistance in the HT supply to the screen of this valve and to the positive electrodes of the other valves.

This will save several hundred thousand smoothing chokes, consisting of the materials mentioned above. We might even adopt permanent-magnet speakers as a standard; in total weight of material they use less, and our own steel industry is capable of supplying all the magnets required without the necessity for drawing on any appreciable foreign supply, thereby saving more copper wire by eliminating the energised speaker.

In addition, all the ancillary parts, such as smoothing condensers of the electrolytic type, decoupling condensers, fixed resistors, and mica condensers, as well as potentiometers and volume controls, tuning condensers, coils, and IF transformers, could be standardised and the bewildering multiplicity of types would be greatly reduced, although our home and export requirements could still be adequately met. It is not intended to curb the set designer as regards the final product, but only to limit the diversity of components that are available to him.

More Drastic Simplifications

Once we have done this we can go even further. The proposals discussed on May 24th also included the evolution of all receivers designed around three basic types of valve. The first should fulfil as many purposes as possible, and several valves exist in our present range which can be used to perform the jobs of frequency changing: RF, IF, and AF amplification; de-modulation, AVC; twin input circuit mixing; BF oscillator, etc. All these functions can be performed by the triode hexodes, in particular by the type in which the first control grid of the hexode portion is common to the triode grid (see Fig. 1). There is no doubt the valve industry could readily develop an ideal type on these lines that would so perfectly fulfil the above requirements that all diversity could be eliminated and the same valve used for all the above purposes in all receivers.



It is suggested that we should standardise the Octal base, here seen actual size.

The second basic type is an output tetrode, and a valve of the 25L6G class is suggested. As this valve has been designed to operate with a screen voltage of the order of 100 volts, it can

Rationalising Broadcast Receivers—
be used for such low voltages quite efficiently, but can also be used at higher voltages for a larger output. In those cases where still more output is required, two or more of this type can be used in push-pull.

The third basic type required is a two-system indirectly heated rectifier of the type having a series-heated filament passing 0.3 amp. at approximately 25 volts. All electrodes would be brought out to separate pins.

A rectifier basically designed for RMS voltages of the order of 125 volts is equally usable at higher voltages if small series resistors are inserted in each anode lead. In those cases when a transformer-type rectifier system is required for yet higher voltages, two of these can be used as a bridge circuit rectifier.

Thus it will be seen that most rectifier problems can be solved with one single Type 25Z6G rectifier, making all other types unnecessary and redundant.

It is clear that with the above three types one could cover something like 70 to 80 per cent. of receiver and other similar applications where mains supply is available.

In those cases where we have to content ourselves with a battery supply, analogous procedure could be followed by using at first four or five of the 1.4-volt range of valves, but ultimately we would concentrate on two basic types. First, we would need a triode-hexode of the type having the first grid of the hexode common to the triode grid, like the mains valve mentioned above. A Type 1A7G, or an improvement of it, would serve. The second type should be a beam tetrode having a 2.8-volt centre-tapped 0.05 amp. filament which could be operated either in series or in parallel with the first-named valve, which has an 0.05 amp. filament.

The writer will now attempt to show that these three basic valve types (the two last-mentioned battery valves are merely logical derivatives of the mains types) will in no way restrict the designer of apparatus either in the sensitivity that can be achieved, in the versatility of performance of the set, or in the fidelity of quality that is commercially required from the home receiver. It should be emphasised here that high-quality specialised apparatus (which only forms some 5 per cent. of the radio industry's total production) is not included in these considerations.

A triode-hexode of the type advocated gives satisfactory results as a mixer without any difficulty whatsoever down to about 13 metres. Such difficulties as exist at lower wavelengths can be overcome by using a two-valve frequency changer which the writer hopes to describe later.

RF, IF and AF Amplification

As an amplifier, this valve can be used quite easily by applying a constant potential of suitable value to the first control grid, thereby allowing the hexode portion to operate as a variable-mu tetrode consisting of the virtual cathode, the second control grid and the anode.

This tetrode has a variable-mu characteristic by virtue of the design construction of the second control grid, but its slope can, in addition, be very conveniently varied by altering the fixed bias on the first control grid, as the virtual cathode of the tetrode is subject to control by the first control grid.

This gives us a very convenient method of varying the gain of an amplifier without requiring to alter the bias on the input grid proper. It will be readily appreciated that by the first control grid bias we can vary the stability of a straight RF amplifier, or in an IF amplifier a "Lamb" type noise limiter circuit can operate on grid 1 and so on.

One can also apply AVC voltage to grid 1 as well as to the input grid proper, thus making the AVC gain control operate at a higher rate.

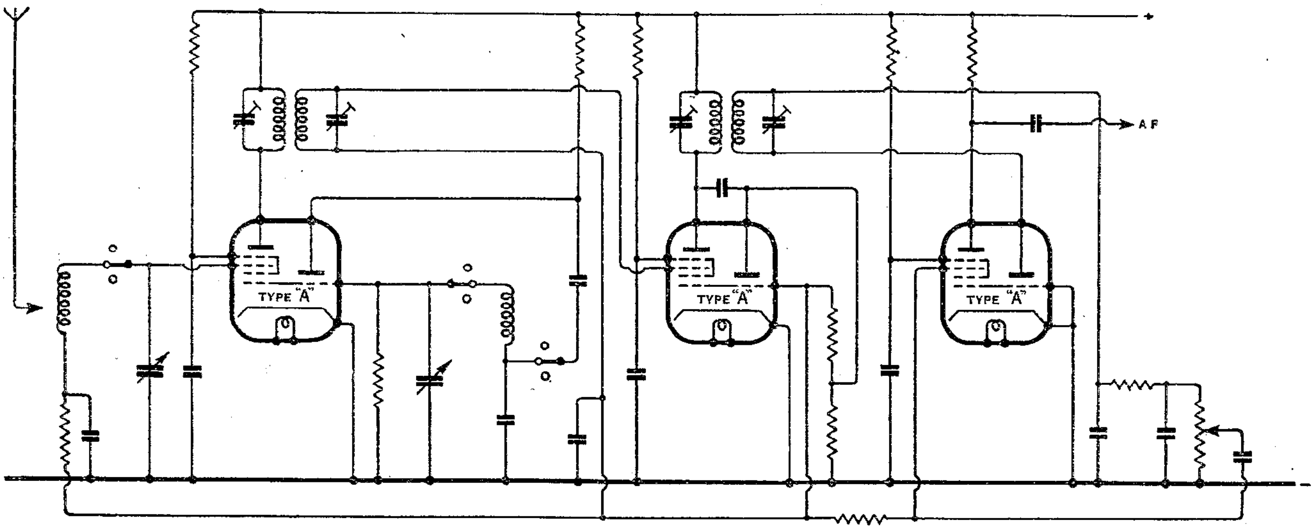


Fig. 2.—Simplified circuit diagram of the earlier stages of an AC/DC superheterodyne embodying the proposals made in this article.

