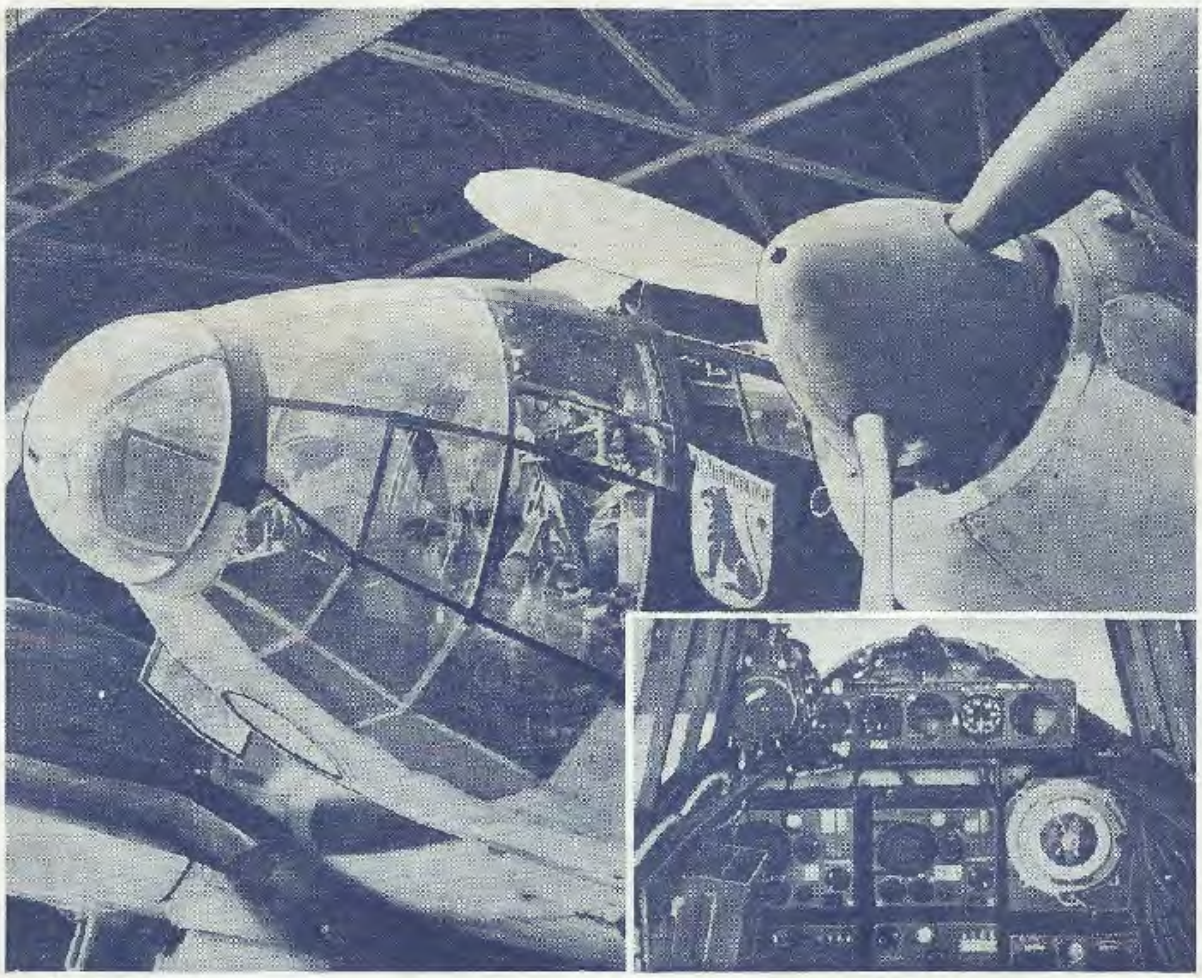
COLOUR TELEVISION IN AMERICA

MONTHLY
ONE SHILLING

The Wireless World

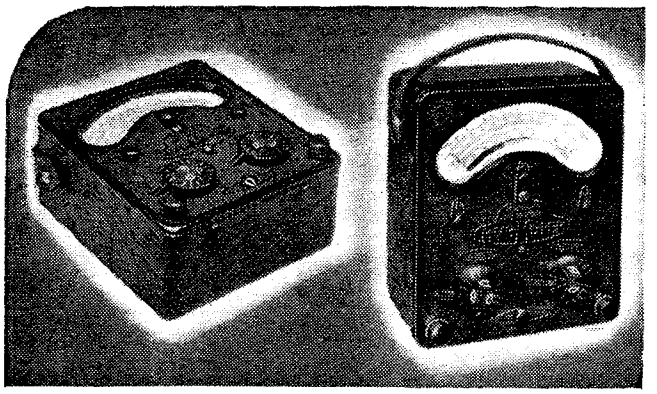
COVERING EVERY WIRELESS INTEREST

NOVEMBER, 1940

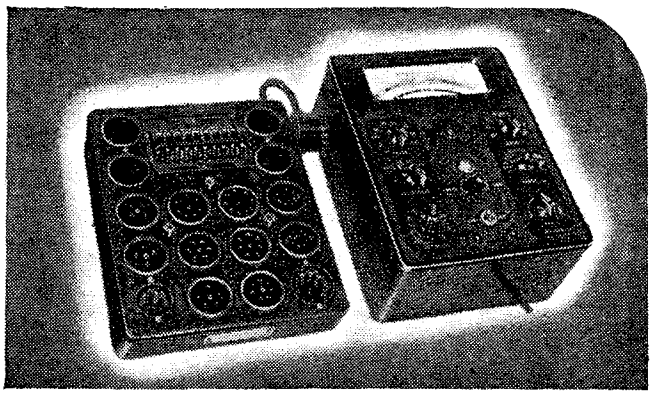


WIRELESS EQUIPMENT OF GERMAN AIRCRAFT

No. 1061 Vol. XLVI No. 13



46-range Model 7 Universal AvoMeter



40-range Model 40 Universal AvoMeter

"Avo" Valve Tester with Universal Panel

PRECISION METERS

that Master every Testing Problem

The world-wide use of "AVO" Instruments is striking testimony to their outstanding versatility, precision and reliability. In every sphere of electrical test work—laboratory, shop or out on a job—they are appreciated for their dependable accuracy, which is often used as a standard by which other instruments are judged. There is an "AVO" Instrument for every essential electrical test.

OTHER "AVO" INSTRUMENTS (not illustrated).

High Resistance AvoMinor.
"Avo" Low Resistance Ohmmeter.
The Avodapter
The "Avo" Bonding Meter
The "Avo" MilliOhmmeter
9-pin AvoCoupler

AVO

Regd. Trade Mark

ELECTRICAL MEASURING INSTRUMENTS

BRITISH MADE

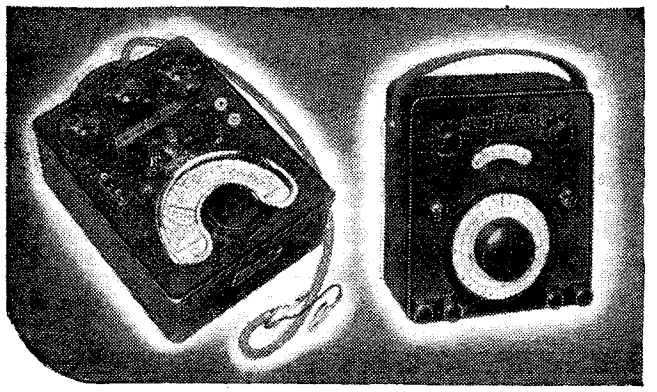
● *Write for fully descriptive literature dealing with any instrument in which you are interested, and for current prices.*

Sole Proprietors and Manufacturers:

THE AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT Co., Ltd., Winder House, Douglas St., London, S.W.1

'Phone: Victoria 3404-7.

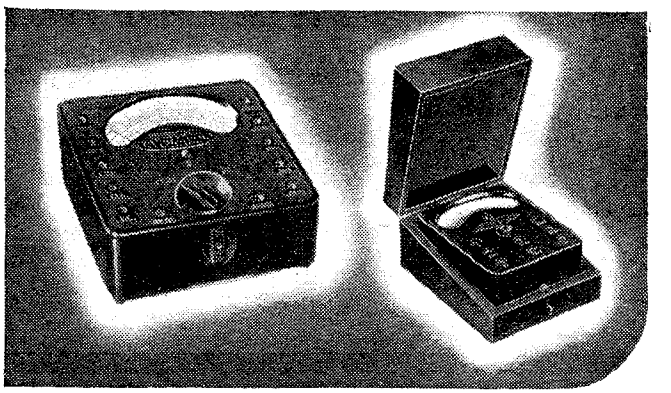
All-Wave "Avo" Oscillator



"Avo" Test Bridge

Universal AvoMinor

D.C. AvoMinor



A

PREMIER RADIO

NEW PREMIER S.W. A.C. RECEIVER KIT

In response to many requests we have now produced an A.C. version of the popular Premier Short Wave SG3 Kit. Circuit: Pentode H.F. Stage, Pentode Detector, Beam Power Output, and F.W. Rectifier. 200-250 v. A.C. Operation. Built-in Power Pack. Hum-free operation. For use in Phones or P.M. Speaker. Complete Kit of Parts with drilled chassis, all components. Plug-in Coils covering 13-170 metres, 4 valves and full instructions and circuits, £4-10-0. Completely wired and tested, £5-10-0. *Send for full details.*

SHORT-WAVE GEAR

Short-Wave Coils, 4- and 6-pin types, 13-26, 22-47, 41-94, 78-170 metres, 2/- each, with circuit. Premier 3-Band S.W. Coil, 11-25, 19-43, 38-86 metres. Suitable any type circuit, 2/11.

4-pin or 6-pin Coil Formers. Plain or Threaded. 1/2 each.

Utility Micro Cursor Dials, Direct and 100 : 1 Ratios, 4/3.

New Premier 2-Gang S.W. Condenser, 2 x .00015 mf. with integral slow motion, 5/9.

Bakelite Dielectric Variable Condensers. .0003 and .0005 mf. Suitable Tuning or Reaction, 1/6 each.

Short-Wave H.F. Chokes. 10-100 m., 10½d. each. High grade Pie Wound U.S.A. type, 1/9 each.

Lissen Dual Range Screened Coils. Medium and Long Waves, 2/9 each.

"LEARNING MORSE"

Premier Morse Practice Key on Bakelite Base and Brass Movemen	3/3
General Purpose Morse Key	5/10
Heavy Duty TX Key on Cast Base ...	10/-
Bakelite Buzzers	1/9
3 Henry Chokes	7/6
Complete Kit of Parts for Valve Oscillator as described in W.W. "Learning Morse"	25/-

SHORT-WAVE CONDENSERS

Trolitul insulation. Certified superior to ceramic. All-brass construction. Easily ganged.

15 m.mfd. ...	1/9	100 m.mfd. ...	2/3
25 m.mfd. ...	2/-	160 m.mfd. ...	2/6
40 m.mfd. ...	2/-	250 m.mfd. ...	2/11

MAINS TRANSFORMERS

Wire-ends. All L.T. Windings Centre-Tapped

S.P. 301	300-300 v. 150 m.a. 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 1a., 4 v. 1 a. ...	15/-
SP. 350A	350-350 v. 100 m.a. 5 v. 2 a. (not C.T.), 6.3 v. 2-3 a.	14/-
SP. 350B	350-350 v. 100 m.a 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 2-3 a.	14/-
SP. 351	350-350 v. 150 m.a. 4 v. 1-2 a., 4 v. 2-3 a., 4 v. 3-4 a.	15/-
SP. 352	350-350 v. 150 m.a. 5 v. 2 a., 6.3 v. 2 a., 6.3 v. 2 a.	15/9

MATCHMAKER UNIVERSAL OUTPUT TRANSFORMERS

Will match any output valves to any speaker impedance.
11 ratios from 13 : 1 to 80 : 1, 5-7 watts, 15/9. 10-15 watts, 20/6. 20-30 watts, 35/-.

PREMIER SHORT-WAVE KITS for OVERSEAS NEWS

Incorporating the Premier 3-Band S.W. Coil, 11-86 Metres without coil changing. Each Kit is complete with all components, diagrams and 2-volt valves. 3-Band S.W. 1 Valve Kit, 14/9. 3-Band S.W. 2 Valve Kit, 22/6.

DE LUXE S.W. KITS

Complete to the last detail, including all Valves and coils, wiring diagrams and lucid instructions for building and working. Each Kit is supplied with a steel Chassis and Panel and uses plug-in coils to tune from 13 to 170 metres.

1 Valve Short-Wave Receiver or Adaptor Kit	20/-
1 Valve Short-Wave Superhet Converter Kit	23/-
1 Valve Short-Wave A.C. Superhet Converter Kit	26/3
2 Valve Short-Wave Receiver Kit	29/-
3 Valve Short-Wave Screen Grid and Pentode Kit	68/-

PREMIER 1940 "5v. 5" COMMUNICATIONS RECEIVER

A 5-valve Superhet, covering 12-2,000 metres in 5 wave bands.

Beat Frequency Oscillator.
2-spread Band-Spread Control.
A.V.C. Switch.
Illuminated Band-Spread Dial.
Send-Receive Switch.
Iron-Cored IF.s.
Phone Jack.
Over 4 Watts Output.

Built into Black Crackle Steel case providing complete screening. 10½in. Moving Coil Speaker in separate steel cabinet to match.

Receiver, complete with all tubes and Speaker **£9.9.0**

Auto Transformers. Step up or down. 100-125 v. to 200, 230 or 250 v. A.C., 60 watts, 9/11; 125 watts, 13/6; 250 watts, 18/6.

L.T. Transformers, all C.T.

4 v. 2-3 a. ...	9/11	6.3 v. 2-3 a. ...	9/11
2.5 v. 5 a. ...	9/11	7.5 v. 3 a. ...	9/11
5 v. 2-3 a. ...	9/11	12 v. 3-4 a. ...	15/-

Lissen Hypernik QPP Driver Transformers. Ratio 8 : 1. 4/3.

Push-Pull Driver Transformers... ... 6/6

Universal Output Transformers. 11 Ratios. Single or Push-pull 6/6

PREMIER BATTERY CHARGERS for A.C. Mains

Westinghouse Rectification complete and ready for use

To Charge :	
2 volts at ½ amp. 11/9	6 volts at 1 amp. 22/6
6 volts at ½ amp. 19/-	12 volts at 1 amp. 24/6
	6 volts at 2 amps. 37/6

MOVING COIL SPEAKERS

All complete with transformer. Rola 6½ in. 15/-; 8 in. P.M.s, 17/6; 10 in. P.M.s, 22/6.

ENERGISED MODELS

Plessy 8 in. 175 ohm field, 7/6; G.12 energised, 63-; 10 in. B.T.H. 1,600 ohm field, less transformer, 11/6.

PREMIER 1940 HIGH FIDELITY AMPLIFIER KITS

Each Kit is complete with ready drilled chassis, selected components, specially matched valves and full diagrams and instructions.

	Kit of Parts with Valves	Completely Wired and Tested
3-watt A.C. Amplifier ...	2 6 6	3 4 0
3-watt A.C./D.C. ,,	2 6 6	3 4 0
6-watt A.C. ,,	6 2 6	7 0 0
8-10-watt A.C. D.C.	5 5 0	6 2 6
15-watt A.C. ,,	6 14 0	8 2 6

Black Crackle Steel Cabinet 15/- extra.

REPLACEMENT VALVES FOR ALL SETS

Europa Mains Valves. 4 v. A.C. Types, A.C./H.L., A.C./L., A.C./S.G., A.C./V.M.S.G. A.C./H.P., A.C./V.H.P., A.C.P., all 5/6 each. A.C./H.P., A.C./V.H.P., 7-pin, 8/6. A.C./Pens. I.H., 8/6; A.C./P.X.4, 7/3; Oct. Freq. Changers, 9/6; Double Diode Triodes, 7/6; 3½-watt D.H. Triode, 12/-. 350 v. F.W. Rect., 5/6; 500 v., 7/6. 13 v. .2 amp. Gen. Purpose Triodes, 5/6; H.F. Pens. and Var.-Mu. H.F. Pen., Double Diode Triodes, Oct. Freq. Changers, 8/6 each. Full and Half-wave Rectifiers, 6/6 each.

Triad U.S.A. Valves

We hold the largest stocks of U.S.A. tubes in this country and are sole British Distributors for **TRIAD** High-grade American Valves. All types in stock. Standard types, 6/6 each. All the new Octal Base tubes, at 7/6 each. 80—5/6.

Premier Pick-up Heads

Will fit any tone-arm 5/9
Premier Pick-up with Volume Control ... 12/6

ANOTHER SPECIAL OFFER

Rothermel Brush Piezo Crystal Pick-ups
New Junior P.U. with arm, 19/6. Standard S.B. Model with arm 29/6. P.U. head only, De Luxe Model, 19/6. 1940 Marconi Pick-up, 21/-.

PREMIER MICROPHONES

Transverse Current Mike, High grade large output unit. Response 45-7,500 cycles. Low hiss level, 23/-.

Moving Coil Mike. Permanent magnet model requiring no energising. Response 90-5,200 cycles. Output .25 volt average. Excellent reproduction of speech and music. 49/-.

Microphone Transformers. Suitable for all mikes. Tapped secondaries. A, 20 and 40 : 1; B. 30 and 60 : 1. 6/6 each.

Microphone Stands. Bakelite table stand, 9 in. ring, 7/6 each. **Adjustable Floor Stand,** 8 in. ring. Chrome finish. 26/6.

ALL ENQUIRIES MUST BE ACCOMPANIED BY 2½d. STAMP.

PREMIER RADIO CO.

ALL POST ORDERS to: JUBILEE WORKS, 167, LOWER CLAPTON ROAD LONDON, E.5. (*Amherst 4723*).
CALLERS to: Jubilee Works, or 169, Fleet Street, E.C.4 (*Central 2833*), or 50, High Street Clapham, S.W.4 (*Macaulay 2381*).

The
Wireless World

COVERING EVERY WIRELESS INTEREST

30th Year of Publication

Proprietors : ILIFFE & SONS LTD.

Editor :
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices :
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone : Waterloo 3333 (35 lines).
Telegrams : "Ethaworld, Sedist, London."

COVENTRY : 8-10, Corporation Street.
Telegrams : "Autocar, Coventry." Telephone : 5210 Coventry.

BIRMINGHAM :
Guildhall Buildings, Navigation Street, 2.
Telegrams : "Autopress, Birmingham." Telephone : 2971 Midland (5 lines).

MANCHESTER : 260, Deansgate, 3.
Telegrams : "Iliffe, Manchester." Telephone : Blackfriars 4412 (4 lines).

GLASGOW : 26B, Renfield Street, C.2.
Telegrams : "Iliffe, Glasgow." Telephone : Central 4857.

PUBLISHED MONTHLY.
Price : One Shilling
(Publication date 20th of preceding month.)

Subscription Rates :
Home and Abroad, 14/- per annum.

No. 1061 Vol. XLVI. No. 13

NOVEMBER, 1940

Contents

The
Wireless World

COVERING EVERY WIRELESS INTEREST

ESTABLISHED 1911

No. 1061 Vol. XLVI. No. 13 NOVEMBER, 1940 Price One Shilling

Editorial Comment

Salvage : The Wireless Contribution

IN normal times few of us find anything good to say of the miser, but during a total war some of his traits are a distinct asset to the community. Anything that prevents waste of materials or human effort, saves shipping space or reduces the demands on our reserves of foreign exchange then becomes a matter of vital importance. For reasons such as these, efforts are now being made to salve materials that at other times would be allowed to go to waste, either through simple economic considerations, or because the saving effected would be thought insignificant.