The anode of the triode is a very convenient diode, the characteristic of which is also variable by the fixed bias applied to grid 1. Thus, if an IF amplifier constructed with this valve can have its own source of AVC in itself. An arrangement such as this is shown in the second stage of the basic circuit shown in Fig. 2. In the third stage of this circuit the same valve is used as follows: The first grid is at a fixed bias and the triode anode, acting as a diode, demodulates the signal in the usual way; audio-frequency voltages thus derived are applied to the second control grid of the hexode, which will thus act as a tetrode amplifier for audio-frequency signals.

As this grid has a variable-mu characteristic, one can apply the AVC voltage, or part of it, as bias and thus obtain the well-known but not very

Rationalising Broadcast Receivers—
frequently used feature of post-detector AVC, or what can be more correctly termed post-detector volume limitation.

By judicious adjustment of the design, matters can be so arranged that whatever the signal strength is above a certain limit the output valve is always fully loaded, but it cannot be overloaded.

A further feature can be conveniently incorporated in a circuit such as this. As shown in Fig. 2, fixed bias, which is normally applied in the cathode circuit of ordinary receivers, is omitted, and the input grids are prevented from reverting to cathode potential under no-signal conditions by the contact potential of the first control grid in the second stage.

Self-biasing

As shown in Fig. 3, the contact potential is that point on the grid-volts grid-current curve where grid current ceases to flow. If a grid floats freely in an electron stream, it will ultimately possess this potential provided its insulation is infinite.

With a finite leakage, say 3 to 4 megohms, as obtained from the AVC load and de-coupling circuits as shown in Fig. 2, the grid potential without signal will revert to some value around $1\frac{1}{4}$ volts, and so the input circuit at no-signal will be damped. This means that the set will have a threshold value and will ignore very small signals having a value comparable to the noise level of the set, but as soon as a signal is appreciable, the AVC derived from the second stage will push the grid bias of the first input grid to a value just larger than the contact potential. The input circuit, now becoming undamped, will immediately give an appreciable signal which will be audible. In other words, by the simplest means and without the introduction of a special so-called "squelch" valve we have incorporated QAVC into this circuit. Thus three identical valves can give us greater apparent sensitivity than the

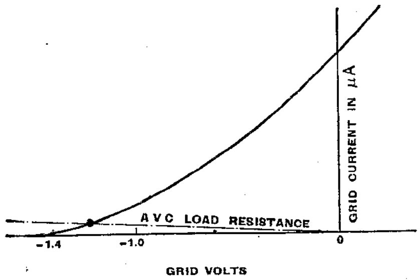


Fig. 3.—How the self-bias scheme works: grid volts-grid current curve for No. 1 grid of a triode-hexode.

usual combination of frequency changer; IF pentode; double-diode triode and, in addition, they will enable us to eliminate cathode resistors and by-pass condensers and we can have the extra attractions of post-detector limiter and QAVC. By following this combination of three Type A valves with one each of Types B and C we have a complete five-valve circuit. Of course, if more volume is desired, one or more Type B valves may be added, as mentioned above.

Fig. 4 shows a suggested arrangement for a two-plus-one-valve local station receiver which, by virtue of the electrodes available in the Type A valve, enables us to use an improved form of reaction control which, in addition to being very simple, has the

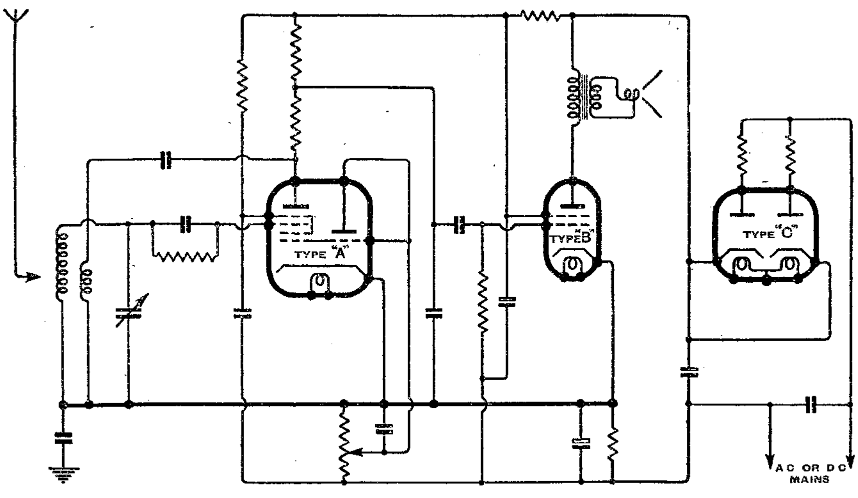


Fig. 4.—Simplified diagram of an inexpensive local-station receiver with space-change controlled reaction.

Rationalising Broadcast Receivers— virtue that it does not alter the tuning of the input circuit.

By regulating the negative bias on grid 1, we vary the slope of the tetrode (constituted by the second control grid, second screen grid and anode) by reducing or increasing the space charge which is the virtual cathode of the tetrode; thus this type of reaction could be termed "space-charge controlled reaction."

It is clear that the industry, by limiting itself to three types of valves, sacrifices nothing. In fact, the designer has great scope and the performance of even the cheapest type of receiver can be improved.

The argument that the greater complexity of Type A valves, as compared with the simpler valves hitherto used in certain circuit stages, will increase the cost of the receiver can be dismissed by pointing out that if the valve industry makes only these few basic types, production costs will be reduced, and even the cheapest type of receiver can afford to use them.

Types D and E, which are the battery equivalent of Types A and B, can, of course, be used more or less in the same manner, and, in connection with Type C, can form a battery-or-mains set.

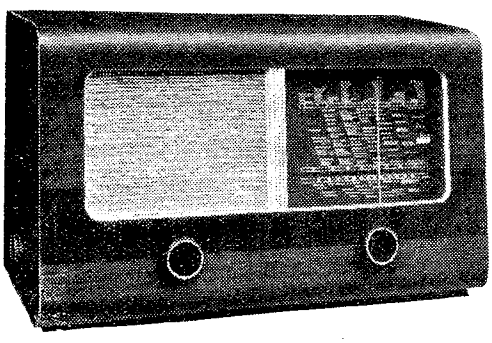
It is difficult to see that any further type except these five should be necessary except for very special applications, which, as mentioned above, do not alter the substance of the argument.

It is hoped that these proposals will be taken by the industry as indicating a way in which we could all contribute very considerably to our country's war effort without in any way limiting the technical efficiency that is so important for the export market. To summarise, it is hoped that future designs will be based on—and even present designs altered to use—the international octal range of valves. After this initial step, the time will be ripe to consider the second, long-range proposal of three basic valve types which should actually give us a great advantage over our competitors by avoiding wasteful competition between ourselves.

KB Receivers for Export

TROPICAL CONSTRUCTION AND SPECIAL SHORT-WAVE RANGES

THE Export Department at the Head Office of Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent, devotes its whole time to the problems of producing and selling sets for use overseas. It is in constant touch with Government departments and export organisations and can bring expert knowledge to bear on enquiries from local agents abroad.



The KB885-0 receiver for operating from AC or DC mains.

Three sets form the basis of the KB export programme. In all these, attention has been given to the short-wave performance and the omission of the usual long-wave band has enabled the short-wave coverage to be extended. International octal valves are used throughout, so that there should be no difficulty regarding replacements. Alternative regional tuning scales are available, and these will cover the requirements of most markets. It goes without saying that the construction has been vetted from the point of view of resistance to high temperature and humidity.

Two of the sets are for AC mains. The "Raleigh" (KB830-0) has four valves + rectifier and covers 13 to 43 metres, 43 to 150 metres and 175 to 550 metres. In the "Drake" (KB850-0) there are three short-wave ranges: (1) 13-30 metres, (2) 30-75 metres, (3) 73-200 metres, and the medium-wave covers 200-545 metres. This set has an RF stage, and push-pull pentodes in the output stage delivering 8 watts undistorted.

Finally, there is the KB885-0 receiver for operating from AC or DC mains, the wave ranges and circuit of which are based on that of the KB830-0.

The cabinet work of all these models is of similar style to that of normal domestic receivers and the tuning scales are indirectly illuminated. A visual wave-range indicator is included.

The AC models are suitable for mains of 100-250 volts, 40-60 cycles, and the DC/AC model for 200-270 volts.

New *Wireless World* Books

TELEVISION RECEIVING EQUIPMENT: FIFTH EDITION OF "WIRELESS SERVICING MANUAL"

ALTHOUGH television is "on the shelf" for the duration of the war, there is no reason why we should forget all about it. On the contrary, a widespread technical knowledge on the subject will ensure that, when the service gets under way again, it will progress rapidly and smoothly. Now is the time for those who have neglected television to make good their omission; those who have merely dabbled in it have an opportunity of putting their knowledge of this extremely interesting subject on a sound foundation.

It is for such reasons as these that our publishers have decided to issue "Television Receiving Equipment," a 300-page book by W. T. Cocking, A.M.I.E.E., of *The Wireless World*. True to its title, it does not deal with the transmitting side except in so far as is necessary to explain receiving practice. Treatment is substantially non-mathematical, although design formulæ have been included where necessary. To avoid recapitulation, it is assumed that the reader is familiar with "sound" broadcast practice. The book, which includes 167 illustrations and diagrams, some of large size, is now available, price 7s. 6d. net, or 7s. 10d. by post, from our publishers, Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

Demands from those who have joined the wireless maintenance branches of the various services is largely responsible for the fact that a fifth edition of the "Wireless Servicing Manual," also by W. T. Cocking, has now been called for. Apart from routine revision, advantage has been taken of this opportunity to add a chapter on the use of cathode-ray gear for various purposes in receiver maintenance and testing. A new appendix describes the construction of a resistance and capacity bridge and a valve-testing bridge. The fifth edition costs 5s. net., or, by post from our publishers (address above), 5s. 5d.

Random Radiations

By "DIALLIST"

History Repeats Itself

TELEVISION in the United States is running pretty true to the form that I predicted in these notes many long months ago. It was launched with one of the most terrific Press boosts of all time. The lay papers gave it huge headlines; the popular technicals devoted the greater part of several issues to it. The public rushed to see demonstrations. But the public, though eager to see television in the demonstration theatre, became strangely coy when asked to buy receivers for home use. Not long ago the head of a great manufacturing concern which has spared no effort to develop and to popularise television in the U.S. confessed that the sales resistance of the man in the street was unaccountably high. I've just been looking through the May issue of the New York *Radio News*. Not a single article on television; in fact the only reference to it in the reading pages is contained in a three-quarter column book review. And the advertisements? Here again I notice only one reference: a small advertisement by a correspondence school, offering training in "Radio plus Television."

Amateur Interest

Does this mean that the American amateur was never particularly interested in television, or that he has lost such interest in it as he had? I don't think so for a moment. The truth is that he is probably going through now very much what we went through some years ago. He was led by enthusiastic but misguided advance publicity to expect too much. In the very early days of wireless broadcasting people used to yearn for receivers that would reproduce as loudly and as clearly as the mechanical gramophones of the period: that was the natural standard of comparison, for both the wireless receiver and the gramophone are home instruments for the reproduction of speech and music. It was not long before the coming of the power valve and the balanced-armature loud speaker enabled the wireless set to equal the volume and improve on the quality of the mechanical gramophone. Then electrical methods were adopted for gramophone recording and reproduction. Both the radio receiver and the gramophone benefited equally from the development of the moving-coil speaker and now they are in such close partnership that they are combined in the radiogram. It was only to be expected that people who didn't think very clearly would seek to draw a parallel with television and the home cinematograph. At first blush it might seem that the television receiver bore to the home ciné almost exactly the same relation as the wireless receiver bore to the gramophone. But it doesn't.

Now's Your Chance

WHEN the idea of a National Wireless Register was first mooted in this journal I sent in my name at once, for I wasn't then quite sure whether or not the Army would call me back again. As things turned out, it did, and I was soldiering again before August was out. Meantime, I'd had a line from the Wireless Register folk saying that they wouldn't be needing me at once. I've just had another, this time asking me to come along, if not already booked. Too late, I'm afraid, for I can't leave the present job. Many readers will have had the same letter and, if they're still free, I advise them not to delay about coming forward. They'll find the work intensely interesting and they will be with people easy to live and work with. I can assure any who are hesitating that there are real men's jobs to be done and that many fields for research of fascinating kinds are open. Fill up the form you've had, sign on the dotted line and come along. Perhaps you didn't fill up the first form giving particulars of your wireless attainments that was published in *The Wireless World* for January 26th, 1939. If so, it probably isn't too late now to make application. You can get this form by writing to The Air Ministry, S.7.e.5, Adastral House, Kingsway, London, W.C.2.