This matter of salvage is as much psychological as material. Few of us can make any great individual contribution to the common cause, but wonders can be worked if everyone cultivates a state of mind bordering on the miserly with regard to waste, and regards every scrap of useful material that can be salved or reclaimed as a personal gift to the national war chest.

Generally speaking, wireless can make no very spectacular response to the salvage appeal, but what it can do is well worth while doing wholeheartedly. On another page we publish two appeals for "scrap"—one for aluminium and the other for exhausted dry cells. Both are addressed primarily to the industry, but all can help.

There must be tons of aluminium in discarded receivers dating back to the days when that metal was generally used for chassis construction. Again, we expect that there are considerable stocks of almost worthless variable condensers or condenser vanes, many of the "shaped plate" variety which were in general use at one time. No doubt many firms and individuals carrying out receiver maintenance work have accumulated large numbers of broken-down electrolytic condensers, which contain an appreciable quantity of aluminium of the highest purity. When we add the quantities of discarded screening cans, inter-stage screens, and even old loud-speaker horns that must be available, it will be seen that the total is quite considerable, without touching upon more normal sources of scrap supply from manufacturers.

The Ministry of Aircraft Production, in issuing its appeal for aluminium, does not ask that gifts should be stripped of parts made of other metals. But, so far as many wireless components (such as variable condensers, for example, or receiver chassis) are concerned, the cost of stripping is considerable, and voluntary labour could usefully be devoted to this task. Electrolytic condensers, which have already been mentioned, should obviously be emptied and washed out, if not completely stripped of non-aluminium parts.

Efficient Collecting Methods

Any salvage scheme depends largely for its success on the efficiency of the organisation for collection, and it is to be hoped that in this matter wireless interests will set an example to others. By bad organisation the material gain of reclamation may be more than offset by wastage of human effort. The collection of scrap from large manufacturers hardly presents any problem, but it is suggested that special arrangements are necessary for collecting material from small firms and individuals. Here the wireless dealer might help by keeping a bin for contributions in his shop. The existing system of collecting dry batteries through the dustman seems open to the objection that dry-cell HT is most used in rural areas where there may be no collection of household refuse.

Wireless Equipment of the *Luftwaffe*

TECHNICAL DETAILS OF APPARATUS RECENTLY ACQUIRED —BY COURTESY OF THE R.A.F.

By permission of the Ministry of Aircraft Production we have been able to examine at first hand the wireless equipment in a number of crashed and captured aircraft, and to publish this description of its more interesting features

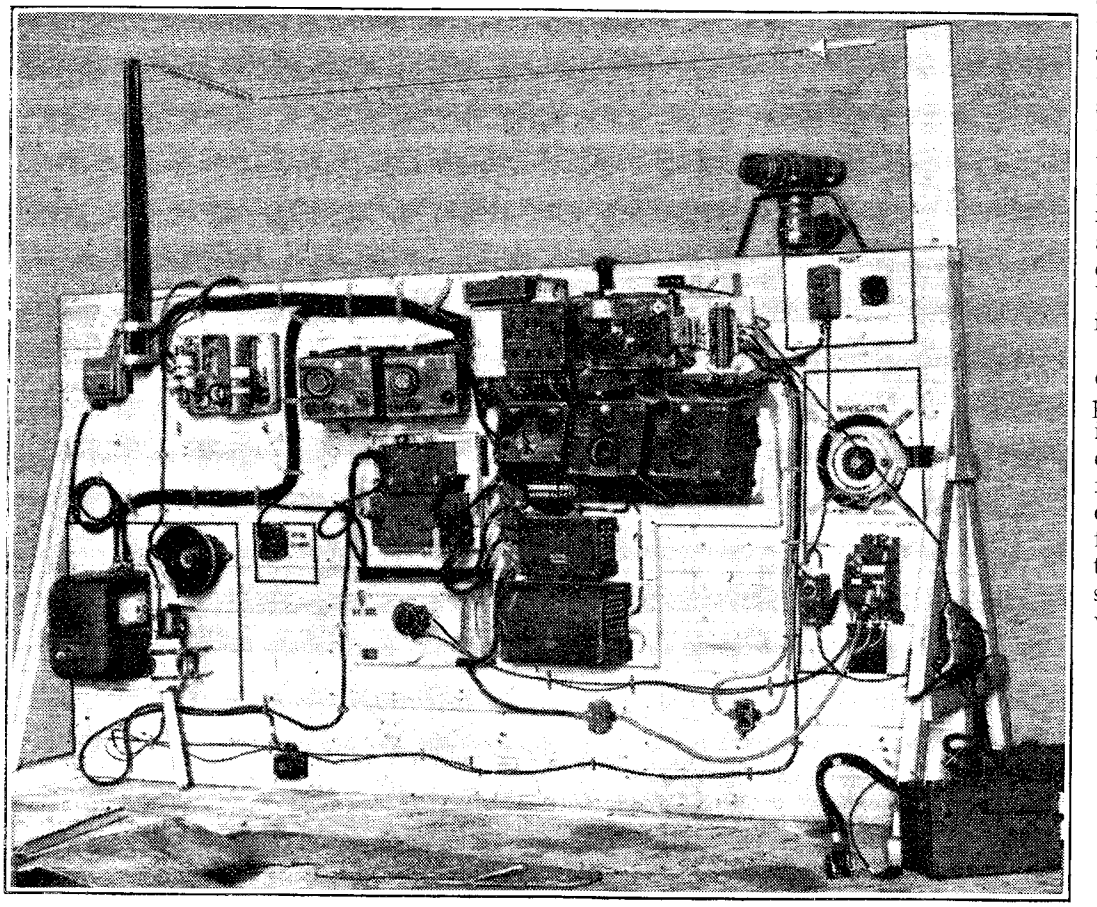
OF late the German high command has obligingly sent a large number of machines for our inspection. Many have arrived somewhat the worse for wear, but it has not taken long for our technical staffs to dissect and piece together complete and detailed specifications not only of the machines themselves but of every item of their armament and equipment.

On the Me. 109 fighter, the wireless installation is of the simplest type and consists of a single waveband transmitter and receiver continuously variable over the range 2.5 to 3.7 Mc/s. This is stowed away in the fuselage behind the pilot and is pre-set to the required frequency before the machine takes off—no readjustment is possible in the air. The range is estimated at 30-40 miles.

In bombers and fighter-bombers such as the Me. 110, He. 111, H and Ju. 88, on the other hand, radio bulks large in the aircraft's equipment—literally for the installation at present standardised and known as the type F.u.G.10 weighs 358 lb., about the same as a 500 c.c. motor cycle. It is built on the unit system and can be installed in different aircraft according to the disposition and requirements of the pilot/navigator and the rear-gunner/wireless operator. The list tabulated on the opposite page gives some idea of the comprehensive nature of the equipment.

A few of the units such as the HT motor generator, the DF receiver and its loop, the blind approach receivers and, of course, the aerial matching unit, are housed in the tail of the machine, but the main transmitters and receivers are compact enough to be mounted on the instrument dash.

The chassis are die castings approximately cubical in form and honeycombed with cells for valves, coils, etc., and channels for wiring. Even the tuning condensers have die cast vanes.



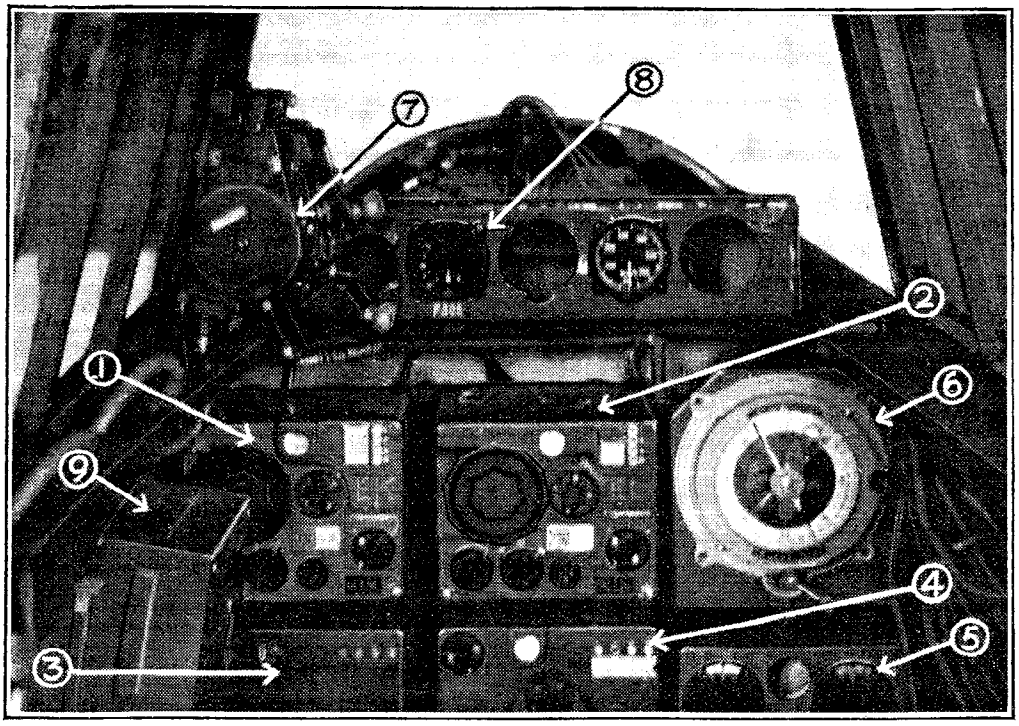
Complete F.u.G. 10 radio equipment carried by German bombers and twin-engined fighter-bombers. Altogether it weighs over 358 lb.

Wireless Equipment of the *Luftwaffe*—

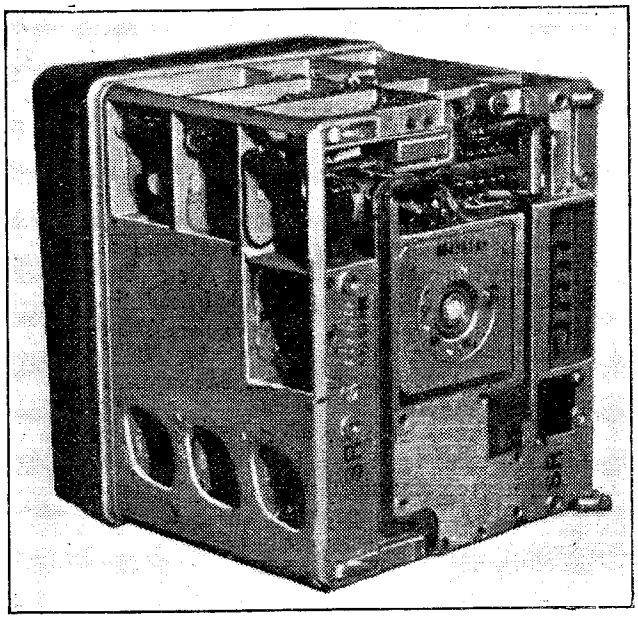
Continuous tuning is possible over both wavebands, but there is also provision for the rapid selection of four spot frequencies on each band which can be pre-set and aligned with ground stations while in the air. Essentially the method adopted is not unlike that used in setting up mechanical push-button tuning systems in broadcast receivers.

The output from each transmitter (about 65 watts) is fed through a low-impedance transmission line to the aerial matching unit in the fuselage. Magnetically operated switches controlled from the dashboard connect the appropriate transformer for matching either to a trailing aerial wire or a fixed antenna on the machine. The aerial transformers can also be tuned by motors of the following-on type controlled from the dash, and correct adjustment is indicated by an aerial ammeter in the control unit.

The transmitters are designed primarily for CW operation, but there is provision for telephony modulation through the intercommunication amplifier.



Units of the F.u.G. 10 equipment as arranged in the cockpit of an Me. 110 twin-engined fighter. (1) and (2) Short- and long-wave receivers. (3) and (4) Short- and long-wave transmitters. (5) Remote control for aerial tuning and matching unit in tail. (6) Compass repeater and loop bearing indicator. (7) DF loop remote control, polar diagram selector switch and DF receiver tuning control. (8) Blind approach indicator. (9) Intercommunication amplifier control panel.



Die-cast chassis of one of the F.u.G. 10 receiver units. The end plate of the die-cast tuning condenser may be seen in the centre. Valves are inserted "upside-down" in valve-holder cells with integral contacts for the top cap.

Radio Communication Units (CW)
- (a) Long-wave transmitter 300-600 kc/s.
- (b) Long-wave receiver 300-600 kc/s.
- (c) Short-wave transmitter 3-6 Mc/s.
- (d) Short-wave receiver 3-6 Mc/s.
- (e) Remote control aerial matching unit.

Navigational Aids
- (a) DF set 165-400 kc/s and 400-1,000 kc/s.
- (b) Remote control unit for waverange and polar diagram selection.
- (c) Compass repeater unit.

Blind Approach Equipment (Lorenz System)
- (a) Pre-set receiver for landing beam.
- (b) Pre-set receiver for marker beacon.
- (c) Visual indicator and remote control selector unit.

Intercommunication Audio Amplifier Unit
- (a) Crew intercommunication telephone amplifier.
- (b) Side tone generator (1,000 c/s) for CW keying.
- (c) Modulator amplifier for telephony transmission.
- (d) Pulse generator for night-error-free DF from ground.

Incidentally, the hollow streamlined spar supporting the fixed aerial is of bakelised laminated construction and houses the vertical rod for the Lorenz approach beam receiver. The dipoles for the marker beacon receiver are fixed to the underside of the fuselage.

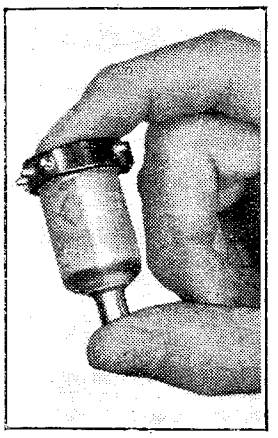
Wireless Equipment of the *Luftwaffe*—

The DF installation has many interesting features, though much of it, including the simple straight receiver, is based on earlier commercial flying equipment. The standard compass is housed in the tail away from magnetic materials, and its bearing, together with the loop setting, are superimposed on a repeater dial on the dash.

Iron-cored DF Loop

A very compact "frame" aerial of unorthodox design has been adopted. It consists of a massive powdered iron core of oval section roughly a foot long and 3 inches average diameter, surrounded at intervals by sectionalised windings. Electrically it approaches the efficiency of the conventional large diameter frame and it has the advantage that it can be housed in a comparatively small "bulge" on the outside of the fuselage.

Three systems of direction finding can be selected by a master switch on the control unit. First, there is the ordinary figure-of-eight polar diagram for general use. Secondly, a cardioid response which can be used either for DF or homing. When the latter is in use, the frame is set to zero and a reversing cam changes the sense of the loop alternatively for the reception of interlaced "A" and "N" signals from the ground station. Thirdly, these signals, which are normally heard in the headphones, can be rectified and applied to the visual indicator of the blind approach apparatus, so that the pilot can converse with the crew on the internal telephone system and at the same time keep an eye on his course.

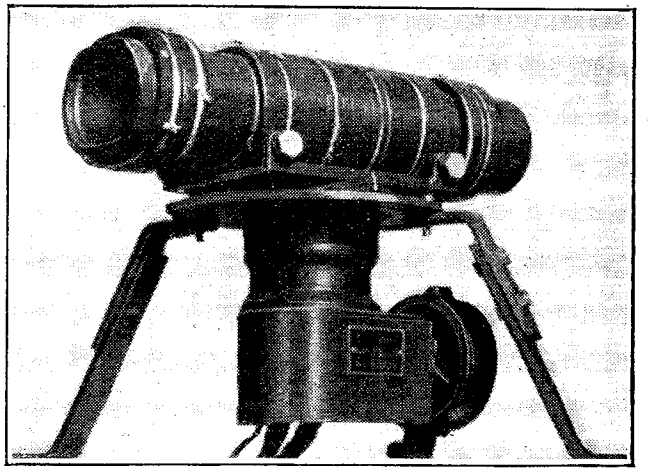


Miniature pentode valve standardised throughout the receiver and amplifier equipment. It has an acorn-type ring seal and is inserted "upside-down" in a deep valve holder.

Both the tuning of the DF set and the rotation of the loop are effected by flexible wire cables. The tuner unit is rather like a small cash register; one turns a handle and the tuning scale degrees appear on a Veeder-type counter.

Only two types of valve—one receiving and one transmitting—are used throughout the radio communication and intercommunication systems. The receiving valve (Tye RV12P) is a pentode which can be used as a triode, mixer, etc. It has side contacts with a ring seal and might be described as a "semi-acorn" type. Inverted valve holders with a built-in socket for the "top" contact are employed, and as the valve bases are thus flush with the outside of the chassis, a special screw knob is provided to extract the valves.

The electrical characteristics of every part of the equipment and complete wiring diagrams have been measured and traced out for the information of the various technical branches of the Ministry of Aircraft Production, where it has been noted with interest and encouragement. As far as the representative of this journal was able to judge, the equipment at present in use by the *Luftwaffe*, while of sound design and construction, and not without features of interest from the mechanical point of view, contains nothing fundamentally new or advanced.



The compact dimensions of the DF loop are achieved by the use of a massive iron-dust core.

BOOK REVIEW

Photo-Electric and Selenium Cells. 2nd edition. By T. J. Fielding. Pp. 163, with 82 illustrations. Chapman and Hall, Ltd., 11, Henrietta Street, London, W.C.2. Price: 7/6 net.

THIS is a second edition of a book first published a few years ago on a subject of rapidly growing interest and importance; and, in addition to extensive revision throughout, several sections have been rewritten and a new chapter introduced. After a brief explanation of the photo-electric effect, the various types of cells and auxiliary apparatus such as amplifiers are described. The remaining chapters are devoted to the astonishingly diverse applications—actual and proposed—of photo-electricity.

The author deals with the subject in an essentially practical manner, leaving advanced theory aside; and amateur experimenters in particular will find the book full of suggestions. Industrial applications are not neglected, however.

The merits of the selenium cell, which have tended lately to be rather overshadowed by the photo-electric types, are deservedly emphasised, and full details are given of how to make these useful cells cheaply. Information on characteristics guides the reader to the most suitable type of cell—selenium, vacuum, gas-filled, or rectifier—for any particular application. The reviewer suggests that a useful additional feature would be tabular data on available commercial cells.

The standard of accuracy is good, but the author does not escape the almost universal error of believing that the Kerr cell *rotates* the plane of polarisation of light. And a crossed wire where a junction should be makes Fig. 25 difficult to follow.

The book is cordially recommended as a readable and practical treatment of the subject. M. G. S.

Compressed Dipoles

By E. L. GARDINER, B.Sc.

REDUCING THE DIMENSIONS OF SHORT-WAVE AERIALS

In this article it is shown how the physical dimensions of short-wave aerials may be reduced by insertion of a loading coil. Measurement of the relative effectiveness of normal and loaded aerials were made by the author and are described. The matter is treated mainly from the point of view of reception

IN a recent article[1] were described a few simple measurements of field strength illustrating the advantages of directional aerial systems in the reception of short-wave signals. Even the addition of a reflector to the usual dipole was shown to yield a very useful improvement in signal-to-noise ratio. Unfortunately, however, the simplest directional array occupies considerably more space than a plain dipole, and when it is designed for use at wavelengths between ten and fifty metres, cannot always be accommodated in the space available. The additional wires and spreaders will often be regarded as unsightly, whilst their weight demands the provision of well designed and strongly constructed masts. For example, a dipole and reflector resonating in the 20-metre band will involve two parallel wires each some 32 feet long, and about 17 feet apart. It is not easy to design a self-supporting arrangement of this size, whilst a wooden framework to support conductors of that length is by no means unobtrusive. These difficulties are accentuated when it is desired to erect the whole structure in a rotatable form.