Learning Morse

THE recent correspondence on learning morse has been of special interest to me because for some weeks now I have been running a course for army signallers. Instruction takes place over telephone lines, its object being to enable the men to read "buzzer" accurately at 10-12 WPM. At first we were hard put to it to con-

Random Radiations—

trive a buzzer that could be used in conjunction with the "spouted" microphone of the head-and-breast set. Experiments showed that good signals could be sent over some miles of none-too-good line by propping up a buzzer on a stand in such a way that the instructor could let the "spout" of his microphone just touch its frame. We have found that we get the quickest results by familiarising our pupils with the sounds of individual letters, making the dits at first as long as the experts dahs, or even longer. At the very beginning only four or five letters were taught during each short lesson. Each letter was sent at first very slowly until the pupil had got the "rhythm" of it into his head. Then dits and dahs were gradually shortened until their length was more or less normal. At the end of the lesson most of them could recognise letters when sent with quite short dits and dahs. The next lesson began with a recapitulation of the preceding one; then other letters were taught. In this way we found that men soon knew the alphabet with dits and dahs of normal length and that they could take down correctly groups of letters, so long as the intervals between letters were exaggerated. Syllables followed, with long intervals between letters to begin with. These could soon be brought down to something approaching normal, and we very soon had a good proportion of the men reading 5 WPM with dits and dahs of normal length, normal intervals between letters and exaggerated intervals between words.

Speeding Up

Hence I'm in agreement with Mr. C. F. N. Leahy (who wrote in the May issue) that one should aim at constant-length dits and dahs, but I don't think that one should start with them right at the beginning. It would work well enough to do so with simple letters, such as E, I, S, H, T, M, O, A, N; but I find that the more complicated combinations, such as C, F, P, L, Q, Y, and so on, are more quickly assimilated if the dits and the dahs are made very long to start with and gradually shortened. The great thing, as Mr. Leahy says, is to preserve at all speeds the correct duration-ratio of dits and dahs—and that's no easy thing to do. Many instructors go all to pieces in this respect when they try to send slowly for beginners. His tip of running slowly a gramophone record of perfectly sent morse is an excellent one. I hope to try it out shortly. But, as he says, the crux of the matter is to find perfectly sent records. Obviously, he knows some; will he be kind enough to give their numbers in a further letter so that the rest of us may benefit by his experience? I expect he'll agree with me that once you've got people reading well at 5 WPM with dits and dahs of normal length, it doesn't take long to work them up to double that speed by reducing the intervals between words. After all, the purpose of exaggerated intervals is to enable the pupil to think out the sounds that he has just heard. He is rather like a person trying to speak a foreign language when he can't think in it. As soon as you can think in a language, fluency comes rapidly. So with morse: once the brain automatically accepts — · — · as C, · — — · as P, and so on, speed in reading is quickly acquired.

Murphy Overseas Models

MODIFIED STANDARD RECEIVERS FOR EXPORT

THE exportation of wireless receivers is no new venture for Murphy Radio, Ltd., and they already have well-documented reports on standard models which have been called in for the past by listeners in all parts of the globe.

The knowledge acquired has been put to good use in developing the XA92—export version of the Model A92 "Station-master." There are two types, the Long-wave Model for European and other countries where long-wave stations are available, and the Standard Model which has an extra short-wave range, instead of the long-wave range. The actual coverage in the Standard XA92 is as follows: (1) 13-metre band; (2) 16-metre band; (3) 19-metre band; (4) 25-metre band; (5) 31-metre band; (6) 41-50-metre band; (7) 49-136 metres; (8) 190-550 metres.

Similarly in the XA90 and XD90 (export versions of the AC and universal sets in the "90" series) the Long-wave Model covers the normal ranges of 16.7-50 metres, 190-550 metres and 970-2,000 metres, while the Standard Model has two short-wave ranges bringing the coverage to: (1) 12.5-33 metres; (2) 40-110 metres; (3) 190-550 metres.

Not only are both these sets well suited to overseas use on account of their construction, which, in chassis and cabinet is designed to meet the climatic conditions likely to prevail in any district where there are mains, but they are sets which have proved qualities for short-wave reception.

A very well prepared booklet describing and illustrating these receivers has been recently issued by Murphy Radio, Ltd., Welwyn Garden City, Herts, and has already been distributed to shippers and importers abroad.

News from the Clubs

Romford and District Amateur Radio Society

Headquarters: Red Triangle Club, North Street, Romford, Essex.
Meetings: Tuesdays, 8.30 p.m.
Hon. Sec.: Mr. H. G. Holt, 5, Butts Green Road, Hornchurch, Essex.

At meetings during April and May members have been demonstrating their home-built apparatus. Recently Mr. Voigt demonstrated his loud speaker and his new pick-up. H.M. forces are welcome at meetings.

Edgware Short-wave Society

Headquarters: Constitutional Club, Manor Park Gardens, Edgware, Middlesex.
Meetings: Wednesdays at 8 p.m.
Hon. Sec.: Mr. F. Bell, 118, Colin Crescent, Hendon, London, N.W.9.

The society are holding their first "Hamfest" and social in the Shakespeare Hall of the Constitutional Club, Edgware, from 4 to 10.30 p.m. on June 29th. Several well-known manufacturers' apparatus will be exhibited. The new Voigt pick-up will be demonstrated. There will be a junk sale and a morse speed competition. A "Hamchat" will be given by the secretary of the R.S.G.B. A dance will be held in the evening. Admission 6d.

British Short-wave Correspondence Club

Headquarters: The Watering, Parham, Woodbridge, Suffolk.
Hon. Sec.: Mr. T. Knight, 50, Scott Street, Barrow-in-Furness, Lancs.

Members wishing to exchange SWL cards through the B.S.W.C.C. QSL service may obtain QRA lists from Mr. D. G. Garrard, 135, Hervey Street, Ipswich, Suffolk. Club stationery may also be obtained from this address.

During the month membership has steadily increased to 140, and the club now has members in all parts of the English-speaking world. Membership is free, and open to all radio amateurs. All enquiries *must* be accompanied by a stamped addressed envelope for reply.

Ashton-under-Lyne and District Amateur Radio Society

Headquarters: 17a, Oldham Road, Ashton-under-Lyne.
Meetings: Wednesday 8 p.m., and Sundays 2.30 p.m.
Hon. Sec.: Mr. K. Gooding, 7, Broadbent Avenue, Ashton-under-Lyne.

A lecture entitled "The Principles of Class A and B Amplification" was given recently by Mr. J. Cropper, who, in conjunction with Mr. W. P. Green, is renewing the series of lectures on the principles of the superheterodyne.

A special Morse class for beginners and new members is held every Monday at 8.30 p.m.

It has been resolved that all members serving with H.M. Forces shall become honorary members for the duration of the war.

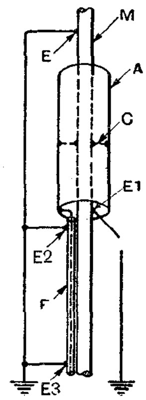
Recent Inventions

Brief descriptions of the more interesting radio devices and developments disclosed in Patent Specifications will be included in these columns.

SHORT-WAVE AERIALS

RELATES to a short-wave aerial which is mounted coaxially with a steel mast, say, that of a ship at sea. The invention is directed to ways and means for supporting the aerial so that any loss of power caused by the close proximity of the metal mast is reduced to a minimum. In some cases the mast itself is utilised as part of the aerial system.

As shown, the aerial consist of a single tubular element A, half a wavelength long, which is shorted to the metal mast M at its centre C, and is coupled at its lower end to a concentric feed line F.



Low-loss mounting of SW aerial.

The metal mast is earthed at the points E, E1, near the top and bottom of the aerial, whilst the feed line is earthed at the points E2, E3 which are half a wavelength apart. Since the end of the aerial is then, in effect, connected to the adjacent part of the mast by a short-circuited quarter-wave link, the impedance between these points will be high relative to the radiating impedance, so that currents will tend to flow into the aerial element, and standing waves on the mast will be largely suppressed. The short circuit at the centre C may be omitted, though this tends to narrow the band of frequencies which can be efficiently handled.

E. C. Cork and J. L. Pawsey. Application date, June 28th, 1938. No. 517772.

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PUSH-BUTTON TUNING

EACH station-selecting button may, in addition to setting the circuits in tune, also modify them to give optimum reception of the particular programme chosen. For instance, a cam controlled by the button is arranged to loosen the coupling between two coils, so as to improve the selectivity when tuning to a distant station, or to tighten the coupling and so give a wider band-width for a local station. In the same way, the tone control of the set may be automatically adjusted to suit the wavelength of the particular station selected.

A special push-button is provided to convert the set from automatic tuning to manual control. At the same time the tuning indicator is changed, say, from the ordinary graduated dial used when tuning by hand to another type of indicator in which the station selected by switch control is identified by an appropriate symbol, which is simultaneously projected in colour on to a ground-glass screen. The London transmitter may be indicated, for instance, by a picture of the Houses of Parliament, Paris by a picture of the Eiffel Tower, and so on.

Kolster-Brandes, Ltd., and W. A. Beatty. Application date June 24th, 1938. No. 516385.

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ELECTRON MULTIPLIERS

IT is found that surfaces such as cæsiated silver, which give a high ratio of secondary emission when bombarded by primary electrons, have relatively low melting points and relative high vapour pressures. The consequence is that, when used in an electron multiplier, they tend to liberate a certain number of free ions, since the multiplier tube is usually highly evacuated.

The presence of such positive ions is undesirable, partly because they interfere with the normal flow of the electron stream through the multiplier, but more especially because they bombard the target elecrodes. The impact causes the coated electrodes to fall off in secondary emission, and so shortens the effective life of the tube.

According to the invention, the multiplier tube is fitted with specially shaped electrodes which serve to deflect the positive ions out of the normal path of the negative electron stream, so that they leave it at an angle, and are collected separately, before they can do any damage.

Farnsworth Television Inc. Convention date (U.S.A.) June 5th, 1937. No. 515097.

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THE problem of using an electron multiplier for the amplification of very high frequencies, or for the handling of a wide band of short-wave signals, as in television, is solved by operating the cathode at what is called a "tepid" temperature, e.g., between 100 and 150 deg. C. In these circumstances the electron emission is limited by the space charge, and there is a high ratio of the mutual conductance of the control grid to the current which the grid allows to pass.

A suitable cathode consists of a plate of silver coated with cæsium, which emits electrons at a satisfactory rate when heated to a temperature of 100 deg. C.

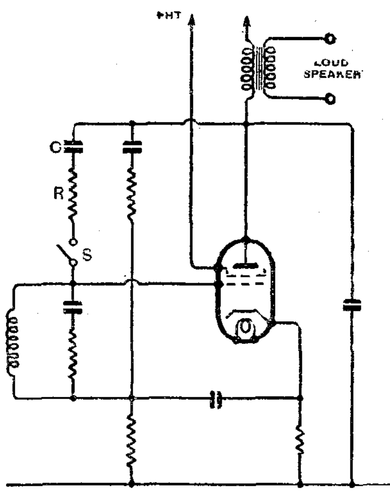
Standard Telephones and Cables, Ltd. (Assignees of Le Matériel Téléphonique Soc. Anon.). Convention date (France), June 23rd, 1937. No. 515525.

o o o o

A "MUTING" CIRCUIT

NEGATIVE feed-back is applied during the process of tuning from one station to another so as to remove interstation "noise." The feed-back, in effect, paralyses one of the amplifiers, preferably the last AF stage, though it may alternatively be applied to one of the radio- or intermediate-frequency valves.

As shown in the drawing, negative feed-back is automatically applied from the anode to the grid of a screen-grid tetrode through the branch circuit C, R and a switch S, during the operation of tuning. The switch S is automatically closed by leaf-spring contacts on the spindle, the contacts being held together only so long as the spindle is in motion.