For shorter wavelengths in the neighbourhood of five to seven metres it fortunately becomes practicable to construct the dipole and reflector of metal tubing, which can be strong enough to support its own weight in a high wind. Even at these short wavelengths, however, there will be occasions when a reduction in bulk would be very acceptable. Experiments in direction finding may be quoted as an example. Just before the war the writer constructed a dipole and reflector supported by a light wooden framework which could easily be transported by car. This was employed in the field to locate a hidden five-metre transmitter. The latter radiated vertically polarised waves, and the procedure was to rotate the receiving aerial system until signals were at a minimum, when the reflector will be in the direction of the incoming waves.

In this way it was found possible to determine direction with an accuracy of about five degrees, provided of course that the direction of arrival of the waves had not been modified by intervening objects.

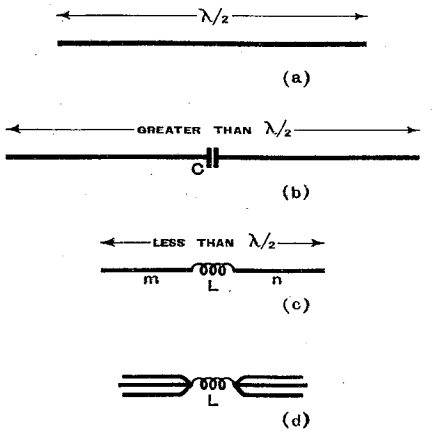


Fig. 1. Illustrating the loading of a half-wave dipole (diagram (a)) by capacity and inductance.

The aerial structure was 8 feet high and 4 feet wide, and could be fairly easily handled when mounted upon a stout camera tripod fitted with a rotating head. It could hardly be termed convenient, however, and too much time was needed in setting it up, so that the need for a more compact arrangement giving, if possible, more pronounced directional effects was very evident.

Consideration of the possibilities of such an improvement naturally directed attention to the compressed dipole. This form of aerial has been known for many years, and is used by certain commercial organisations as a television receiving aerial in locations where space is very limited. It is barely mentioned, however, in most handbooks, and very little information seems to be available concerning its general use in short-wave reception. Thus there seemed good reason for carrying out practical tests on similar lines to those described in the previous article already mentioned, and in which the field strength measuring equipment could be pressed into service.

Half-wave Aerial Characteristics

The ordinary dipole, or more correctly the Hertzian half-wave aerial, resonates to a certain wavelength by virtue of the distributed inductance and capacity of the conductor. In open space the resonant wavelength is slightly more than twice the length of the dipole, which is therefore slightly less than a half-wavelength long. The proximity of buildings or of other conductors increases the electrical capacity of the wire, and thus reduces the length necessary to resonate at any particular wavelength.

An interesting example of the effect was noticed by the writer when adjusting the length of a 20-metre aerial, one end of which was only a few feet above roof level, whilst the other was 20 feet higher. It was found that the lower end could be reduced in length by some two feet

[1] "Aerial Reflectors," *The Wireless World*, October, 1940.

Compressed Dipoles—

to restore resonance, thus making the two halves of the aerial unequal by that amount with respect to its electrical centre. Similarly, the resonant length of a dipole can be increased if the distributed capacity of the wire be reduced. This can be done in practice by the introduction of a condenser into the centre of the aerial, and shown at C in Fig. 1 (b). Since the capacity of two condensers in series is always less than that of either alone, and the added condenser acts in series with the distributed capacity of the aerial wire, the effective value of tuning capacity is reduced. The aerial thus resonates to a shorter wavelength, or must be increased in overall length to resonate at the wavelength to which it responded before the condenser was inserted. It is possible to tune the aerial over a limited range by varying the capacity of the added condenser.

Reducing Aerial Length

As a rule, however, there is no advantage in increasing the length of a dipole, and it will be more useful to decrease it. By analogy with a tuned circuit employing a coil and condenser, the wavelength will be increased, or the aerial shortened for a fixed wavelength, if either its distributed capacity or inductance be increased. It is inconvenient to increase the capacity to any material extent. To do this by adding a condenser would imply connecting this between the two free ends of the dipole, and would only be possible by the addition of long leads which would modify the action of the whole system profoundly, or by bending the aerial round until the free ends are in close proximity. In either case the aerial becomes a closed loop, and whilst it will in fact resonate to a considerably longer wavelength than before, it is no longer a dipole, and is not within the scope of this discussion.

It is, however, quite convenient to increase the inductance of a dipole by the addition of a coil, which can be inserted at the electrical centre as shown at L in Fig. 1 (c). This coil acts in series with the inductance of the wire, increasing the effective value, and thus increasing the resonant wavelength. The distributed capacity is little changed, and the overall length of the dipole must be reduced to bring it back into resonance with the original wavelength. Being shorter, the aerial is termed a compressed or loaded dipole.

As the value of added inductance is increased the overall length must be reduced to maintain resonance at a particular wavelength, and this shortening process can be continued until finally the dipole itself vanishes, leaving only the loading coil which now resonates by virtue of its own self-capacity. In such an extreme case there would clearly be little radiation from or reception by the "aerial," which has become a closed circuit consisting of a small coil of wire. Some intermediate case must be investigated, and for the purpose of these tests it was decided to choose a value of loading coil which would reduce the overall length to one half of its original value, or to about a quarter wavelength. The accompanying table gives an idea of the lengths and sizes of loading coil found suitable for wavelengths of from 5 to 20 metres. No. 16 SWG enamelled copper wire was used throughout in constructing the aerials, and the loading coils were wound on a Trolitul former $1\frac{1}{4}$in. in diameter, the turns being spaced by approximately the diameter of the wire. It must be appreciated, however, that whilst the figures given will form a satisfactory starting point from which to work when trying out compressed dipoles, they cannot be regarded as exact. The resonance of these aerials is noticeably sharper than that of a half-wave aerial, and for best results the length should be trimmed experimentally, since it will be determined to some extent by the exact materials used, and particularly by wire diameter and turn spacing.

Approximate design data for compressed dipoles having a length of one-quarter wavelength.

Wavelength metres	Approx. length of comp. dipole ft. in.	Turns in loading coil	80 ohm feeder tapped across turns
5	4 0	12	2
7.0	5 6	16	3
10	8 0	22	4
20	16 0	40	6

In order to keep the conditions as simple as possible, the remainder of the dipoles were composed of straight single wires. It is possible to employ as the portions *m* and *n* of Fig. 1 (c) either conductors of larger diameter, such as copper tubes, or several spaced parallel wires joined together at the terminals of the loading coil, as sketched in Fig. 1 (d). By so doing the distributed capacity of these portions is further increased, and either the overall length or the inductance of the loading coil can be decreased somewhat. Clearly the possibilities are extensive, and for the present no attempt has been made to examine the properties of aerials which are compressed to less than a quarter wavelength, or in which multiple wires are used. Probably the chief advantage of increasing the diameter of the arms *m* and *n* lies in the established fact that by so doing the "Q" of the aerial is reduced, and it resonates more broadly over a wider band of wavelengths. This may be important in the particular case of television reception, where some slight loss in image detail may result from the excessive selectivity of a compressed dipole in which a single wire composes the arms, and for which three wires in parallel spaced by about 2 inches can be recommended. A second case which might justify this procedure would be where a fairly uniform performance over the whole of a wave-band was desired, rather than the best possible performance at any one frequency.

Feeder Connections

Before experimental tests can be made with a compressed dipole it must be connected by a non-radiating feeder to the transmitter or receiver. Whilst any of the recognised types of feeder could be used, the aerial is symmetrical about its electrical centre, and therefore lends itself to a balanced twin-wire transmission line, rather than to the concentric type. Since it is particularly necessary that only the aerial shall radiate, a low-impedance line was preferred to one of a higher impe-

Compressed Dipoles—

dance, in which the two conductors would be spaced by several inches, because the latter is more likely to become unbalanced during the course of adjustments. A proprietary cable of 80 ohms nominal impedance was selected, having the useful property that the radiation from it was too slight to be measured by the equipment used, even when the cable was not exactly matched to the aerial impedance.

The simplest and most widely used method of coupling is to break the dipole at its electrical centre, and, on the assumption that its impedance at this point has the theoretical value of 72 ohms, to insert a cable of about that impedance directly. This system works well in practice, but suffers from the disadvantage that if any steps are taken which change the impedance at the centre of the dipole, a mismatch to the feeder must occur. The presence of a reflector near to the dipole will have the effect of lowering this impedance, and thus tends to destroy the desired correct matching between feeder and aerial.

Matching Impedances

In the case of loaded dipoles a better method of coupling is fortunately available, since it would not be advisable to break the continuity of the loading coil. The feeder may be tapped across a few turns equally placed on each side of the centre of the coil, as shown in Fig. 2 (a). Whatever the exact impedance of the feeder or of the aerial, it is now possible to get an exact match, for the impedance across a portion of the loading coil will vary from zero when the two feeder wires are attached at a common central point, up to a comparatively high value when they are separated by the whole coil. At an intermediate point, therefore, an impedance equal to that of the feeder will always exist, and can be found by trial.

An alternative method exists in the form of inductive coupling between the loading coil and a coil of a few turns connected across the ends of the feeder cable, as shown in Fig. 2 (b). For the sake of completeness a method of coupling to the extended dipole of Fig. 1 (b) may be mentioned. Here the feeder is joined directly across the series condenser, as shown in Fig. 2 (c), and the capacity of the latter is selected so that its reactance matches the impedance

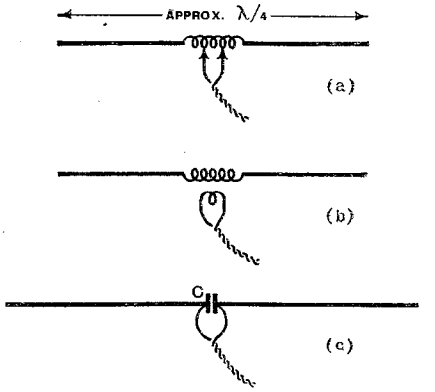


Fig. 2. Methods of connecting the feeder to a loaded dipole.

of the feeder. In this way an exact match to cable of any impedance is possible at one particular wavelength only, but unlike most other arrangements the system will not operate satisfactorily at harmonics of this, since the reactance of the condenser will then be different.

It will be remembered that the performance of various arrangements was measured in the present case by connecting the aerial under test to a transmitter adjusted to deliver as far as possible constant power and observing the readings of a field strength meter placed at some two wavelengths from the aerial. It can be safely assumed that the behaviour of the aerial under receiving conditions will be complementary to that when tested as a radiator, since the same physical factors are involved in the two cases, and provided of course that the incoming waves can be assumed to arrive from the direction in which measurements are made.

It was decided first to determine how the radiated field from a compressed dipole of the dimensions given in the table compared with that from a plain dipole. The latter was first set up, under the conditions of the preceding article, and the field strength at a point broadside to the aerial was noted. In this case the feeder was tapped directly into the centre of the dipole. A compressed dipole was then erected in the same position, and the same feeder connected across a few turns of the loading coil, as in Fig. 2 (a). This tapping was varied until the radiation from the aerial was at maximum, no change being made to the coupling of the other end of the feeder to the transmitter, or to the adjustments of the latter, which was, of course, crystal controlled. It was noted with great surprise that the field strength from the two aerials was almost identical, whilst in the second case the feeder current and estimated current in the aerial had increased. The experiment was repeated several times, and on a number of wavelengths, with similar results. It was found that the reduction in overall length of the compressed dipole to one half of the original was not accompanied, as had been anticipated, by a reduction in the radiated field to 50 per cent. or less of its former value, but that if the feeder current was maintained the same in the two cases, the field strength was reduced to between 70 per cent. and 80 per cent. only, whilst if the feeder tapping point on the loading coil was adjusted to optimum performance as first described, there was practically no reduction observed. Secondly, it was noticed that, whilst no accurate method for measuring the oscillatory current within the dipoles was available, it was clear, from the usual tests of coupling a neon tube or small lamp to the aerial wire, that both the current near the centre of the compressed dipole and the voltage at its free ends was greater.

Unexpectedly Good Results

It is generally assumed that the most effective portion of a dipole in radiation or reception is that near the centre, in which maximum current flows. It would therefore be expected that, if this portion be coiled up and rendered ineffective as a radiator, the radiation from the whole aerial would suffer considerably. From the evidence it seemed that this was not altogether true.

Whilst calculation of the current distribution within a loaded dipole would not be simple, it seemed likely that the following two effects were mainly responsible for the relatively good performance. First, the "Q" of the compressed dipole had

Compressed Dipoles—

been increased, as was evident from its sharper tuning, and a given amount of power induced in it would thus be expected to set up a larger oscillatory current. The radiation resistance of the aerial was almost certainly lower than that of a plain dipole, and so there would be less damping through radiation. Secondly, it was possible to reach a very effective impedance match into the feeder by the tapping adjustment, and this would still be possible when the aerial formed part of an array, and its impedance was upset by the presence of other elements. The transfer of energy into the aerial was therefore somewhat better, and in conjunction with the former point, these two factors seemed approximately to compensate for the reduced size of the aerial.

As a receiver the compressed dipole may not show up quite so well, since the improved impedance matching will not hold over any wide band of wavelengths. Attempts to confirm this by reception tests over a period indicated that in general signals were noticeably but not seriously weaker than from a full-length dipole, but that when it was possible to tune the aerial exactly to the wanted signals, this difference largely disappeared. A simple and

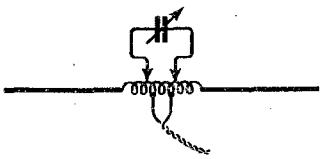


Fig. 3. Tuning a compressed dipole to exact resonance by means of a condenser.

apparently effective method for tuning the aerial was evolved, and is of particular assistance in tuning loaded reflectors, as will be mentioned later. It consisted in joining a small variable condenser across a few turns near the centre of the loading inductance. In the case of the five-metre band, the feeder cable was tapped across two turns of the coil, and a 15 m-mfd. condenser across four turns, as sketched in Fig. 3. This enabled the aerial to be tuned over some two megacycles, and was a decided assistance in reception.

(To be concluded.)

Emergency Reception

WORKING AC MAINS SETS FROM BATTERIES

By B. W. F. MAINPRISE, B.Sc.Hons.(Eng.)

IT is not generally realised that, by slight alterations to the wiring of the rectifier valve socket of almost any receiver, public address amplifier or small transmitter operated off AC mains, the equipment may be adapted so that it can be instantly connected, in the event of mains failure, to an emergency power supply, consisting of an LT battery and, say, a vibrator, or convertor or bank of HT cells.

No skilled workmanship is required, nor the cutting of a hole in the chassis for a connector panel, nor the making of screw terminal connections in the dark after mains failure.

The adaptation is of especial use in local Defence Headquarters, where a receiver must at all costs be kept running at all times to receive emergency broadcasts, or in places where PA equipment is used to distribute instructions throughout the building.

It is also of great use for mobile equipment such as is used, for example, in Army trucks. When the vehicle is located in a village, the communications equipment can be operated off the mains, and when in motion it can be instantly worked off the starter battery.

The necessary modifications are indicated in the accompanying diagram, where thick lines show the original chassis wiring to the rectifier valve socket. The broken lines indicate the additional wiring required. This is as follows:—

Connect contact 4 to earth (chassis).

Break the lead from the non-earthed side of the heater winding on the mains transformer and take the ends to contacts 1 and 2.

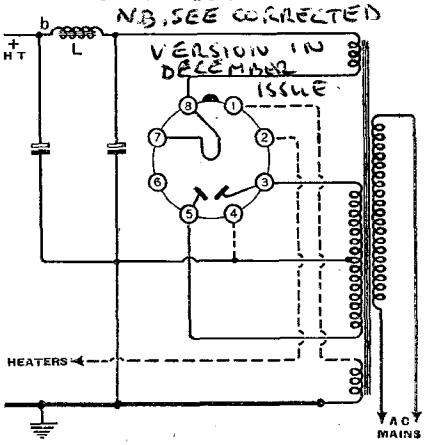
Join *pins* 1 and 2 of the rectifier valve itself (not on the socket).

This completes the alteration.

Operation.—Insertion of the rectifier valve for mains operation automatically joins contacts 1 and 2, and the circuit is as originally wired.

The leads from the emergency LT battery and, say, the vibrator, or convertor, or bank of HT cells are connected to an octal plug, LT+ to pin 1, LT− and HT− to pin 4, HT+ to pin 8. Insertion of this plug in place of the rectifier automatically connects the supply to the appropriate points and disconnects the heaters from the heater winding which would otherwise act as a virtual "short" across them.

The change-over can be accomplished almost before the heaters have lost their glow. No damage can result if the receiver is accidentally connected to the mains while working off the emergency supply.



Rewiring the rectifier socket to allow the use of an emergency source of H.T. supply.

It will be seen that contact 6 is unused. In receivers where chassis and HT− must not be joined owing to the presence of a bias resistance, take HT− to contact 6.

In certain cases it will be necessary to consider other details. For instance, if the receiver employs an energised loud speaker in place of the smoothing choke L, the voltage drop across its field winding may be uneconomical for vibrator or convertor working. In this case, take HT+ to pin 6 instead of to pin 1 of the connecting plug, and wire contact 6 of the socket via a 20.H, 250-ohm choke to the end marked b of the winding L. The residual magnetism of the loud speaker will still provide reception, though at reduced volume.

Should contact 6 not be required for either of these uses, it is suggested that it be joined to contact 1. Join pin 1 of the connecting plug by a lead to LT+ thus providing two leads in parallel for LT+ and thereby minimising loss of voltage.

The connections shown are for international octal bases. Any other 8-pin base may clearly be used provided due allowance is made for difference in base connections. Rectifiers of the 4-pin type should either be replaced by the octal equivalent, or else an octal base be fitted in place of the 4-pin one.

Colour Television in U.S.A.

THE COLUMBIA SYSTEM DESCRIBED

By A. DINSDALE

As recently reported in this journal, television in the United States was thrown into an uproar by bureaucratic *ukase* early this spring. Recriminations, charges and counter-charges were defiantly hurled about by the various protagonists. But it was no use. When the noise of battle died, television in the United States was dead, too, deader than a doornail—at least for the time being. Transmitters went off the air to be rebuilt to operate on higher frequencies. Nothing seemed to disturb the autumnal calm until suddenly, like a bolt out of the blue, the Columbia Broadcasting System put on a demonstration of television in full colour!

True, the subject-matter was provided by coloured film run through a film scanner, and not a direct pick-up. Nevertheless the demonstration was a very good one, highly convincing, and most interesting in its implications.