Silent tuning system

N. H. B. Brown. Application date, July 19th, 1938. No. 516504.

o o o o

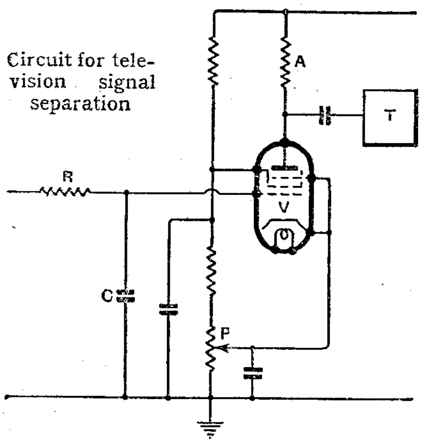
TELEVISION IMPROVEMENT

A SINGLE valve is used to separate the "framing" impulses from both the "line" impulses and the picture signals, particularly in interlaced systems of scanning. Advantage is taken of the comparatively long duration of the framing impulses to arrange that they alone drive the separator valve on to the sloping part of its characteristic curve, the other signals being confined to the flat-topped part of the curve.

As shown in the drawing, the incom-

The British abstracts published here are prepared with the permission of the Controller of H.M. Stationery Office, from specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

ing signals are applied to the control grid of a pentode valve V through an input circuit C, R which has a time constant somewhat greater than the normal duration of a framing impulse. The grid of the valve is so biased, from a tapping on the potentiometer P, that the line impulses and picture signals produce only a negligible effect on the output current. On the other hand the framing impulses, by changing the operating point to a sloping part of the curve, are repeated in the anode circuit A and are



Circuit for television signal separation

applied to the time base T. The circuit gives an "infinite" discrimination between the two sets of synchronising impulses, and allows the same valve to be used both as separator and amplifier.

Pye, Ltd.; W. Jones; and B. J. Edwards. Application date, April 22nd, 1938. No. 515302.

o o o o

REMOTE TUNING CONTROL

AN endless band, strung over a pair of rollers, is marked on one margin with a station-indicator scale, and on the other margin with a series of equally spaced slots. A station-selector pointer is fixed to one edge of the endless band, and as it is moved into alignment with a desired station causes the slots to pass between a lamp and a photo-electric cell. The passage of each slot, therefore, creates a current impulse which is amplified and applied to operate a distant electro-magnetic relay.

The relay is geared to a ratchet wheel which is thus moved, step by step, through an angle corresponding to the movement of the station-selecting needle at the control point. The ratchet wheel, in turn, rotates the variable condenser, and so tunes the distant receiver to the desired programme.

Soc. Anon. Fimi. Convention date (Italy) July 22nd, 1937. No. 517033.

o o o o

VOLUME COMPRESSION

RELATES to amplifying circuits in which the volume can be expanded or contracted at will, either to suppress undesired noise at low levels of volume, or to adjust the input of sound to a level where it can best be amplified without distortion.

According to the invention, the output circuit of the amplifier is shunted by a potentiometer consisting of two resistances arranged in series. The first is a silicon-carbide element the resistance of which varies inversely with the current flowing through it, whilst the second is a constant resistance, which is small in value compared with the lowest resistance of the first element. A connection is taken from a point between the two series resistances to the grid of the amplifier, so that the voltage developed across the constant resistance is fed back in the negative sense to the input. The overall gain of the amplifier is large, and the amplification is effected at low voltage levels.

H. A. M. Clark. Application date July 16th, 1938. No. 516250.

o o o o

FLUORESCENT SCREENS

IT is found that the pictures reproduced on the fluorescent screen of a cathode-ray television receiver are liable to be blurred owing to the accumulation of casual electric charges on the screen. These act to repel or divert the electrons forming the scanning beam, and so spoil the clearness of the picture at the points affected. The difficulty can be overcome by depositing the fluorescent material of the screen on a layer or grid of conducting material which serves to dissipate or equalise any local charges that may be set up.

With this object in view, the support or backing of the screen is first covered with a continuous thin layer of platinum, which is then partly removed by a cutter so as to form a number of transparent strips, the open parts of which are ten times wider than the residual metal. This makes a metal grid or network on which the fluorescent material is laid, the solid parts interfering only to a negligible extent with the luminescence of the screen as a whole.

Baird Television, Ltd.; A. K. Denisoff; and J. M. S. Spiers. Application date July 27th, 1938. No. 517427.

o o o o

IMPROVEMENTS IN AMPLIFIERS

IN certain multi-stage amplifiers using negative feedback it is found necessary to reduce the phase shift at frequencies above and below the operating frequency, in order to prevent the production of harmonics and to ensure stability. The desired result can be obtained if the feedback resistance is supplemented by inductive reactance.

With this purpose in view the feedback resistance is accordingly wound into a coil having the necessary dimensions to introduce the required inductance; alternatively, the coil may be wound, on a former of the required size, and may be composed partly of resistance wire and partly of copper wire, so that the proportion of resistance to reactance may be accurately adjusted.

Standard Telephones and Cables, Ltd., and A. H. Roche. Application date July 1st, 1938. No. 516628.

TELEVISION MODIFICATION

INSTEAD of radiating the two sets of synchronising impulses on the same carrier wave, they are divided between the sound and vision channels. The frame impulses, for instance, are combined with the vision signals, one being used to modulate the carrier wave downwards from a given datum level, and the other upwards. This makes it possible to use the synchronising impulses both for the usual scanning purpose, and also for automatic volume control.

The line impulses are combined with the sound signals on the second carrier wave, the frequency being doubled, if necessary, to facilitate separation. For the same reason, the impulses may be arranged to cut the carrier down to zero, whilst the sound signals are prevented from doing so. In general, the arrangement ensures a more definite separation, and minimises the effect of electrical interference.

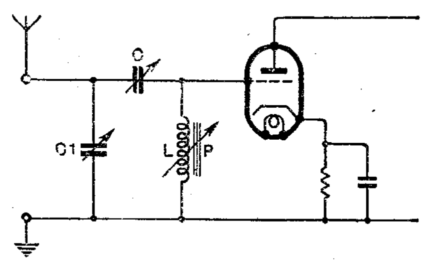
Baird Television, Ltd., and P. W. Willans. Application date May 11th, 1938. No. 514643.

o o o o

AERIAL COUPLINGS

THE Figure shows an input circuit, which is particularly suitable for an aerial of small effective height, such as is used on a car. It is intended to give constant coupling over a wide range of frequencies, together with a high uniform gain. Provision is also made for balancing out any variations in the capacity of the aerial, and for ensuring the accurate alignment of all the tuned circuits in the set.

The circuit consists of an inductance L shunted by two capacities C and C1 arranged in series. It is tuned by moving a powdered-iron core P in and out of the coil windings in such a way as to maintain a constant ratio between the inductive reactance and the resistance of the circuit. The core is designed so that, as it is gradually inserted, the



Input circuit arrangement for car aerials

total resistance increases as the first power of frequency, whilst the inductance increases inversely as the second power of frequency.

Any difference between the capacity of one aerial and another may be balanced out by adjusting the condenser C1 once and for all. The input circuit, as a whole, is then aligned with the other tuned circuits of the set by means of the second condenser C.

Johnson Laboratories Inc. (Assignees of F. N. Jacob). Convention date (U.S.A.), May 17th, 1937. No. 514641.

Wireless World

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*

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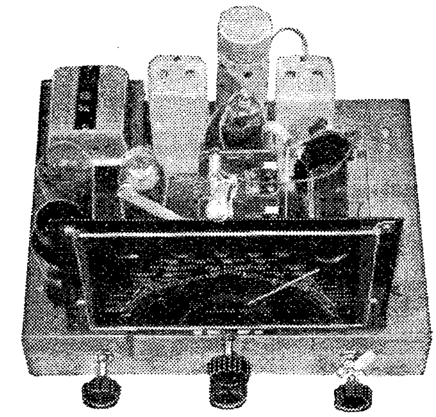
8-v. 4-BAND ALL-WAVE SUPERHET CHASSIS (13-160m. continuous & normal Broadcast bands)



This chassis has been developed on the lines of our Model AW38 which has proved an outstanding success since its introduction at 1939 Radiolympia. Overseas requirements, however, have been given primary consideration. Firstly, an additional short-wave band has been incorporated and the chassis now gives an efficient continuous short-wave coverage from 13 to 160 metres. All coils and I.F. transformers have been specially treated to render them impervious to humidity. Switching is of extra robust construction and contacts heavily plated. The mains transformer is interleaved and has a generous iron content to avoid excessive temperature rise and the steel chassis itself is heavily cadmium plated for tropical use. International standard base valve-holders are used throughout .... **8 gns.** Plus 5%

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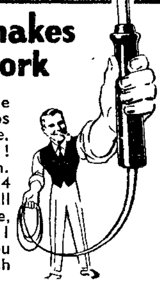
Constant heat makes neat efficient work



With ordinary soldering when the iron cools you get unsightly blobs of solder, wasteful and insecure. Change to Solon Electric Soldering! No stopping to heat up the iron. Once hot, and that takes only 4 minutes, the Solon stays hot—all the while you need it. It's simple, quick, cheap. 15 hours use for 1 unit. No coal grit—no soot; you get cleaner, stronger, joints with the Solon.

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This new handbook contains comprehensive information for everyone interested in Cathode ray receiving equipment. The treatment is substantially non-mathematical although design formulæ has been included, where necessary, largely for reference.

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WANTED, all types.—Particulars, Radio Service Co., 223, Eversleigh Rd., London, S.W.11. [9018

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RESISTANCE Boxes, Wheatstone bridges, meggers, ultra-sensitive voltmeters, micro-ammeters, milliammeters, etc.; state requirements.—Newmans, 7, Russell Chambers, Bury Place, Bloomsbury. [9111

COMPONENTS

SECOND-HAND, CLEARANCE, SURPLUS

R

RADIO CLEARANCE, Ltd.,

63, High Holborn, W.C.1. 'Phone: Holborn 4631.

LISSEN 2v. Screen-grid Valves, S.G.215 and S.G.2V, 4/6 each.

LISSEN 2v. Battery Pentode, 4-pin side terminal P.T.2A and P.T.225, 4/11 each.

LISSEN 4v. Mains Screen Grid, A.C./S.G.; 5/11 each.

LISSEN 4v. Mains Output Pentode A.C./P.T.; 5/11 each.

LISSEN Rectifier Valve V650; 2/11 each.

ALL-WAVE Superhet Chassis, 5v. A.C., latest Mullard valves, T.H.4B., V.P.4B., T.D.D.4., Pen. A.4., L.W., 4/350v.; ranges, short-wave 16-48 metres, medium wave 200-550 metres; long wave 800-2,200 metres; size of chassis, 14½in. long, 7½in. deep, height overall 8½in.; controls, tuning at side; volume on/off at side, wave-change, provision for pick-up; complete with valves and knobs, £4/10; special speaker, 1,500 ohms-field, 10/6 each.

ULTRA Short and Short-wave Choke, Lissen Hi Q, inductance 100 microhenries; boxed, list, 2/-; our price, 1/- each.

ULTRA Short and Short-wave Double Wound Low-resistance choke; Lissen Hi Q resistance less than 0.5 ohms; boxed, list, 2/6; our price, 1/3 each.

LOW-LOSS Ceramic Valve-holders, Lissen Hi Q., baseboard and chassis, 5- and 7-pin; 10d. and 1/- each.

MANSBRIDGE Type Condensers, Lissen Hi Q. 250 D.C. working, moulded case with feet 0.1 mfd. and 1 mfd.; 6d. each.

ROTARY Coil Unit.—Lissen Hi Q four-band from 4.8-91 metres, can be selected by a turn of the knob, with circuit; boxed, list, 15/6; our price, 6/11 each.

LOW-LOSS Short-wave Variable Condensers, Ceramic insulation, brass vanes, Lissen Hi Q, minimum capacity 5 micro-micro farads; two types, boxed, with knobs, 160 m.mfd..; list, 7/6; our price, 3/- each; 20 m.mfd., list, 5/6; our price, 2/6 each.

CONE Speaker Unit, Lissen, complete with reed and chuck, boxed; 1/- each.

PUSH-PULL Switches, Lissen; 2-point, 4d. each, 3-point, 6d. each.

ROLA P.M. Speakers, latest type, 7½in. cone with power and pentode transformer, boxed; 15/- each.

CLOCK-FACED Dials, 5in.×3½in., with printed 3-wave scale, ox-copper escutcheon and glass, 3/6 each; ditto, less escutcheon, 2/6 each.

FILAMENT Transformers, input 200-250v., output 4v. 4 amps., 4v. 6 amps; 4/11 each.

MAINS Transformers, Plessey, 350-0-350v., 90 m.a., 4v. 2.5 amps., 4v. 6 amps.; 8/6 each.

MAINS Transformer, G.E.C., American windings, 350-0-350v., 65 m.s., 5v. 2 amps., 6.3v. 2.5 amps., suitable for replacements in G.E.C. models; 5/6 each.