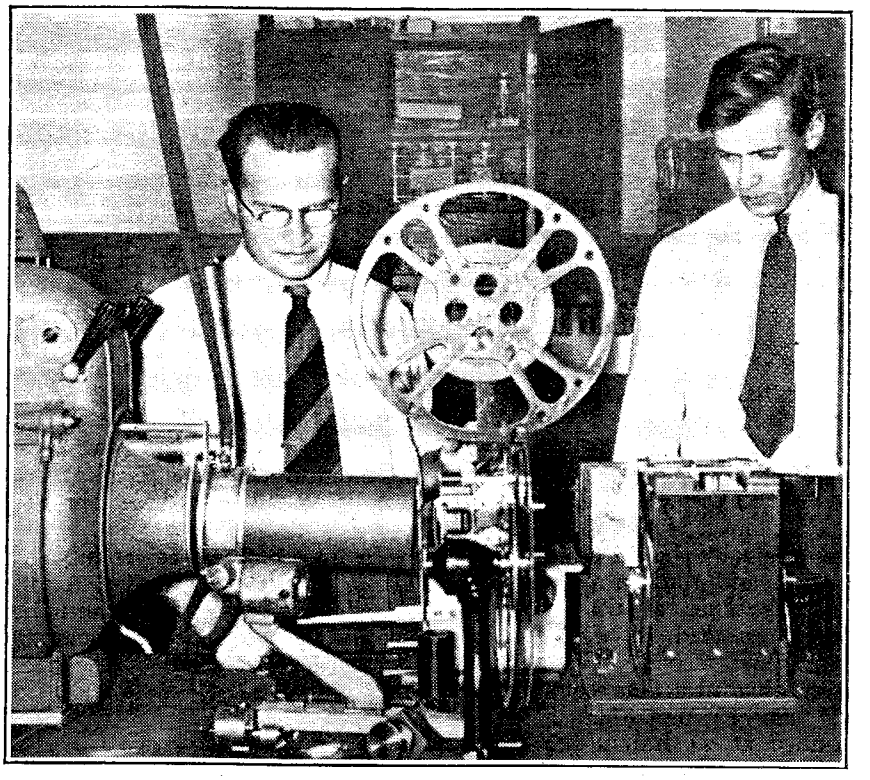
For a long time many people have wondered just what C.B.S. was up to. It may be remembered that in 1931 and 1932 C.B.S. transmitted television programmes by the mechanical disc method. These programmes were discontinued and C.B.S. apparently lost interest in television until 1936, when Dr. Peter Goldmark, formerly with Pye Radio, Ltd., was appointed television chief engineer. About two years ago Dr. Goldmark built a high-power vision transmitter on top of the tower of the Chrysler Building in New York, and it was announced that C.B.S. would shortly recommence the broadcasting of television programmes in competition with N.B.C. But nothing happened. The transmitter seemed to be on the air only at rare intervals, and then only to transmit test patterns.

Dr. Goldmark says he has been working on colour for some time, but very intensively only during the past six months. Asked how he came to be interested in colour television, he explained that he is an enthusiastic amateur motion picture photographer. He began to use colour film, and thereafter acquired what he described as an inferiority complex not only towards black-and-white film but also towards black-and-white television.

In the demonstration given in New York last September 4th, transmitter and receivers were connected by cables, but in a private demonstration given a week previously to James L. Fly, Chairman of the Federal Communications Commission, the images were broadcast by radio from the Chrysler Building transmitter. This transmitter was then immediately dismantled to make the change-over to its new frequency allocation.

The film used for the demonstration was 16 mm. Kodachrome, and included a wide range of subjects, close-ups and long shots. In one scene a girl in a brightly coloured dress held up a large black-and-white photograph of herself. It speaks well of both the Kodachrome process and the television process that this photograph showed up black-and-white on the television screen.

A most interesting basis of comparison was provided by C.B.S. engineers. Alongside the colour television receiver they placed an ordinary black-and-white receiver, and fed it from the same signal scource. It was thus possible to make comparisons between the black-and-white image and the coloured image. The black-and-white image provided slightly better detail than the coloured image, and by comparison with customary black-and-white television the image was much less

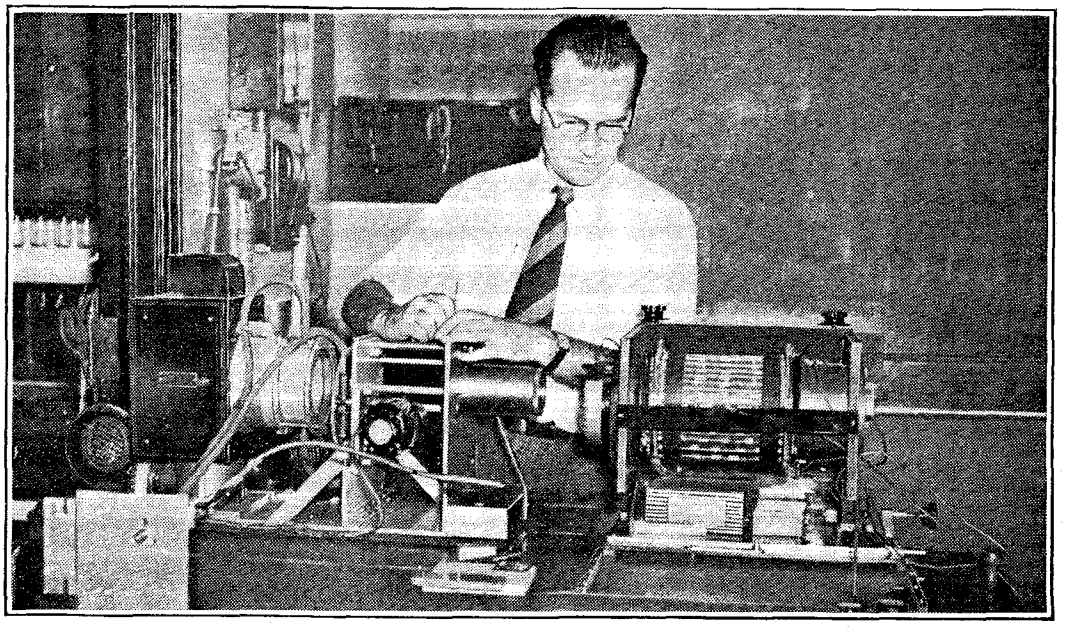


The Columbia colour television projector; the optical system is water-cooled. Dr. Goldmark, C.B.S. chief television engineer, is on the left.

Colour Television in U.S.A.—

"contrasty." The effect is best compared with the difference between ordinary 16 mm. film and panchromatic film.

The colour image was steady, the colours perfectly registered. In fact, it was difficult to realise that one was not watching a Kodachrome film on a home movie screen. As to the improvement lent by the addition of colour the additional value is exactly the same as in the case of the addition of colour to the ordinary home movies.



The C.B.S. colour system was developed with the help of this "still" projector, to which motion has now been added.

Only a limited amount of technical information was released. Dr. Goldmark pleaded the patent situation, the fact that C.B.S. is not interested in manufacture, and that they wish to make their revelations first to the National Television Committee. This latter event is expected to occur about January 1st next, by which time C.B.S. hopes to have its radio transmitter rebuilt and operating again.

Frame Periodicity

The film used in the demonstration was originally shot at 64 frames per second, and run through the television scanner at 60 frames per second, instead of the usual 24 frames per second. Work is now proceeding on a film scanner which will use 16 mm. film shot and scanned at 24 frames per second. After this has been completed, 35 mm. equipment will be built.

In contrast to the American standard of 441 lines for black-and-white Dr. Goldmark at present uses 343 lines, interlaced. He thinks he can increase the number of lines to more than 400 without exceeding the permitted 6 Mc/s band width of the radio channel. His present equipment utilises 4.25 Mc/s of the band.

Between the film scanner and the electronic pick-up tube there is a rotating disc containing red, green and blue filters in that order. When the red filter is in front of the tube only those parts of the picture which contain red make any impression on the pick-up tube. When the green filter is in front of the tube, only those parts of the picture which contain green (and this includes yellow) register on the tube. Similarly with the blue filter. The three filters are balanced to give the effect of pure white when the picture is white, in accordance with the physical laws governing these three primary colours of light.

In front of the receiver tube is a similar rotating filter disc, exactly synchronised with the transmitter disc by means of special synchronising impulses sent out by the transmitter.

Scanning in Colour

In black-and-white systems, the image is completely scanned every 1/24th of a second. In the C.B.S. colour system the image is completely scanned every 1/60th of a second. However, at the end of the first sixtieth of a second only two colours have been used. The third colour requires an additional 1/120th of a second. Thus, the total elapsed time for one picture, totally scanned in full colour, is 1/40th of a second. The exact scanning sequence is as follows:—

The odd number lines are scanned in red in 1/120th of a second. The even number lines are scanned in green in 1/120th of a second.

At this point the whole picture has been scanned, but there is as yet no blue in the picture. Elapsed time: 1/60th sec.

Now the red on the odd number lines has faded and these same lines are scanned in blue in 1/120th sec.

At this point the whole picture has been scanned $1\frac{1}{2}$ times, but in full colour only once. Elapsed time: 1/40th sec.

Now the green on the even number lines has faded and these same lines are scanned in red in 1/120th sec.

At this point the whole picture has been scanned twice, but in full colour only $1\frac{1}{3}$ times. Elapsed time: 1/30th sec.

Now the blue on the odd number lines has faded and these same lines are scanned in green in 1/120th sec.

Elapsed time: 5/120th sec.

Now the red on the even number lines has faded and these same lines are scanned in blue in 1/120th sec.

At this point the whole picture has been scanned three times and in full colour twice. Elapsed time: 1/20th sec.

And now the whole progressive cycle begins again with the odd number lines being scanned in red.

The output of the pick-up tube,

Colour Television in U.S.A.—with the different colour impulses unsegregated, proceeds along a single channel to the main control panel. Here the different colour impulses are sorted out and routed into three separate channels for control purposes. After passing the controls, the three sets of impulses are again recombined in a single channel and sent to the radio transmitter to be broadcast. At the receiver the impulses are not segregated, but fed directly to the electron tube.

At the main control panel each colour can be separately regulated by means of a gain control in each of the three colour circuits (after segregation). By this means an accurate colour balance can be achieved. During the demonstration, at a moment when a close-up of a large red zinnia with green leaves was on the screen against a deep blue sky, Dr. Goldmark slowly took out the red component entirely, leaving the red petals of the flower as a nondescript shadow on the screen.

Viewing in Bright Light

At one point during the demonstration the lights in the room were switched on. The image in the black-and-white receiver faded out until only the highlights were visible. The coloured image, however, *held its brilliance and clarity*, both in the highlights and in the shadows. In fact, it looked the same as it did when the lights were off. The only noticeable difference was a relief from eye strain when the room lights were on. This may be an item of considerable social and other significance if and when television in full colour is fully adopted and running on a daily schedule like sound broadcasting is to-day.

Both the receivers used in the demonstration were equipped with 9in. tubes.

Dr. Goldmark stated that he is working now on equipment for direct pick-ups in full colour. The only reason he demonstrated with film first, he said, was that he has been held up for some months awaiting delivery by a manufacturer of an important component part. He further stated that he estimated that direct pick-ups in colour will require two to three times as much light as is required for direct television pick-ups in black-and-white. He expects to have his direct pick-up equipment ready for operation by January 1st next.

When asked if he had to develop a composite screen of several different photoelectric materials for his pick-up tube, Dr. Goldmark replied that he found that ordinary cæsium tubes were adequate to cover the entire colour range.

In reply to a further question, Dr. Goldmark stated that there is no special significance in the scanning standards he had adopted. His choices were governed entirely by considerations of convenience in relation to the equipment he had on hand, or had to build.

On the ground that C.B.S. is not a manufacturing company, Dr. Goldmark refused to be specific when asked about the cost of adding colour to existing television receiver designs. He thought the additions necessary to enable a receiver to reproduce colour might add about 10 per cent. to the list price. As to the possibility of adapting existing receivers, it depended upon their design whether they could be readily adapted. In some cases the cabinet size or arrangement would make adaptation rather difficult and expensive. However, the receiver would still be capable of receiving his colour transmissions, but it would reproduce them in black-and-white, and, as already noted, the detail would be better and much less "contrasty," so present owners of televisors stand to gain anyway. The necessary changes involve circuit changes to conform to his scanning standards, and the addition of a colour disc, complete with driving motor and synchronising mechanism. The diameter of the colour disc is not quite twice the diameter of the electron tube.

Back in 1928, when John L. Baird first demonstrated a crude form of colour television, it was thought that the only way to accomplish the feat would be to use three channels, one for each colour, or else use one channel of three times the band width required for black-and-white television. Baird used the latter method. In this present day of high-quality black-and-white television, Dr. Goldmark has shown that the already overworked latitude of persistence of vision can apparently be stretched still further to provide high-quality colour television without taking up any more room in the ether than is required for the transmission of black-and-white images.

The question in the United States, as regards television in general and Government interference with it, is: And now—what next?

Books Received

The Superhet Manual. Edited by F. J. Camm. A handbook on the principles, design and maintenance of the superheterodyne. The opening chapters deal with general principles and those problems of selectivity which initially provided the *raison d'être* of the superhet. Details of design are then discussed; a concluding chapter is on servicing with the help of the cathode-ray tube. Pp. 135; 89 diagrams. George Newnes, Ltd., Southampton Street, Strand, London, W.C.2. Price 5s. net.

Definitions and Formulæ for Students: Radio and Television Engineering. By A. T. Starr, M.A., Ph.D., A.M.I.E.E. The first section of this pocket-sized reference book contains short definitions of terms used in wireless engineering. In the second section, entitled "Formulæ and Circuits," a number of subjects are treated at greater length; for instance, about three pages are devoted to data on the inductance of coils. Under the subheading of "Valve Circuits" the principal functions of a valve—amplifier, detector, oscillator, etc.—are illustrated by diagrams, with explanatory text and formulæ. Television is similarly treated in two sections. Pp. 49, with 33 diagrams. Sir Isaac Pitman and Sons, Ltd., Parker Street, London, W.C.2. Price 6d.

Radio Engineer's Pocket Book. By F. J. Camm. A vest-pocket book of reference for service engineers, students, constructors and others. The contents include graphical symbols, radio formulæ, valve base connections and a large amount of general data. Among sections of interest to operators are the "Q" code, abbreviations, phonetic alphabet, etc. Pp. 147. George Newnes, Ltd., Southampton Street, Strand, London, W.C.2. Price 3s. 6d. net.

Radio Training Manual. Edited by F. J. Camm. A textbook on the principles and practice of radio, written for students desiring to enter the Services or the industry. The two opening chapters deal with the prospects of radio as a career, while later sections are devoted to electrical principles and to receiver design (including the superheterodyne). Servicing is treated in the concluding chapter. Pp. 160; 96 diagrams. George Newnes, Ltd., Southampton Street, Strand, London, W.C.2. Price 3s. 6d. net.

On Joining the R.A.F.

ADVICE ON PRELIMINARY STUDIES

By J. A. McGILLIVRAY

THERE is at present a considerable number of vacancies for wireless personnel in the Royal Air Force. Pay and chances of promotion depend in every case upon individual attainments and qualifications, and it is not necessary in every case that entrants should start at the foot of the ladder.

There are three principal classes of wireless personnel, namely, Signals Officers, Wireless Mechanics, and Wireless Operators, and these are further subdivided as explained below.

Applicants for appointment as Signals Officer must have extensive theoretical and practical knowledge of modern radio equipment, including HF and DF apparatus. Experience gained over some years is essential. Selected candidates are interviewed by an Examining Board, and if approved and physically fit are appointed to a station when competent. Their duties do not normally entail flying.

An appeal for Wireless Mechanics was recently broadcast by the Air Ministry. Entry into this branch is restricted to men with servicing experience who are able to locate faults and handle tools. Knowledge of morse is not required, and, after appointment, training covering the equipment in general use is given. Extensive theoretical knowledge is not required, but sufficient must be known of radio principles to enable men to make an intelligent use of servicing apparatus and to reason logically when tracing faults.

Vacancies also exist for Radio Mechanics, who require similar qualifications to the above on enlistment. These men also receive training on the equipment which they will use in the Royal Air Force.

Pay on appointment is according to ability, with a maximum of 5s. 6d. per day. Uniform is provided and full food and accommodation, or allowances in lieu, together with marriage and children's allowances where applicable. Chances of promotion to higher rank depend in every case upon ability, and there are definitely good prospects in this branch of the Service.

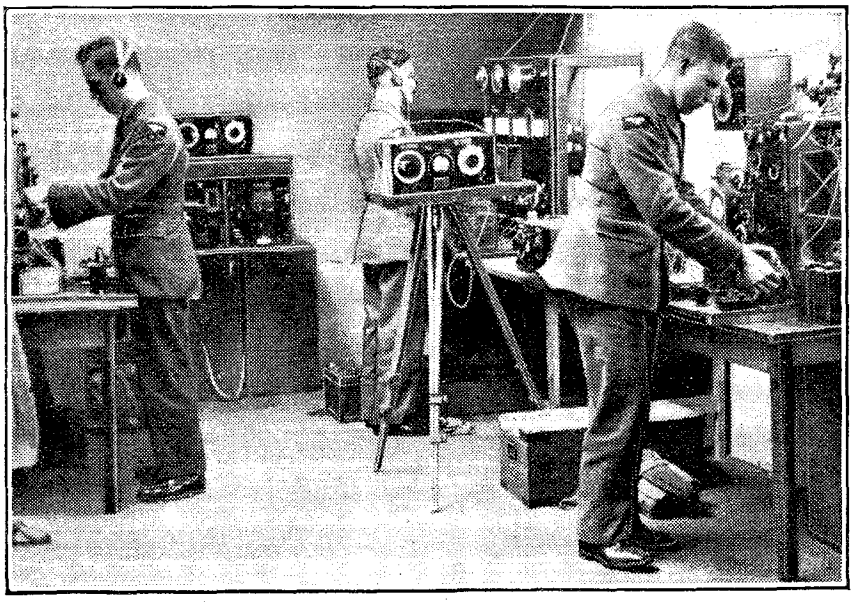
Recruits for duty as Wireless Operator, or Wireless Operator/Air Gunner, need not have any previous wireless experience. On enlistment they are posted to a School for preliminary training in more signalling and general educational subjects. At the end of the preliminary course trainees are divided into two categories for further training either as ground wireless operator or as wireless operator/air gunner (air crew). Men in the second category are all volunteers, and must be of high standard physically. They must not exceed six feet in height nor weigh more than 175 lb.

Initial Training

After selection, both categories are sent to a wireless school, where they are given a course of training which embraces theory, signalling, signals procedure, and practical work. Emphasis is placed on basic principles, and instructional films are used wherever applicable. Every endeavour is made to arouse interest in those particular subjects which many find uninteresting.

Signalling and signals procedure are subjects which can be taught in conjunction, and this is the usual practice. Practice is given in use and maintenance of equipment of all types, including accumulators, generators, transmitters, receivers and all auxiliary apparatus. In order to foster dexterity, lots of practice is given both on the ground and in the air.

To complete the course successfully in the time allotted, considerable effort is required. Young men who intend to enter this branch of the service, or who have volunteered and are awaiting call-up, can do much to promote chances of success by a course of spare-time work during the waiting period. If such time is limited, then preparation should be restricted to morse practice. In this connection, *The Wireless World* handbook, "Learning Morse," is most valuable. The principles contained in it should be



R.A.F. entrants undergoing instruction in the adjustment of Service apparatus.

On Joining the R.A.F.

closely followed, as they form the basis of correct sending and receiving.

For those with more available time a course of study of elementary principles will prove time well spent. There are various textbooks suitable for home study, and a short list is given below.

Morse practice at a Supplementary Wireless School.

Men who have already completed training sufficient to reach a morse standard of 20 words per minute, and have the P.M.G.'s Certificate of Proficiency in wireless telegraphy, can enlist directly as wireless operators for further training in R.A.F. procedure, etc., after which they are graded and classified according to ability.

Air crew operators are given training in air gunnery, and, after successfully completing the course, are promoted to the rank of Sergeant, with a pay of 7s. 9d. per day with allowances where applicable.

Posting to an operational unit follows directly on promotion, and at the operational unit men fulfil the part for which they have been trained, acting as second operator until a high degree of proficiency has been reached. Many of these men have already been employed on arduous long-distance flights, operating successfully against Germany and Italy.

There are distinctly good opportunities to transfer to the observer or pilot branch of the service for those who are so inclined. With this goes increased pay and rather better chances of promotion to a commission.

List of suggested books for prospective R.A.F. entrants:—

"Learning Morse"—Iliffe (6d.).

"Foundations of Wireless"—Sowerby—Iliffe (5s.).

"Elementary Aircraft Wireless"——Radio Dept. Scottish Aviation, Ltd. (2s. 6d.).

"Modern Radio Communication," Vol. 1—Reyner—Pitman (7s. 6d.).

"Wireless Telegraphy"—Crook—Pitman (7s. 6d.).

"The Wireless Engineer"

OVER four hundred and fifty articles on wireless and allied subjects recently published in the technical journals of the world are abstracted or referred to in the Abstracts and References section of the October issue of *The Wireless Engineer*. This regular feature of our sister journal, which is published on the first of the month, is divided into fifteen sections for easy reference. The value of this section, which is prepared by the Radio Research Board, has been greatly enhanced by the difficulty now experienced in securing journals from abroad.

The October issue, which is obtainable through newsagents or direct from the publishers, Dorset House, Stamford Street, London, S.E.1, at 2s. 8d., post free, also contains an article on the suppression of noise by the use of amplitude limiter circuits. A device designed to allow the continuous shifting of the phase angle between two AC voltages by known amounts is also described.

MURPHY AD94

Low-priced Universal Model for Wartime Conditions

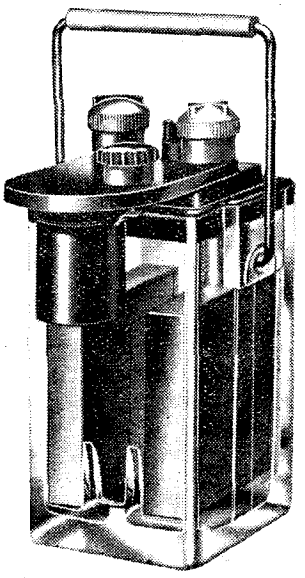
ALTHOUGH smaller than any table model so far produced by Murphy Radio, Ltd., Welwyn Garden City. the new AD94 is in no sense a "midget" receiver. It has three wavebands with the short-wave range going down to 16.7 metres, and a 4-valve rectifier superhet circuit. The IF transformers are of the stable type used in the more expensive receivers, and there is provision for a plug-in aerial filter in areas close to a strong transmitter.

The cabinet is a one-piece moulding in which the chassis is supported by ribs running along each side. It is of striking appearance, with strong vertical ribs forming the loud speaker fret. The overall dimensions are $13\frac{5}{8} \times 12\frac{5}{8} \times 6\frac{3}{4}$in. and the weight is only 13 lb. A specially designed chassis of girder-like construction minimises the possibility of mechanical distortion, and keeps the depth of the cabinet from back to front shallow.

Suitable for mains voltages (DC or AC) of 200-250 and frequencies from 25 to 100 cycles, the Model AD94 consumes 60 watts (at 230 volts). The price is £9 10s.

EDISWAN "ENSURE-A-LITE"

THIS neat accumulator hand lamp has been produced as an emergency lighting unit for use under wartime conditions. The glass cell is filled with jelly electrolyte and gives from 50 to 60 hours light, with the 2.5-volt flash-lamp bulb, on a single charge. The lamp attachment, which is moulded in bakelite, incorporates a shield for the bulb and a simple and reliable screw-type switch.

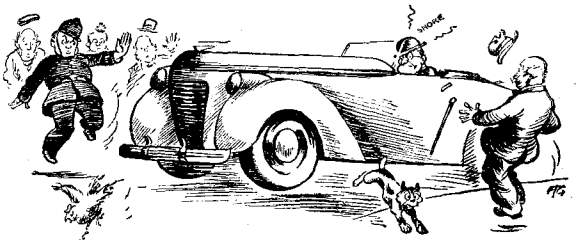


Ediswan's emergency lighting unit.

The price of the complete unit is 7s. 6d., fully charged, and the makers are the Edison Swan Electric Co., Ltd., Ponders End, Middlesex.

Unbiased

By FREE GRID



The car of the future.

A New Use for Morse

IT has often been said that war has a swift and devastating effect on the ethical standards of the civilised world, and, although this present struggle is far from finished yet, there are already signs that it is leaving its mark on our youth as shown in their pastimes, more particularly those of music and dancing. It was so in the last war, of course, and I recollect with bitterness how the stately measures of the minuet with which I used to beguile my young days degenerated into the coarse and vulgar waltz, though even this dance is, I fear, considered a back number nowadays.

It was, however, only recently that I had brought home to me in very startling fashion that this present *Blitzkrieg* has already started a very pernicious cultural decline among our younger folk. It so happened that I arrived home the other

The stately minuet.

evening with a set of gramophone records made for the benefit of those who desire to attain, in as short a time as possible, an expert knowledge of the Morse code. I was particularly interested in these records, as the Editor had passed them on to me for my comments.

I ought to have known, when I approached my domicile, that something unusual was afoot by the din emanating from it. Every loud speaker in the house was going full blast and making the evening air hideous with the horrible noise that has taken the place of the stately rhythm of the dance music of my youth. When I got in I found that Mrs. Free Grid was entertaining the local troop of bright young things in uniform who have taken the place of the WAACS and WRENS of the last war.

However, party or no party, I had a duty to perform. Accordingly, I advanced to the radiogram, and, ignoring the cries of protest, removed the record of so-called hot rhythm that was being churned out and substituted one of the Morse discs. I was so intent on deciphering the Morse that for a moment I did not see what was happening, but when I looked up I saw, to my unspeakable astonishment, that the assembled mob had with one accord assumed the melancholy expression and commenced to go through the elephantine evolutions which nowadays one associates with so-called dancing.

For a moment I was frankly puzzled, but I soon saw the explanation. The practice record was churning out rapid Morse with a background of interference in order to represent conditions which the budding wireless operator might reasonably expect to experience, and the resultant row certainly *was* strangely reminiscent of modern dance music. Evidently it was regarded as a super-hot record, as when it ended I was besieged for the name of it, and quite unwittingly secured for myself an undeserved and unwanted reputation among the bright young things as a connoisseur of "swing."

The Receiver of the Future

I AM sorry to see that push-button tuning seems to be suffering a temporary setback, as, in spite of the croakings of the diehards, who are invariably against progress in any shape or form, I still think that it is one of the major developments of wireless. Provided that it can be done without sacrificing technical efficiency, I would always prefer to tune in a station, whether distant or near, by pressing a button, rather than by fiddling with a tuning knob. Call it laziness if you like, but I believe I am correct in saying that even the croakers would rebel if our present push-button system of electric lighting were replaced by one using a voltmeter and a variable resistance with which it was necessary to fiddle in order to get the voltage across the lamp correct.

Apart from this, however, push-button tuning has several technical advantages over dial tuning, as has been pointed out elsewhere in this journal. If we wish to get the utmost out of our sets in the case of every station we tune in, we ought, if we are logical, to readjust the aerial coupling in the case of every wavelength to which we tune. This would, in the case of an ordinary set, require an extra control knob. We all know the great need there is of variable selectivity, and many sets already have an extra knob for this, as well as a compensatory tone control knob to enable us to adjust the AF amplifier so as to make the best of a bad job when conditions of interference force us to put the selectivity knob hard over to maximum sharpness.

The whole point is that the perfect receiver ought to have a veritable host of knobs so that we could adjust almost everything in the set in order to bring it into the most suitable condition to fetch in a given station. Years ago we had such a host of variables, and it was marvellous what a skilled operator could do with them; some of the results in fact would put to shame many of the efforts of modern sets. The present state of affairs is not the fault of the manufacturers, however. They have had to compromise on

Unbiased—

almost everything in order to reduce controls to a minimum, as the average set user is far from skilled. Such a compromise has meant, for instance, that a fixed degree of aerial coupling is used, which gives fair results on all stations, and first-class results on none.

If manual controls were entirely abandoned, and a totalitarian push-button system adopted, all these old "variables," so valuable in the hands of the skilled operator, would be brought back at one fell stroke. All that would be needed would be that each push-button should have associated with it a whole host of cams and contacts to enable the aerial coupling and whatnot to be adjusted to maximum efficiency to deal with the particular station named on the button. Such a set when it comes will be a worthy companion to the car of the future which, instead of steering wheel, gear lever and such-like antiquities will merely have rows of buttons bearing the names of various towns and hamlets so that we need only press the correct button and leave it to the car to take us to our destination.

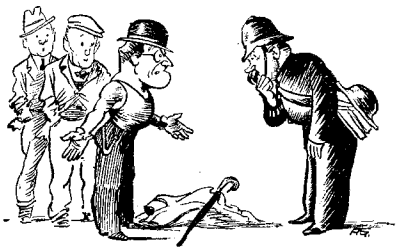
Uncanny Reproduction

I RAISED a veritable hornet's nest about my ears as a result of asking some of you pukka sahibs who have lived out East to help me elucidate the meaning of the mysterious message I had received from an aged Eastern seer to "Make ready the magic mirror for ere many moons be passed it will shine forth again." The interpretations I got were as varied as they were numerous, but the most promising reply I had was from a retired Colonel of the Indian Army, who advised me to visit a certain address he gave me and ask for an Indian gentleman with an unpronounceable name.

I duly arrived at the address the Colonel gave me, but my unsuccessful efforts to pronounce the name of his Indian friend aroused grave suspicions of my identity, and I was subjected to the indignity of a search. As in the case of most men of my age, my figure has run to seed a little, and I have been endeavouring to counteract the ravages of time and reduce my embonpoint by means of a body belt. Like most other citizens, I have also been endeavouring, in the interests of National economy, to restrict all unnecessary purchases, and my body belt is therefore of rather an old-fashioned type—to be quite candid, it is a garment discarded by Mrs. Free Grid many years ago, and usually known to the vulgar as "stays."

Unfortunately, this was the cause of my undoing, as in the course of my personal degaussment experiments, which I told you about recently, I had replaced the existing network of whalebone by steel, and in a trice I was accused of being a mobile wireless station, and almost before I knew what had happened I found myself in the arms of the law.

I was involved in many weary hours of explanation before I was released and was able to resume my investigations, but I must confess that it was well worth it. The Indian gentleman to whom I had been referred by the Colonel produced an elaborate mirror into which he bade me glance. I have never been a disciple of Narcissus, but I must admit that what I saw reflected back to me put me up several pegs in my own estimation. All the wrinkles



My undoing.

and other ravages of age had been eradicated from my face, and a youthful Apollo-like countenance gazed at me. The reproduction was in fact what many people claim for their wireless sets, namely, far better than the real thing.

It was all very simple, of course, as it was merely a cunningly devised distorting mirror such as you still see occasionally in old-fashioned "fun palaces," except, of course, that the distortion was designed to improve the looks of the beholder instead of making him appear ridiculous. Needless to say the mirrors were produced for commercial gain, and sold well, I was told, among ladies of mature years.

Obviously, however, this was not the magic mirror I sought, and it was only when I expressed my disappointment and explained matters to my host that I found that my quest was ended, for he at once told me what I ought to have known before, that this prophecy had a radio significance, and the expression "magic mirror" was merely the flowery Oriental term for a television set. Even so, I am still mystified, as the B.B.C. has definitely assured us that television is "off" for the duration, and there is not the slightest likelihood of this ukase being rescinded.

Lament for the Past

IN normal times we should, at this period of the year, be eagerly scanning the pages of *The Wireless World* and delving into the bagful of "literature" collected at various radio shows, wondering which manufacturer to put our money on.

In spite of such things as Government work, husbanding of raw material, and all the other impediments to production, manufacturers are not leaving us entirely comfortless this year, and, apart from sets already "released," there are one or two interesting things on the stocks for us.

Unfortunately, I cannot follow my usual custom of getting special information for you by means of my paid spies in the factories of the manufacturers, as they all have been ruthlessly liquidated on the somewhat flimsy pretext that they are in the pay of a certain gentleman across the Channel. Of course, manufacturers know perfectly well that this is not so, and are merely battening on the feelings of the times in order to get in a lightning thrust at the weakest spot in my defences. Like a modern ship, however, my activities are divided into watertight compartments, and the torpedoing of one of them will not sink me. I can afford to wait until I am in a position to counter-attack with devastating effect.

Test Report

K.B. Model 850/2-0

FOUR WAVEBAND AC SUPERHET (SEVEN VALVES + RECTIFIER) FOR OVERSEAS MARKETS

FROM every point of view this receiver is a worthy representative of the British wireless industry, and can be relied upon to confirm or, where necessary, establish our good reputation in markets overseas. The performance, particularly on short-waves and in quality of reproduction, is excellent, and the precautions which have been taken to make the set suitable for tropical climates have been carried out without detracting from its handsome appearance.

International octal valves, for which replacements are readily obtainable, have been specified, and special regional tuning scales are available for different export markets.

Circuit.—An EF8 valve with aligned grids is used in the RF stage for silent operation. Its couplings are of the simplest type with transformers in the aerial and single tuned-grid intervalve circuits.

The frequency changer is a triode hexode, and the standing bias, together with that of the RF stage, is increased on the medium-wave range to level up the sensitivity. Permeability tuned transformers are used in the IF stage, which functions at a frequency of 472 kc/s.

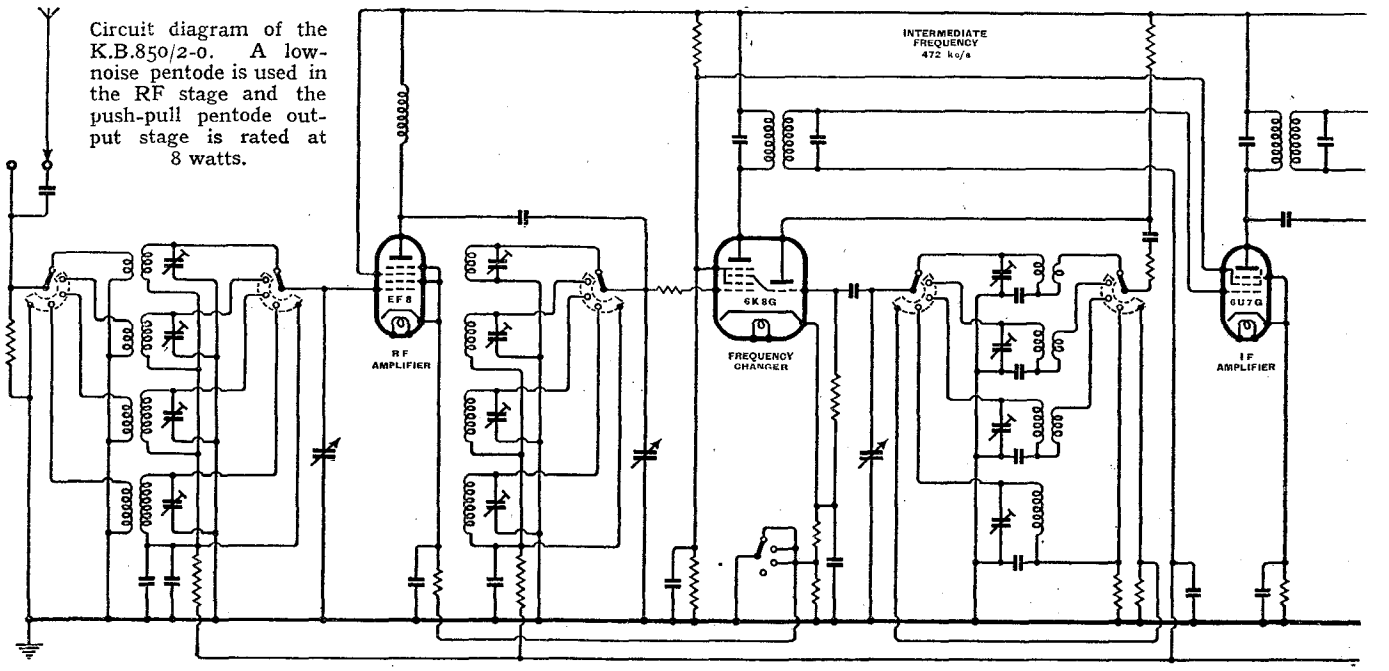
In the combined signal and AVC rectifier and first AF stage, the control voltage for the tuning indicator is taken from the signal circuit through a suitable filter. AVC is delayed, and is applied to the three preceding stages. Bass response is controlled by switching in an additional series condenser in the coupling to the triode section of the valve.

The second AF stage includes tone compensation in the cathode return circuit, and phase splitting is effected by a parallel-fed auto-transformer.

Push-pull pentodes in the final stage give an undistorted output rated at 8 watts. The top-cut tone control is connected between the anodes. A switch in the output transformer secondary circuit enables the internal loud speaker to be disconnected if desired, but it is important that this switch should not be opened unless an external unit is connected, otherwise the pentode valves may be damaged through operating without a load.

Performance.—In a receiver in which care has obviously been taken to achieve a well-balanced performance, it is difficult to select specific points for comment, but there can be little doubt that the quality of reproduction and the signal-to-noise ratio on all wavebands are outstanding. There is an ample reserve of sensitivity on all wavebands, and the limiting factor is the prevailing external background level and not the noise voltages generated in the receiver itself. There is a commendable absence of self-generated whistles, and image rejection is in every way satisfactory.

A continuous search throughout the range of the receiver from 11 to 545 metres showed that the sensi-



Circuit diagram of the K.B.850/2-0. A low-noise pentode is used in the RF stage and the push-pull pentode output stage is rated at 8 watts.

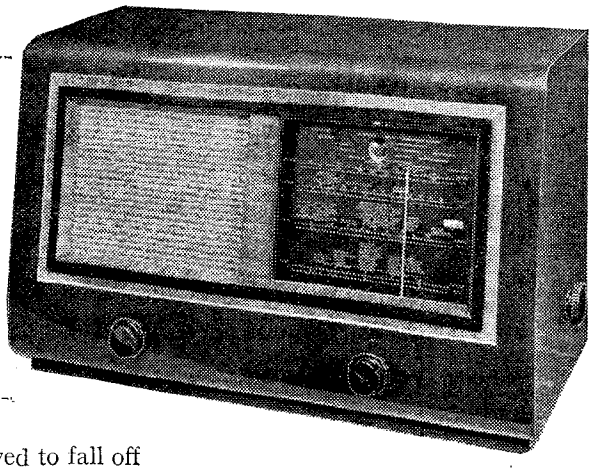
WAVERANGES

(1) 11- 30 metres

(2) 30- 73 metres

(3) 73-200 metres

(4) 200-545 metres



tivity has not been allowed to fall off in parts of the waveband which, although of little interest to broadcast listeners in this country, might be of first importance to listeners abroad. The particular receiver tested was calibrated on the medium-waveband with African and Indian "local" station names and short-wave stations in the Far East as well as the familiar European and American SW stations.

During the period of our tests propagation conditions over the Atlantic were not particularly good; nevertheless, American programmes were received with unfailing regularity and at a strength which would do justice to many a so-called "local station."

The push-pull output stage in conjunction with the 8in. loud speaker gives first-class reproduction with ample volume. The attack is good, and with tone controls for both bass and treble exactly the right balance can be achieved for any type of transmission. Normally, we found the full bass response with a little less than the full top to be best for general reception. No tendency to microphonic feedback was noticed when using the full bass response.

Constructional Features.—The controls are grouped rationally with the waverange switch associated with tuning and volume with tone in concentric pairs. A separate control at the side of the cabinet gives a bass cut, and with it is combined the remaining radio-gram switch.

The tuning scales are open and easily read. Frequency as well as wavelength calibrations are provided.