MAINS Transformers, Wearite, type R.C.1, 250-0-250v., 80 m.a., 4v. 2.5 amps., 4v. 4 amps., 9/11 each; type R.C.2, 350-0-350v., 120 m.a., 4v. 2.5 amps., 4v. 4 amps., 12/6 each; type R.C.3, 350-0-350v. 150 m.a., 4v. 2.5 amps., 4v. 2 amps., 4v. 5 amps., 15/- each; type R.C.4, 500-0-500v. 150 m.a., 4v. 2 amps., 4v. 2 amps., 4v. 2.5 amps., 4v. 5.6 amps., 21/- each; all above are centre-tapped windings; type R.C.5, 100-watt auto transformer, 100-110v., 200-250v., reversible, 12/6 each; all transformers 200-250v. tapped primaries.

(*This advt. continued in 3rd column.*)

GALPINS

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Telephone: LEE GREEN 5240

Terms: Cash with Order

EPOCH P.M. MOVING-COIL SPEAKERS, 10in. cone, 10 ohm speech coil, handle 10/12 watts, **32/6** each. Carriage, 2/6.

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PUBLIC ADDRESS 8-10 WATT AMPLIFIERS, 200/240-volt A.C mains using 2PX4's in parallel, less valves, **32/6** each, carriage 2/-.

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MAINS TRANSFORMERS, 200/240 volts input, 50 volts 8 amp. output, useful for small arcs, etc., **15/-** each, post 1/-.

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TRUVOX PUBLIC ADDRESS HORN SPEAKER UNITS, 15-ohm. speech coil, 6-volt field, **15/-** each, post 1/6.

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COMPONENTS—SECOND-HAND, CLEARANCE, SURPLUS, ETC.

(*This advt. continued from 1st column.*)

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1-WATT Resistances, Polar N.S.F., 4d. each; 3/9 dozen; all sizes up to 2 meg.

VOLUME Controls, American C.T.S., finest made, divided spindles, length 2½in., with switch 2,000, 5,000, 10,000, 25,000, 100,000, 250,000, 500,000 and 1 meg., 2/6 each; wire wound 5-watt (less switch), 2,000, 5,000, 10,000, 20,000 and 25,000 ohms., 2/- each.

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10ft. Coils, glazed connecting wire; 4d. coil.

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B.I. 8×8 mfd., 550v. working, cardboard electrolytics, 3/6 each; ditto, 16×8 mfd., 4/6 each; ditto, 8 mfd. tubulars, 2/- each; ditto, 4 mfd. tubulars, 1/9 each; ditto 2 mfd. tubulars, 4,300v. working, 3/3 each

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VAUXHALL.—Electrolytic condensers, cardboard, 8 mfd. 500 v., 2/-; 8 plus 8 mfd., 3/6; 50 mfd. 50 v., 1/9; 50 mfd. 12 v., 1/6; metal can, 8 mfd. 500 v., 3/-.

VAUXHALL.—Tuning coils, bar-type condensers, full vision drives, stocked; volume controls, 2/-; with switch 3/-; pick-ups from 11/.

VAUXHALL UTILITIES, 163a, Strand, London, W.C.2.—Stamp for price list above goods. [9097

MAINS RADIO DEVELOPMENT Co. Regret to announce suspension of their service for Duration, owing to partners taking up R.A.F. flying duties; their super service will resume as soon as the war is won. [9089

5/- Only.—Bargain parcel comprising speaker cabinet, drilled steel chassis, condensers, resistances, and many other useful components, worth 35/-; limited number; postage 1/-.—Bakers Selhurst Radio, 75, Sussex Rd., South Croydon. [9104

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4-WAY Lead in Single Cover, brown or white, single strand, 4 yards 1/3; push back connecting wire, stranded, 12 yards 1/3; Polar dials, less escutcheon, 2 band, 1/6, V.P. type, spindle offset to right-hand.

SPEAKERS.—Celestion, energised types, 7,500 and 2,000 ohms, less transformer, 8in., 5/6 each; 600 ohm ditto, 6in., 5/-; Magnavox 2,000 ohm, with pentode transformer, 8/6.

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SPEAKERS.—Pairs elliptical cone M.C. speakers, Plessey and R. & A., ex Philco, push-pull pentode transformer, fields 325 ohm for smoother, 8,600 ohm as bleeder, handle 10-15 watt, 10/9 pair.

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FERRANTI Wire Wound 2½ watt Resistances, with metal end caps, tubular, sizes 3,000, 4,000, 6,000, 8,000, 35,000; four for 1/3.

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PLESSEY 3-gang Fully Screened Straight Type Condensers, with top trimmers, 2/9; Plessey 3-gang straight type, all wave, ceramic insulators with SM cord drive, antimicro feet, 2/9.

T.C.C. Tubular 8 mf. Dry Type 450v. Electrolytics, wire ends; 1/6 each, 12/9 dozen. [9114

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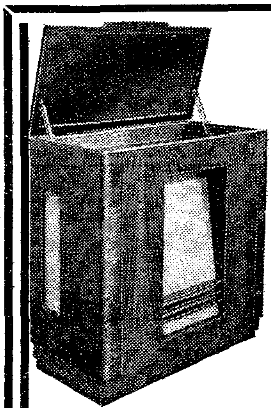

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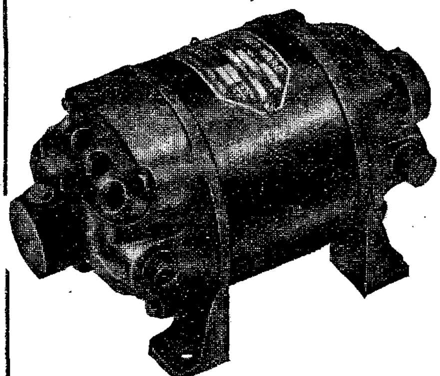

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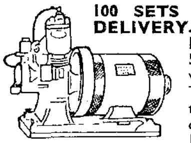

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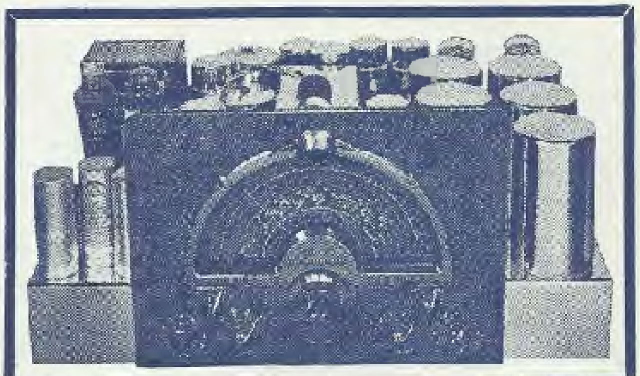

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