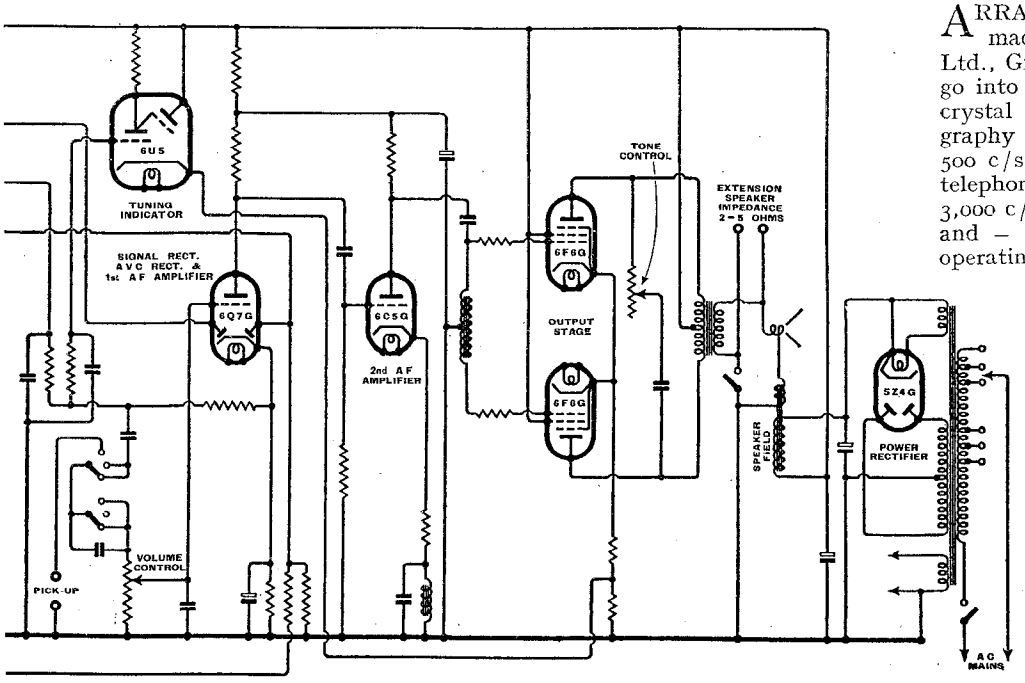
A very massive mains transformer is provided with six alternative settings between 100 and 250 volts. The mains voltage adjustment is effected by an accessible plug connector.

The chassis is substantially built, and is of more than average size. It is 3½in. deep, which gives it unusual rigidity.

The energised moving coil loud speaker has a generously designed field magnet, and the output transformer is of ample size. An unusual refinement is the provision of a sponge rubber ring seal between the loud speaker chassis and the cabinet.

As the set is produced solely for export, it is not possible to give a price, but in relation to the home market it may be said to belong to the intermediate price category.

Makers.—Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.



Simmonds-Robinson Crystal Filters

Double Crystal Band-pass Couplings for Telegraphy and Telephony

ARRANGEMENTS have now been made by Simmonds Aerocessories, Ltd., Great West Road, Brentford, to go into production with two types of crystal band-pass filters, one for telegraphy with band widths of 300 to 500 c/s ± 50 c/s, and the other for telephony with band widths up to 3,000 c/s and tolerances of + 250 c/s and − 500 c/s. Normally the mean operating frequency is 465 kc/s, but other frequencies between 440 and 480 kc/s can be supplied. A filter for 1,600 kc/s has also been developed.

The filters are made up in conventional screening cans with external adjustments for the circuit trimmer and balancing controls, and can be readily substituted for existing IF couplings. Circuit constants have been worked out for input and output loads usually met with in RF pentode valves.

Current Topics

RECENT EVENTS IN THE WORLD OF WIRELESS

CAR RADIO TRAFFIC CONTROL

New Application in U.S.A.

MOTORISTS approaching the western entrance of the George Washington Bridge, New York, are now confronted by the notice "Highway radio ahead; tune 550 on your dial." Those owners of car radio sets who obey this instruction then hear, while crossing the bridge, a one-minute broadcast giving instructions as to the best routes to follow for various destinations.

Our American contemporary *Electronics* describes several of the more unusual features of this novel service, which is still in the experimental stage. Radiation which, it will be realised, is at the extreme lower frequency limit of the broadcast band, is confined almost entirely to the bridge and its immediate vicinity This obviously desirable end is achieved not only by the screening afforded by the bridge structure, but also by the "aerial" system. This latter comprises a "wave-guide" cable, terminated by a 400-ohm resistor to stop standing waves and consequent radiation, which runs along the 3,500ft. span of the bridge. Only the induction field around the cable is effective.

The message to motorists is normally broadcast automatically from a magnetic tape recording, but if necessary the 4-watt transmitter may be remotely actuated.

NOVEL STATION SITE

A NEW idea in the choosing of the sites for broadcasting stations is illustrated by the announcement of details of the new 50-kW transmitter for WABC, Columbia's key station in New York City.

The new transmitter is to be erected on Little Pea Island, which lies off New Rochelle, N.Y. The island, which is nothing more than a few jagged rocks projecting out of the water, is to be blasted to make a level foundation for a man-made island 150 feet square, around which concrete walls extending 16½ feet above the water at mean low tide are to be built.

The new site will afford WABC's signal a direct sea path to the Metropolitan area of New York, Long Island, Westchester, Connecticut, New Jersey and Pennsylvania.

THE PURCHASE TAX

Applications to the Wireless Industry

OCTOBER 21st has been fixed by the Treasury as the date on which the Purchase Tax comes into operation. It will, however, not necessarily have an immediate effect upon purchasers, for the tax does not apply to goods obtained by the retailer prior to the above date.

Whilst complete receivers, radio-gramophones, valves, accumulators and batteries are taxable at 33⅓ per cent of their *wholesale* value, components are, generally speaking, exempt. There are, however, some accessories to, and parts of, radio-gramophones which are taxable. They are those items which are inherently parts of gramophones, such as pick-ups, motors, turntables, record changers, etc., because a gramophone is designated a musical instrument and as such is taxable.

Gramophone records, except those for the use of the blind having titles embossed in Braille and solely reproducing speech, are chargeable at the full rate of 33⅓ per cent.

Transmitting sets, ships' and aircraft apparatus and PA equipment (including microphones) are not chargeable with tax. Specialised valves for use with deaf-aids are also exempt.

Speaking at the Radio Industries Club recently on the application of the Purchase Tax, Mr. A. J. Dew, President of the Radio Wholesalers' Federation, said that as components are exempt from taxation, he wondered whether it will revive home construction, especially of mains sets, as for these the only taxable components are the valves. He stated that the Purchase Tax on a complete receiver will probably be in the region of £2.

DIATHERMY INTERFERENCE

WITH the development of television and frequency modulation, which operate above 40 Mc/s, a new interference problem is presenting itself to Americans; namely, that arising from the present extensive use of diathermy apparatus. The chief engineer of the Federal Communications Commission suggests that if screening the room in which the apparatus is used is considered impracticable or economically inadvisable, the only solution would be to use apparatus covering a restricted frequency band, which would not interfere with radio reception.

APPEALS FOR SCRAP

Ministry of Supply's Salvage Schemes

THE Aluminium Appeal Committee of the Ministry of Aircraft Production has issued an appeal, which has received the blessing of the Radio Manufacturers' Association, for the collection of all kinds of aluminium parts for presentation to the nation. Gifts of aluminium components and scrap should be forwarded to the Ministry of Aircraft Production Depot, 53, South Side, Clapham Common, London, S.W.4.

Mr. I. M. Barclay, Secretary of the Appeal Committee, asks to be informed at the Ministry of Aircraft Production, Millbank, London, S.W.1, of the weight and nature of the gifts for purposes of record.

Old HT and torch batteries are now being salvaged and broken down to produce useful material for the war effort. It is said that from 100 tons of HT batteries there is, among other things, a yield of 3 tons of carbon rods and 10 tons of zinc. Firms are now engaged on this work of reclamation, and the Ministry is asking wireless dealers and private individuals to save their batteries, which should be put out for collection by the local council's refuse department. They must be kept separate from the ordinary refuse.

Another source of valuable material is old gramophone records. The salvaged "shellac substitute" means an enormous saving in shipping because shellac is such a light substance.

FM RECEIVERS

THE manufacture of frequency-modulation receivers in America is proceeding apace, according to a recently conducted survey which revealed that fourteen manufacturers will have receivers ready for the market by this autumn. Although the demand will be limited until FM stations are operating in more cities, our American contemporary, *Broadcasting*, points out that the number of manufacturers now developing FM receivers indicates preparations to create and meet a demand for sets as the service expands.

Receivers at present in production range from a $70 table model to a $450 combination AM/FM console. General Electric is producing a "translator" model at $49.95, for use with an ordinary broadcast receiver.

AMATEUR FM

"WE are puzzled over the apparent lack of amateur interest in frequency-modulated transmission," says the Editor of *QST*. The opinion is given that FM contains the answer to many of the difficulties in amateur transmission. It is pointed out that the rewards to be gained from adapting FM to amateur requirements include the disappearance of man-made noise, the consequent extension of operating ranges, and the simplification of transmitters.

Among the problems to be solved is the development of a satisfactory and inexpensive frequency-modulation receiver, which, regardless of cost, is a very big problem, for it has been found difficult to obtain sufficient selectivity for 5-metre band operation.

PRAISE FOR COLOUR TELEVISION

"IF television broadcasting had been launched in colour, it would now be a universal medium of entertainment and instruction, occupying a position comparable to that of present-day radio," said Mr. Gerald Cock, North American Representative of the B.B.C., who was formerly B.B.C. Director of Television, when he recently viewed the colour television demonstration (described elsewhere in this issue) given by the Columbia Broadcasting System. Mr. Cock said he gained the impression that, compared with black-and-white television, the colour reception had the additional dimension of depth.

GOVERNMENT'S SCIENTIFIC ADVISERS

IN order to ensure the continuance of the fullest possible co-operation of scientific workers with the Government in the war effort, a Scientific Advisory Committee has been appointed. Dr. E. V. Appleton, Secretary to the Committee of the Privy Council for Scientific and Industrial Research, who is so well known and respected in the world of wireless, has been appointed to the Committee, of which Lord Hankey is chairman.

"THE TRADER"

WE learn from our contemporary, *The Wireless & Electrical Trader*, that Mr. D. Sisson Relph, who since May 1936 has edited the journal, has been called up, in response to his offer of service, to train for a commission in the R.N.V.R. Mr. W. E. Miller, who has been technical editor for many years, is now in charge of the editorial side of the journal. He is being assisted by Mr. B. E. Talbot and Mr. E. A. W. Spreadbury.

We join with Mr. Relph's many friends in the industry in wishing him good luck and a safe return.

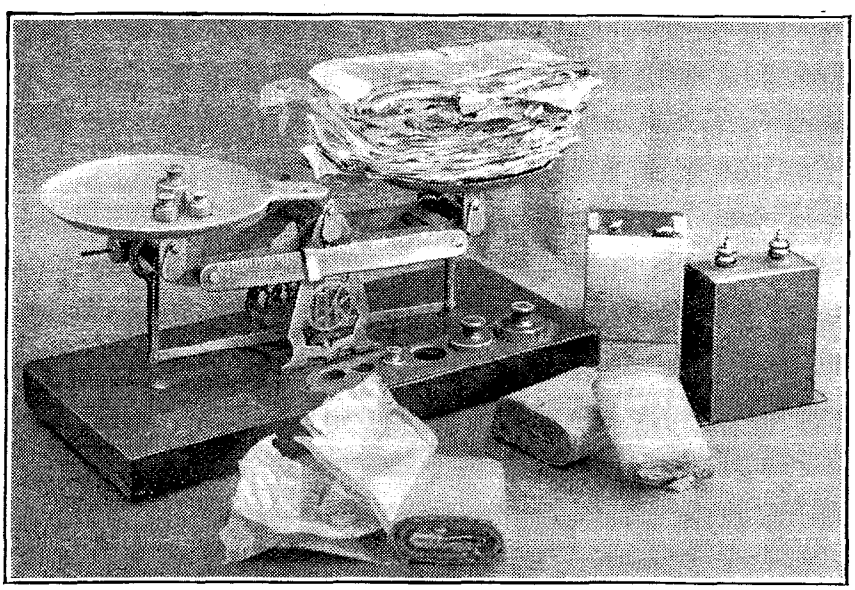
NEW C.B.S. SHORT-WAVE STATIONS

THE U.S. Federal Communications Commission has approved the Columbia Broadcasting System's application to build a new 50-kW international short-wave station at Brentwood on Long Island, New York. Columbia has also been granted permission to transfer the short-wave station WCBX from Wayne to Brentwood, which is about 40 miles from New York City, and to increase its power to 50 kW.

The two 50-kW transmitters, which will be housed in an extension of the Mackay Radio and Telegraph Company's point-to-point transoceanic transmitter building, will employ 13 frequencies.

DEDICATED TO FREE RADIO

TWO identical plaques "dedicated by the broadcasters of America to a free radio in the public interest" were unveiled at the New York and San Francisco World's Fairs during the observance of Broadcasting's Day on August 3rd. The plaque, which portrays the head of a broadcaster speaking into a microphone, and five American statesmen of the past, bears this inscription from Walt Whitman, "I say there can be no safety for these States . . . without free tongues, and ears willing to hear the tongues." The sequel to the success of this day has been the proposal to Congress that August 26th be set aside each year as "National Radio Day."



SALVAGE.—Even a burnt-out paper condenser yields an appreciable amount of aluminium foil—nearly ¾oz. from the 2-mfd. size though the recovery of it is a somewhat laborious process.

FROM ALL QUARTERS

Radio-Therapy

WE regret that we failed to acknowledge the courtesy accorded us by Electro-Medical Supplies, Ltd., who kindly lent us the photographs which appeared on pages 416 and 418 of last month's issue as illustrations to the article on Radio-Therapy. The cover illustration also came from the same source.

Pioneer Mast Builder

THE death at Ormstown, Quebec, of Mr. Alfred Martin Basham, at the age of 71, recalls his association with Marconi, for whom he built the 160ft. mast at South Foreland, from which signals were successfully transmitted to a lightship six miles away. Mr. Basham went to Canada in 1915.

I.E.E. Meetings

MR. J. R. BEARD, M.Sc., president of the Institution of Electrical Engineers, will deliver his inaugural address for the 1940-41 session at a meeting arranged for October 24th. The Council of the Institution have decided that it would be inadvisable to hold the usual programme of London meetings. It has, therefore, been arranged that copies of the papers that would have been read will be obtainable by members from the secretary. Two papers of wireless interest are scheduled for the first half of the session; they are "The Applications and Use of

Current Topics—

Quartz Crystals in Tele-communications," by C. F. Booth, and "Broadcast Receivers: a Review," by N. M. Rust, O. E. Keall, J. F. Ramsay, and K. R. Sturley. Copies will be available about December 19th and January 8th.

Central Radio's Ambulance

THE Central Radio Laboratories of Milwaukee, Wisconsin, have supplied a complete mobile surgical unit at a cost of £600 for the American Ambulance, Gt. Britain, organisation. Subscriptions to the organisation amount to nearly £150,000.

Swiss Transmissions

SWITZERLAND'S broadcasting service recently announced that its new short-wave broadcasting station at Schwarzenburg, which has been operating experimentally each day using an omnidirectional aerial, is now heard regularly from noon to 1.30 p.m., and from 10.0 to 10.30 p.m. (B.S.T.). It is understood the directional aerials are not yet in use.

Wireless for the Blind

IT is learned from the annual report of the National Institute for the Blind that during the year 1939-40 the British "Wireless for the Blind" Fund provided 8,625 wireless sets to sightless listeners. This made a total distribution of 54,535 sets since the fund was inaugurated.

British I.R.E. Vice-President

SIR LOUIS STERLING has accepted election as Vice-President of the British Institution of Radio Engineers.

H.M.V. Factory Concerts

FOLLOWING its practice during 1914-18, the Gramophone Company is arranging a series of lunch-hour concerts in the canteen for its factory staff.

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.).
WBOS (Millis)	9.570	31.35	11.45.
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	12.15 a.m.‡.
WRUL	11.790	25.45	8.30§‡, 9.30§‡.
WRUL	15.130	19.83	12.15 a.m.‡.
WRUL	15.250	19.67	8.30§‡, 9.30§‡.
WLWO (Cincinnati)	9.590	31.28	7.25 a.m.‡.
WLWO	11.870	25.27	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.
VLQ7	11.880	25.25	9.50.
VLR (Melbourne)	9.580	31.32	10.0 a.m. 3.0
VLR3	11.850	25.32	9.50.
China			
XGOY (Chungking)	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	
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†.
India			
VUD2/3 (Delhi)	9.590	31.28	9.0 a.m., 1.30, 4.50, 6.30.
VUD3 (Delhi)	15.290	19.62	9.0 a.m.
Japan			
JZJ (Tokio)	11.800	25.42	9.5.
JZK	15.160	19.79	9.5.
Manchukuo			
MTCY (Hsinking)	11.775	25.48	8.0 a.m., 10.5.
Rumania			
Bucharest	9.280	32.33	10.40‡.
Spain			
FETI (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	7.15.
TAQ	15.195	19.74	12.15.
U.S.S.R.			
—— (Moscow)	7.545	39.76	10.30, 11.30.
RW96	9.520	31.51	7.33 a.m., 7.30, 9.0, 10.30, 11.30.
RAL	9.600	31.25	1.0 a.m.
——	11.499	26.09	12.0 noon.
——	11.710	25.62	9.0, 10.30.
RNE	12.000	25.00	1.0 a.m., 9.0†, 10.30.
——	14.720	20.38	12.0 noon, 5.0.
RKI	15.040	19.95	1.0 a.m.
RW96	15.180	19.76	1.0 a.m., 7.33 a.m., 9.0 a.m., 7.30, 9.0, 10.30, 11.30.
——	18.540	16.18	12.0 noon.
Vatican City			
HVJ	6.190	48.47	8.0 (Th.).
Yugoslavia			
YUA (Belgrade)	6.100	49.18	10.25.

It should be noted that at this time of the year changes of wavelength are frequently made and readers are, therefore, advised to try alternative wavelengths.

REGULAR LONG- AND MEDIUM-WAVE TRANSMISSIONS

Country : Station	kc/s	Metres	Daily Bulletins (B.S.T.)
Bulgaria			
Sofia	850	352.9	9.55 (Th. and Sat.).
Hungary			
Budapest 1	546	549.5	11.10.
Ireland			
Radio-Eireann	565	531	6.45‡, 10.10 (10.5 Sun.).
Latvia			
Madona	583	514.6	10.0 (Tu. and Fri.).
Kuldiga	1,104	271.7	10.0 (Tu. and Fri.).
Rumania			
Radio-Romania	160	1,875	10.45‡.
Bucharest	823	364.5	10.45‡.
Spain			
Radio-Coruna	968	309.9	1.10 a.m.
Sweden			
Motala	216	1,389	10.45.
Stockholm	704	426.1	10.45.
Goteborg	941	318.8	10.45.
Falun	1,086	276.2	10.45.
U.S.S.R.			
Moscow 1	172	1,744	11.30.

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

Reducing Interference

METHODS APPLICABLE TO THE RECEIVER

By R. I. KINROSS, A.M.I.E.E.

(*Concluded from page 436, October issue*)

In this concluding instalment the author discusses what is probably the most successful of the various "balancing" systems, and describes his own modifications to it. He also summarises his conclusion on the effectiveness of the various anti-interference systems.

THE de Monge system, while not strictly within the category of devices incorporated in the receiver, since it requires a special aerial, at the same time incorporates a balancing circuit within the receiver itself, and, as it provides good results, is thought to be worth describing briefly.

The commercial anti-interference aerials as at present on the market rely on the signal collector being placed outside the field of interference and the signal being fed to the receiver *via* a feeder immune from the effects of the interference surrounding it. This ideal condition can rarely be attained in practice; the usual thing is that the signal collector is placed in an interference field of somewhat lower intensity than the feeder with a consequent improvement in signal/noise ratio, but complete elimination of man-made static is rarely possible by this method.

The Comte de Monge conceived that it should be possible to use some of the interference picked up by the feeder to balance out the smaller interference voltage induced in the signal collector. He carried this out in practice by means of the arrangement shown in Fig. 13.

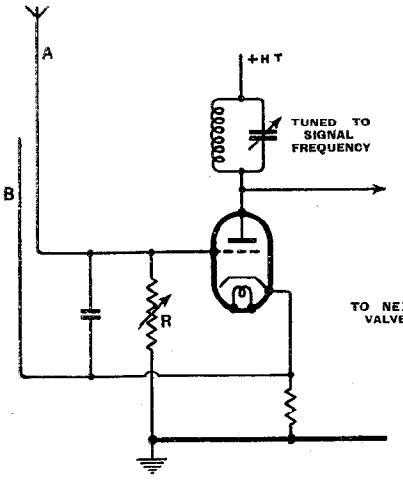


Fig. 13.—The de Monge system of balancing out interference.

A is an ordinary single-wire aerial and B is a second wire running parallel and about two inches away from it for about half its length. By adjusting the variable resistance R, two points of balance will be found in the voltage feed to the grid of the next valve in the receiver, owing to a 180-degree phase opposition of the anode and cathode voltages of the valve shown. The first point of balance is due to neutralisation of the wanted signal picked up in conductors A and B. The second point of balance is due to neutralisation of the interference voltage picked up in these same two conductors. Providing the signal/noise ratio in two conductors is different (which it will always be, providing A extends into a field of lower interference and higher wanted signal) these points of balance will not coincide. Thus, by adjusting R to the second point of balance, a considerable improvement in signal/noise ratio is possible. In practice, complete neutralisation of the interference does not occur owing to adjustment being made only for amplitude and not for phase. Nevertheless, on MW and LW reception improvements in signal/noise ratio with this system are appreciably greater in noisy districts than are possible with the normal type of anti-static aerial.

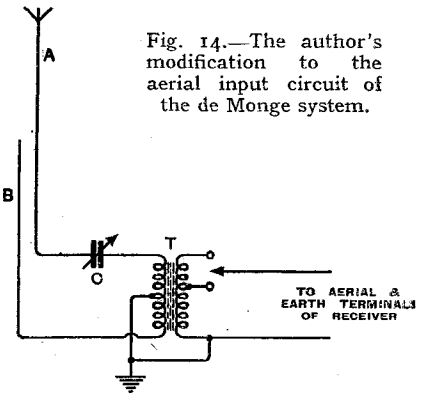


Fig. 14.—The author's modification to the aerial input circuit of the de Monge system.

The disadvantages of the de Monge system over an ordinary anti-static aerial are:—

(1) It requires an extra valve.

(2) It cannot be added easily to an existing receiver.

(3) It introduces cross-modulation owing to the absence of pre-selection in front of the balancing valve.

(4) The two parallel wires with their spacers look unsightly.

(5) The performance is very erratic on short waves.

The author found he could get over the first three of these difficulties while still retaining the advantages of the system by means of the arrangement of Fig. 14. It will be seen that by adjusting the value of C the interference voltage from A and B can be neutralised out in the primary of the transformer T (while neutralisation of the wanted signal will be obtained at an entirely different setting of C). The improved signal/noise ratio is fed into the aerial and earth terminals of the receiver *via* the secondary winding, which is tapped to suit the input impedance of the receiver.

Care had to be taken in the design of the transformer in order: (a) To keep the setting of C constant on all wavelengths between 200 and 2,000 metres. (b) To make the efficiency as high as possible over this rather wide coverage. The first was achieved by keeping the leakage inductance of the primary at as low a level as

possible by using a bi-filar winding for both halves. The second was attained by the use of a core of high effective permeability at the frequencies in question. This kept up the inductance of the primary and so the efficiency on long waves. It was also found necessary to sandwich the bi-falar primary winding between two halves of the secondary and use a closed magnetic circuit in order to reduce the leakage inductance between primary and secondary and so increase the frequency of the top cut-off point.

Slightly better efficiency can be obtained by making the first signal-frequency tuned circuit of the receiver constitute the secondary winding, and this should be done where possible, but, of course, this means interfering with an existing receiver. The loss due to an external transformer as outlined is not serious.

The fourth disadvantage of the de Monge arrangement may be got over by using two phosphor-bronze wires embedded in Telconax or rubber strip ½in. wide which still affords sufficient mechanical strength while not reducing the characteristic impedance of the line or increasing its losses appreciably.

The reason results are erratic on short waves is that the length of the waves received is of the same order as the size of the aerial, and consequently the question of phase becomes as important as that of amplitude in balancing. Even if an adjustment for phase as well as amplitude were included and both were readjusted for each new wavelength tuned in, results would still not be good owing to the many different length paths along which interference can reach the aerial. The difference in length of these paths is small compared with the wavelength on medium and long waves, but this is no longer the case on short waves, and so makes it impossible to get a good point of balance for the interference. The best compromise would appear to be to use a doublet for short-wave reception, this doublet being turned into a T aerial for MW and LW reception by joining together the wires at the foot of the feeder. A third wire could then be used for the wire B running up to the top of the feeder and slightly spaced from it.

The arrangement of Fig. 14 has been tried out in a number of localities ranging from suburban single-story bungalows to tall city buildings. In the case of the former, the wire A usually ran to a small pole at the foot of the garden and the wire B followed it from the receiver as far as the eaves. In the latter case a plain vertical wire for A was usually sufficient with the wire B about half its length. Only in two instances did the point of balance for the wanted signal and the interference almost coincide when setting C, showing that the signal/noise ratio in the leads A and B was approximately the same. The first was in the case of a tall building with lift motors placed on the roof, and the second was due to interference being radiated from overhead wires feeding a motor with a faulty commutator in a neighbouring factory working from a different power supply to that used on the receiver. In both cases the signal/noise ratio was no worse than obtainable on an ordinary anti-static aerial of the same geometry (in the case of the lift results were better). In all other places where the new arrangement was tried out it gave appreciably better results than a commercial anti-static aerial known to be one of the best on the market as far as MW and LW were concerned.

General Summary

The time has now come to summarise broadly the effectivenessness of the various systems discussed. Devices relying on a limiting action will reduce large amounts of interference to small amounts but will not reduce small amounts. These small amounts are still sufficient to spoil programme value either in themselves or in the distortion introduced to attenuate them to a lower level. (There is one method which relies on limiting which is an exception. It involves feeding the interference and signal through a broad band amplifier, limiting and then feeding into a narrow band amplifier. A greater proportion of interference energy is removed in this way, but difficulties of cross-modulation render this arrangement rather impracticable except perhaps on ultra-short waves.)

Methods which rely on gapping the signal during peaks of interference give no better results than a good limiting device unless care is taken to gap the signal at a stage in the receiver where interference pulses have not been unendurably lengthened and care is taken to see that gapping pulses arrive at the right time and are of the right duration. The gapping itself must also be achieved silently. All this entails rather bulky and expensive additional apparatus, but is capable of remarkably good results on certain types of interference.

Finally, an improved form of anti-static aerial is possible which relies on balancing out some of the interference picked up in the signal collector, this action being limited to medium- and long-wave reception.

It should be repeated that this work was carried out in the interest of broadcast reception and not communication engineering. Any one of the devices described gives an appreciable improvement in speech or morse intelligibility when interference is being experienced.

A tremendous amount of work has been done on the subject of interference reduction, and the inclusion of a bibliography would either be bulky or incomplete.

The author is indebted to Mr. Percival for help in the design of delay filters, and he would like to take the opportunity of thanking Electrical and Musical Industries, in whose laboratories the work described in this article was carried out, for permission to publish the results.

The Wireless Industry

READERS of this journal who are interested in receiver construction will, we are sure, wish to join us in congratulating two well-known suppliers of components who have now resumed business. Radio Clearance, Ltd., are now at 38, Lamb's Conduit Street, London, W.C.1, and Ryall's Radio have taken accommodation at Arnhurst, Marsh Lane, Taplow, Bucks.

The Comparative Valve Charts issued by Leonard Heys, Faraday House, Henry Street, Blackpool, Lancs, show the equivalent types in upwards of eighteen different European and American makes. A list of valves under Post Office control is also given, and the publication is well suited for use in conjunction with the *Wireless World* Valve Data given in the May, 1940, issue.

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
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
Philadelphia (U.S.A.)	WCAB	6.060	49.50	10
Motala (Sweden)	SBO	6.065	49.46	12
Toronto (Canada)	CFRX	6.070	49.42	—
Lima (Peru)	OAX4Z	6.080	49.34	15
Nairobi (Kenya)	VQ7LO	6.083	49.31	1
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
Teheran (Iran)	EQB	6.155	48.74	14
Schwarzenburg (Switzerland)	—	6.165	48.66	25
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
Athlone (Ireland)	—	6.190	48.47	—
Ica (Peru)	OAX1A	6.335	47.33	—
Radio Nations (Switzerland)	HBQ	6.675	44.94	20
Bandoeng (Dutch E. Ind.)	PMH	6.720	44.64	1.5
Valladolid (Spain)	FET1	7.070	42.43	—
41-Metre Band (7.200–7.300 Mc/s)				
Calcutta (India)	VUC2	7.210	41.61	10
British Oversea Service	GSW	7.230	41.49	10–50
Bombay (India)	VUB2	7.240	41.44	10
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
Madras (India)	VUM2	7.270	41.27	10
Delhi (India)	VUD2	7.290	41.15	10
Moscow (U.S.S.R.)	RWG	7.360	40.76	20–100
Moscow (U.S.S.R.)	RKI	7.520	39.89	20–100
Moscow (U.S.S.R.)	—	7.545	39.76	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	—
Lima (Peru)	OAX4J	9.340	32.12	—
Radio Nations (Switzerland)	HBL	9.345	32.10	20
Moscow (U.S.S.R.)	—	9.465	31.70	20–100
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
Lahti (Finland)	OFD	9.500	31.58	1
Mexico City	XEWW	9.503	31.57	10
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
Pretoria (South Africa)	ZRG	9.523	31.50	5
Hong Kong (China)	ZBW3	9.525	31.49	2.5
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
Suva (Fiji)	VPD2	9.535	31.46	—
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
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
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
British Oversea Service	GRY	9.600	31.25	10–50
Moscow (U.S.S.R.)	RAL	9.600	31.25	20–100
Cape Town (South Africa)	ZRL	9.606	31.23	5
Sydney (Australia)	VLQ	9.615	31.20	—
Budapest (Hungary)	HAT5	9.625	31.17	5
Taihoku (Formosa)	JFO	9.636	31.13	—
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
Buenos Aires (Argentine)	LRX	9.660	31.06	7
Manila (Philippine Islands)	KZRH	9.660	31.06	—
Treasure Island (U.S.A.)	KGEI	9.670	31.02	20
Teheran (Iran)	EQC	9.680	30.99	14
Mexico City	XEQQ	9.680	30.99	10
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
Singapore (Malaya)	ZHP	9.700	30.93	2.5
Lisbon (Portugal)	CSW7	9.740	30.80	10
Madrid (Spain)	EAJ7	9.860	30.43	10
Bandoeng (Java)	PMN	10.260	29.24	1.5
Sofia (Bulgaria)	—	10.310	29.10	—
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
Canton (China)	XGOK	11.650	25.75	—
25-Metre Band (11.700–11.900 Mc/s)				
Motala (Sweden)	SBP	11.705	25.63	12
Moscow (U.S.S.R.)	—	11.710	25.62	20–100
Winnipeg (Canada)	CJRX	11.720	25.60	2
Vatican City	HVJ	11.740	25.55	25
British Oversea Service	GSD	11.750	25.53	10–50
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
British Oversea Service	GSN	11.820	25.38	10–50
Bound Brook (U.S.A.)	WNBI	11.820	25.38	25
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
Melbourne (Australia)	VLR3	11.850	25.32	2
British Oversea Service	GSE	11.860	25.29	10–50
Cincinnati (U.S.A.)	WLWO	11.870	25.27	50
Sydney (Australia)	VLQ2	11.870	25.27	—
Pittsburgh (U.S.A.)	WPIT	11.876	25.26	40
Sydney (Australia)	VLQ7	11.880	25.25	—
Chungking (China)	XGOY	11.900	25.21	35
Moscow (U.S.S.R.)	—	11.900	25.21	20–100
Moscow (U.S.S.R.)	—	11.920	25.17	20–100
Rabat (Morocco)	—	11.940	25.13	—
Moscow (U.S.S.R.)	RNE	12.000	25.00	20–100
Shanghai (China)	FFZ	12.050	24.90	—
Moscow (U.S.S.R.)	—	12.145	24.70	20–100
Quito (Ecuador)	HCJB	12.460	24.08	—
Radio Nations (Switzerland)	HBJ	14.538	20.61	20
19-Metre Band (15.100–15.350 Mc/s)				
Moscow (U.S.S.R.)	RKI	15.040	19.95	20–100
Teheran (Iran)	EBP	15.100	19.87	14
Vatican City	HVJ	15.120	19.84	25
Boston (U.S.A.)	WRUL	15.130	19.83	20
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
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

Station	Call Sign	Mc/s	Metres	kW
Ankara (Turkey)	TAQ	15.195	19.74	20
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
Belgrade (Yugoslavia)	YUG	15.240	19.68	10
Boston (U.S.A.)	WRUL	15.250	19.67	20
British Oversea Service	GSI	15.260	19.66	10–50
Cincinnati (U.S.A.)	WLWO	15.270	19.65	50
Wayne (U.S.A.)	WCBX	15.270	19.65	10
Delhi (India)	VUD3	15.290	19.62	10
Buenos Aires (Argentine)	LRU	15.290	19.62	7
British Oversea Service	GSP	15.310	19.60	10–50
Schenectady (U.S.A.)	WGEA	15.330	19.57	25
Budapest (Hungary)	HAS3	15.370	19.52	5
Moscow (U.S.S.R.)	—	15.390	19.49	20–100
Moscow (U.S.S.R.)	RW96	15.410	19.47	20–100
Moscow (U.S.S.R.)	—	15.500	19.35	20–100
Moscow (U.S.S.R.)	—	15.715	19.09	20–100
Moscow (U.S.S.R.)	—	15.735	19.07	20–100
Moscow (U.S.S.R.)	—	16.090	18.61	20–100
16-Metre Band (17.750–17.850 Mc/s)				
Pittsburgh (U.S.A.)	WPIT	17.780	16.87	40
Bound Brook (U.S.A.)	WNBI	17.780	16.87	25
British Oversea Service	GSG	17.790	16.86	10–50
Cincinnati (U.S.A.)	WLWO	17.800	16.85	50
Chungking (China)	XGOX	17.800	16.85	35
British Oversea Service	GSV	17.810	16.84	10–50
Wayne (U.S.A.)	WCBX	17.830	16.83	10
Tokio (Japan)	JLS2	17.845	16.81	50
Moscow (U.S.S.R.)	—	17.910	16.75	20–100
Radio Nations (Switzerland)	HBF	18.450	16.26	20
Moscow (U.S.S.R.)	—	18.540	16.18	20–100
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
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
Cincinnati (U.S.A.)	WLWO	21.650	13.86	50
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 NOVEMBER

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

DURING September short-wave reception was not impaired to any great extent by atmospherics, the general level of which was appreciably less than that during recent months; the intensity, however, was noted to be above normal on the 8th and 9th.

Ionosphere storm conditions were in evidence on the 1st, 7th, 14th, 15th, 25th, 26th, 27th and 28th.

Exceptionally stable reception obtained during the periods midnight, 9th, to midnight, 13th, and noon, 16th, to noon, 20th.

The average Disturbance Factor (zero = negligible; 9 = extremely great) for the above two periods fell to the low value of 0.5 and 0.9 respectively, compared with 2.3 for the remainder of the month.

It may be of interest in this connection to recall that, in reviewing the conditions of reception for July*, reference was made to the possibility of favourable conditions being experienced for a few days centred approximately on one (or more) of the following dates in September:—

(a) 10th, (b) 18th, and (c) 27th.

In point of fact, both (a) and (b) proved to be associated with "peak" reception, whilst (c) was one of a group of subnormal days.

There was no definite evidence during September of the effects of any sudden disturbance of the "Dellinger" type.

Particulars of the broadcast bands which, it is considered, should prove most reliable under normal conditions of propagation during November on five selected routes are given below; these may serve as a guide when considering reception from places other than those mentioned.

Considerations of transmitter power and efficiency of aerials at both the transmitting and receiving end may often result in better reception being obtained on other wavelengths, as may also be the case during disturbed conditions. (The times given in this report are G.M.T. on the 24-hour clock notation.)

Tokio: Midt/0100, 31 or 41 m; 0600/0700, 19 or 25 m; 0700/1300, 16 or 19 m; 1300/1500, 19 or 25 m; 1500/1800, 31 m; 1800/2200, 31 or 41 m; 2200/midt, 31 m.

The period from 0100 to 0600 is likely to be extremely difficult at times as a result of low ionisation at the London end and excessive attenuation at the Tokio end. Whereas in summer it is sometimes possible to maintain communication between London and Tokio on a single wavelength continuously throughout the 24 hours, in winter it is found that each particular wavelength has its definite limitations as to the hours of advantageous service.

Bombay: Midt/0400, 31 or 41 m; 0400/0600, 19, 25 or 31 m; 0600/0800, 16 or 19 m; 0800/1400, 16 m; 1400/1700, 16 or 19 m; 1700/midt, 25 or 31 m.

Buenos Aires: Midt/0300, 25 or 31 m; 0300/0700, 31 or 41 m; 0700/0900, 25 or 31 m; 0900/1000, 16, 19 or 25 m; 1000/1200, 16 m; 1200/1600, 13 or 16 m; 1600/1830, 16 or 19 m; 1830/midt, 19, 25 or 31 m.

Difficulties of reception may be encountered between 0900 and 1000, and 1800 and 2000.

Montreal: Midt/0600, 31, 41 or 49m; 0600/1100, 25 or 31 m; 1100/1300, 19 or 25 m; 1300/1800, 16 or 19 m; 1800/2100, 19 or 25 m; 2100/midt, 25, 31 or 41 m.

Except as may be otherwise occasioned by ionosphere storms, the most difficult period is likely to be from 0730 to 1030.

Cape Town: Midt/0300, 31 or 41 m; 0300/0500, 41 or 49 m; 0500/0600, 25 or 31 m; 0600/0800, 19 or 25 m; 0800/1600, 16 m; 1600/1800, 16 or 19 m; 1800/2000, 19 or 25 m; 2000/midt, 25 or 31 m.

As to the general prospects for November, in the absence of any material change in the present trend, disturbances are likely to prove more intense during the latter half of the month, with the possibility of recovery to more normal conditions during the last day or two.

*The Wireless World, September, 1940; p. 396.

Letters to the Editor

THE EDITOR DOES NOT NECESSARILY ENDORSE THE OPINIONS OF HIS CORRESPONDENTS

Broadcast Interval Signals

I FIND it hard to agree with Mr. Ellinger's suggestion of an international system of interval signals. His suggestion, although noteworthy because it breaks away from the usual theme, seems impracticable from the listeners' point of view. Most transmitters take their interval signal from folk songs, bird calls or bells. Some use gongs or a series of notes by which they are now famous. The mere substitution of a musical theme such as Mr. Ellinger suggests would only bring a storm of protest. In fact, I doubt whether popular opinion would welcome the innovation. I beg to remind him of the B.B.C.'s attempt to introduce the 24-hour clock notation.

ROBT. WM. IBALL.

Langold, Notts.

Sound on Film

I WOULD like to make a few comments on the article on sound on film recording by Mr. R. F. E. Miller in the September number of *The Wireless World*.

I would call attention to an advantage of the Class B type of push-pull track which may have been overlooked by the author, namely, the automatic background-noise reduction afforded by this type of track.

Whilst on the subject of noise reduction, I would observe that the biased galvanometer has now, so far as I am aware, been abandoned owing to slight distortion introduced by it at low levels of modulation.

It may be that lack of space precluded mention of the use of ultra-violet light in variable-area recording, and the following notes may, therefore, be of interest.

Owing to the wide band of frequencies covered by white light, it is not possible to focus it accurately; consequently part of the light penetrates to the surface of the celluloid base on which the emulsion is coated and a further part penetrates to the other surface of the celluloid, at both of which points it undergoes reflection back into the emulsion, thus causing undesirable images which tend to reduce the clarity of the main image.

A further trouble which occurs through the use of white lights is the random reflection from the individual grains of which the emulsion is composed; this causes "fog" in the valleys between successive peaks, and, together with the trouble due to undesired reflections, impairs reproduction of the higher frequencies.

Use of a narrow band of frequencies in the ultra-violet region permits of the light being accurately focused in the centre of the emulsion, thus avoiding surface reflections, and considerably reducing the number of emulsion grains which can cause random reflection or "scatter."

So far as the depth of the light slit is concerned, both for recording and reproduction, the length of a 9,000 c/s wave is 0.002in., and it is not, of course, possible to scan this with a slit of comparable size. Current practice employs a 0.002in. slit optically reduced to 0.0005in.

There appears to be an error in line 9, page 387; Fig. 2a shows a positive track, not a negative.

G. MORGAN.

Stoke-on-Trent.

Modulation Systems

RECENT references to frequency modulation have reminded me of the contest which surged in these pages as to whether or not Major Armstrong's system cannot be more truly described as phase modulation. Perhaps some purists will join me in denying the present B.B.C. system the misleading term amplitude modulation.

In the simpler text-books the audio-frequency component is shown as a complex curve which is added to a regular "strip" of carrier-wave in such a way as to vary its magnitude, i.e., its amplitude. The rectifier of the receiver is merely a special form of low-pass filter rendering audible the audio-frequency variations. Yet such is not the case in, say, a choke modulated transmission which emits sidebands to one-third of the output power, leaving an unvarying carrier to waste two-thirds of the power.

I submit that this is not modulation but intermodulation, so beloved of "Cathode Ray," and should the output be varied linearly at audio frequency, it will modulate the carrier without producing sidebands. The advantages are obvious; mistuning will only affect the magnitude of the input, and leave quality unharmed; the carrier only need be received; the advantages of high selectivity can be

Letters to the Editor—

used to override interference; while a frequency of 20,000 c/s is as easy to radiate as 200 c/s.

As to how this can be done, I offer a tentative suggestion. Consider a 10-watt amateur telephone transmitter, crystal oscillator buffer, power amplifier. The output is, for Class C operation, say, 6 watts. But 2 watts are sideband, 4 watts carrier. Suppose the oscillator voltage remains unchanged, but the buffer be a variable mu valve of linear characteristics. Modulation could be affected by variation of grid potential, a process giving a radio-frequency voltage of variable amplitude. The power amplifier must also be linear, i.e., operate in Class A. The power output is now about 3 watts, *but all of it is useful.* Any cost incurred by Class A output is more than balanced!

I would be glad to see comments on this suggestion. A. Q. MORTON.

Glasgow, E.2.

HF Currents in Human Tissues

AS chief of the Electro-Medical Research Section of The Marconi Company I was naturally interested in the article on radio-therapy in the October issue of your journal.

By publishing an article on this subject you are rendering a great service to those of us who have been engaged on electro-medical research work for many years, as few people even to-day fully realise what is being done in the art of healing by the application of physics and high frequency currents to medicine and surgery.

My main purpose in writing to you, however, is to point out that the dipole theory of the action of high frequency currents in human tissues was published by me in *The Marconi Review,*" Nos. 51 and 52 for November-December, 1934, and January-February, 1935, respectively. Dr. P. P. Dalton's claim that this is his original idea cannot, therefore, be allowed to pass unchallenged.

I may add that my paper received a very favourable comment at The International Congress of Physics, Biology and Medicine, at which I was present in Vienna in July, 1937.

A. W. LAY, F.Inst.P.

Chelmsford, Essex.

Random Radiations

By "DIALLIST"

Verb : Sap

THE WIRELESS TRADER did a good job of work when it showed up, as it did some weeks ago, the great pull - down - your - aerial - fit - one - of - our - devices - and - hear - more - stations ramp that has been working for some time now. Most of the gadgets offered are worth as components but a tiny fraction of the price asked. As wave-catchers they leave much to be desired. But glowing publicity and the use of a few impressive (even if incorrect) terms that the average listener reads with awe, if not with understanding, work wonders in creating a demand and much good money is being spent on the things. I've no doubt that enthusiastic—and perfectly genuine—testimonials from users can be produced by the score. I honestly believe that if you sold a wireless set with nothing inside its cabinet there'd be people who would write to say that its reproduction was the best they had ever heard! Possibly its because no man likes admitting, even to himself, that he has spent unwisely; he will force himself to believe that what he has bought is value for money, even though he knows that it isn't.

Aerials That Aren't

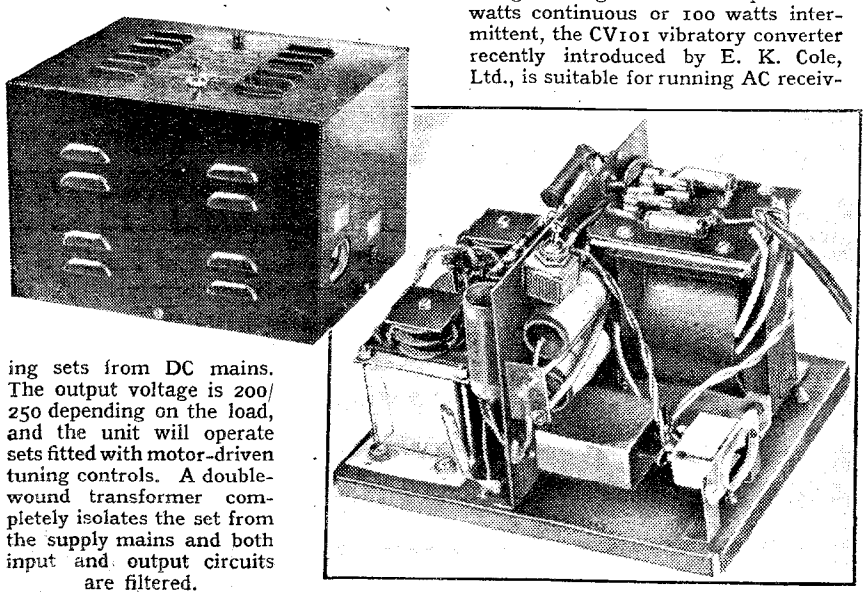
Probably, too, almost any form of collector will give better results than some of the appalling outdoor aerials that one sees here, there and everywhere to-day. I remember examining one which proved to be without any connection between the downlead and the terminal on the inside of the window frame. There had been a wire running through the wood; but apparapparently it was iron wire, for it had vanished under the effects of corrosion. The set was in fact working on a very inefficient earth and about a couple of feet of flex joining the "blind" terminal on the window frame to its aerial terminal. I could give lots of other instances of aerials that weren't aerials at all (including one that was permanently earthed owing to a slight misunderstanding on the part of its owner about the connections of what he called the lighting switch!) and so, no doubt, could you. What wireless really needs is a kind of missionary movement to convert the masses from the worship of false aerials!

The Quality Question

ON the vexed question whether the man in the street does or dosen't want quality from his loud speaker a Toronto reader expresses much the same view as did Mr. Voigt in his letter in a recent issue of *The Wireless World.* Some time back, if you remember, I referred to the "mellow tone" beloved by so many ordinary

EKCO DC/AC CONVERTER UNIT

Designed to give an AC output of 80 watts continuous or 100 watts intermittent, the CV101 vibratory converter recently introduced by E. K. Cole, Ltd., is suitable for running AC receiving sets from DC mains. The output voltage is 200/250 depending on the load, and the unit will operate sets fitted with motor-driven tuning controls. A double-wound transformer completely isolates the set from the supply mains and both input and output circuits are filtered.



Random Radiations—

listeners. Mr. Voigt and my Toronto correspondent both hold that Mr. and Mrs. Everylistener twiddle the tone control knob as far counter-clockwise as it will go and cut the top in self-defence. There's no doubt that there's very much amiss with the upper audio-frequency part of the B.B.C.'s transmissions, and apparently that is true of the Canadian broadcasts as well. Probably it is another of those instances of vicious circles in full operation: the public have been educated down to the cheap receiver, incapable of good quality in its reproduction; the broadcasting folk realise that ninety per cent. of their listeners have such sets and arrange their transmissions accordingly. And so it goes on! Certainly I've found people astonished and delighted at the quality of both speech and music when they heard the sound part of the television broadcasts for the first time on a first-rate set. But there again the process of educating downwards wasn't long in coming into play. How many television receivers incorporate an AF side that does anything like justice to the high-fidelity transmissions of speech and music that accompany the images on the CR tube screen? Not nearly so many as there should be, I'm pretty sure.

More Fashionable

IT'S interesting to see that so many people are either learning morse at the present time, or are brushing up their rusty knowledge of the art. Time was when telephonic transmissions were so scarce that you had to know morse if you wanted to get value for money out of the receiver that had cost you so much to build. That was twenty years and more ago. As more and more amateurs took up telephony and more and more broadcasting stations came on to the air, the spoken word was so much to be heard that one could get on well enough without bothering about the dits and dahs. There was no longer widespread keenness to learn morse and many of us who had been not too bad at it allowed our knowledge of it to slip away from us through want of practice. I confess that I'm one of the latter. I used to be able to read at a respectable w.p.m. rate; but when the present war came along I doubt whether I could have passed the most elementary army test. The art leaves you if you don't practise it, though it's remarkable how quickly it comes back. Some months ago I stopped to watch one of my sergeants, who was transmitting an exercise for an advanced class. There had, you'll recall, been much correspondence in *The Wireless World* on the subject of the handling of tapping keys, and I was interested to see the method that he was using. At first I heard nothing but almost meaningless dots and dashes, with a letter here, a syllable or a short word there. Then to my surprise I found that by making an effort I could get a good deal of what he was sending. It was a very, very astonished, N.C.O. who heard me say after a while—"By the way, Sergeant Blank, there's no A in definite." Since then I've found that my morse has very nearly come back to its old standard, though my opportunities for sending or receiving have been rather few and far between.

Now that the great majority of the Continental broadcasting stations are in enemy hands their outpourings are of no great interest. The more distant telephony stations haven't been too well heard for considerable periods on end this year. But there's nearly always something of interest to pick up if you know morse.

Not What They Seem

THE other day the excellent "Old Contemptible" who cleans my buttons and in general looks after me like a mother, handed me a message that he had taken down on the telephone. It shouldn't fall to his lot to do anything of the kind, but it happened that he was the only person about when the bell rang. It was brief but puzzling—at any rate for a moment. The second of its two short sentences ran "Arthur Roberts sick, so miner won." No, it wasn't the result of a boxing match. Can you see what it was? The Army has a system of fool-proof (but not blue pencil fool-proof) names for the letters of the alphabet. When we spell out a word we say "R for Robert," and so on. There's the Arthur Roberts. Figures we also pronounce in a fool-proof way—six, owe, niner, wun. Got it? I once produced a comic aid to spelling on the telephone and the radio transmitter which went rather well with friends. The principle was that though the words really did begin with the letter they purported to make clear, the pronunciation of the initial (if it was pronounced at all) was wildly different. Try on your friends A for Aesthete, C for Cesarovitch, E for Eileen, H for honour, M for Mnemonic, P for Physic and T for Tchekov, to give but a few samples. You'll doubtless be able to complete the greater part of an alphabet with more ingenious "helps" than these. Believe me, you'll have great fun with them.

Interference Suppressors and Engine Performance

THE PROBLEM AS IT AFFECTS THE CAR MANUFACTURER AND DESIGNER

THE widespread use of resistance suppressors in car ignition systems, which followed the rise in popularity of car radio receivers, and the possibility of future legislation to prevent interference with television and other ultra-high-frequency services, has naturally aroused the interest of motor-car manufacturers.

Reports of impaired performance in certain types of engine were not always confirmed by road tests instituted privately by individual manufacturers, and the subsequent controversy seemed likely to continue indefinitely until the Society of Motor Manufacturers and Traders asked the Automobile Research Committee to undertake a thorough investigation of the matter. This was carried out at the Research Department of the Institution of Automobile Engineers, at Brentford, Middlesex, and through the co-operation of Joseph Lucas, Ltd., one of their research assistants, Mr. N. Hendry, was employed by the Committee for the period of the investigation. The results have been published in a report, from which we have been privileged to abstract the following information.

Preliminary Tests

Visits were first paid to twelve manufacturers who had expressed willingness to give facilities for road tests on their vehicles. Sets of 15,000-ohm suppressors with ganged shorting switches were fitted to the engines, and observations were made with and without suppressors on (1) idling, (2) slow running in gear, (3) acceleration on the level and uphill, (4) maximum speed, (5) full-throttle pulling at slow engine speed. The vehicles tested (about twenty in all) included all types from small private cars to large commercial vehicles. In only three cases was any effect observed due to the introduction of the suppressors, and even then was limited to the low speed end of the range—i.e., when driving in top gear between 4 and 10 m.p.h. or when idling. All three cars were of the expensive, high-performance type which are expected to have good slow-speed performance in top gear. Also they were all of the overhead-valve type.

With these facts as a pointer, work was continued in the laboratory and a single-cylinder o.h.v. motor cycle engine was chosen for experiments under slow-running conditions. Power output was measured on a dynamometer, which was modified to increase its sensitivity to small changes, and in view of the importance of flame propagation in all ignition problems "ionised gaps" were fitted near to the spark plug and at the opposite side of the combustion chamber. A DC potential is applied across these gaps which are in the nature of miniature spark plugs. Unexploded mixture is a good insulator, but when the flame reaches the gap a current flows through the ionised gas and a voltage is developed across a resistance in the circuit. This voltage is applied to a cathode-ray tube, and not only the time of arrival of the flame but its rate of growth may be studied. Three tubes were used to obtain simultaneous photographic records of the currents at each gap, and the output from the original spark plug was passed through a buffer valve circuit to separate the ionisation current and prevent the spark potential from reaching and paralysing the oscillograph.

As a result of research undertaken by the Automobile Research Committee, many controversial points relating to erratic engine performance have been cleared up, and methods of overcoming minor troubles resulting from the fitting of ignition suppressors are suggested.

Tests were made at speeds from 200 to 2,000 rpm, and the running was found to be affected below 1,500 rpm when the suppressor resistances were in circuit. Below 500 rpm the engine running was rather erratic and tended to mask the effect of the suppressors, and 1,000 rpm was standardised for the purpose of experiment. At this speed perfectly regular running was obtained without suppressors; but with suppressors, although the first two gaps showed ionisation, the flame did not always reach the far side of the combustion space.

Engine Adjustments

Tests were next made to ascertain the effect of a number of variables on the sensitivity of the engine to the fitting of suppressors. The results are quoted from the original report.

Effect of Mixture Ratio

These tests were carried out at 1,000 rpm light load, the mixture strength being varied from 10: 1 to 22: 1, but the effect of suppressors was in no way altered by this variation of mixture strength.

Ignition Advance

"Under otherwise similar engine operating conditions, it was found that an effect due to suppressors was most apparent with the optimum ignition timing.

Spark Energy

"This was varied by increasing the primary volts supplied to the 6-volt coil from 4 volts to 12 volts. In one or two instances, there appeared to be a slight lessening of the effect of suppressors by increasing the primary volts.

Sparking Plug Gap

"This was varied from 0.020 in. to 0.120 in., but no alteration in the effect of suppressors was noticed.

Interference Suppressors—

Leaky Plug

"An attempt was made to simulate conditions existing with a leaky plug by connecting a variable resistance in parallel with the plug. The resistance could be varied from 500,000 ohms downwards, and at a particular value the plugs ceased sparking. It was found that the point at which this occurred was not in any way affected by suppressors. It is realised, however, that an external fixed resistance of this kind probably does not truly represent the internal shorting of a sooted plug."

A similar series of tests on a single-cylinder side-valve engine fitted with ionised gaps showed no trace of irregular running as a result of the introduction of suppressors at any speed or load. The outstanding difference between the overhead- and side-valve engines *at low speeds* is that the gas turbulence on the inlet and compression strokes is greater in the side-valve type.

To test the hypothesis that turbulence is the factor most likely to affect the rate of combustion when suppressors are used, the overhead-valve engine was fitted with a special "shrouded" inlet valve—i.e., a valve with a deflector lug formed on the underside of the mushroom to impart a swirl to the incoming mixture. After fitting this valve it was no longer possible to detect any effect due to the fitting of a suppressor.

By way of confirmation, the side-valve engine was fitted with a pocketed spark plug to give a region of stagnant mixture near the plug. As a result a drop in speed of about 20 rpm at 1,000 rpm on light loads was observed, and the combustion at the far side of the cylinder head was frequently so weak as to give no trace on the oscillogram.

Tests on a six-cylinder side-valve engine showed no irregularity in running, nor any measurable reduction of power output from the fitting of suppressors, though on some ionisation records the plug in the middle of the combustion space indicated a slight reduction in the steepness of the ionisation peak. On a six-cylinder OHV engine, on the other hand, a 9 per cent. power loss on light load could be measured, but with a somewhat heavier load the effect was less (4 per cent).

The report concludes:—

"The results of both road and laboratory tests indicate that no effect due to suppressors is obtained at moderate or high speeds, or under appreciable load. In addition, side-valve engines appear, in general, to be insensitive to the effect of suppressors. Some overhead-valve engines are, however, affected by suppressors at the lower speeds, the maximum loss of power observed in the present tests being 9 per cent. The present investigation suggests, however, that the effect due to suppressors is usually much smaller than this.

"The adverse effect of suppressors on overhead-valve engines at low speeds is due to insufficient turbulence, and this can be remedied by the fitting of a shrouded inlet valve. On the other hand, an engine previously insensitive might become affected if the sparking plugs are pocketed.

"Factors, such as mixture strength, ignition advance, sparking plug gap, leaky plugs, and spark energy, only have an effect if the predisposing condition of insufficient turbulence is present, but, even then, the effect of these variables is small."

Recent Inventions

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

RF COUPLINGS

OWING to the tendency of the tuning condensers used, for instance, in the IF stages of a superhet to be affected by temperature variations, they are, in some cases, replaced by coils with movable powdered-iron cores.

According to the invention, such coils are designed so that their effective inductance can be varied without producing any change in what is known as the "Q" factor. This is ensured by using a magnetic core having a diameter which is definitely related to the ratio of the maximum inductance of the coil when the core is fully in and when it is fully out. Alternatively, the mean area of the coil is made three times the area of the core. Special means are also provided for maintaining the cores of two coupled coils a fixed distance apart, e.g., by so arranging that one of the coils is moved relatively to its core when making tuning adjustments.

W. J. Polydoroff. Application date September 23rd, 1938. No. 519451.

o o o o

PREVENTING "OVERLAP"

IN press-button tuning, the pre-set circuits are naturally designed for those stations which come in at considerable strength. The same stations are, of course, those most likely to "overlap" or interfere with the reception from more distant stations usually tuned by manual control.

The set is accordingly so arranged that, when the push-button is operated to give the listener manual control of tuning, it automatically brings into circuit those fixed tuning units which correspond to the two most powerful interfering stations. The units are so inserted that they act either as blocking circuits to reject the interfering signals in question, or else as acceptor circuits to by-pass them away from the grid of the first amplifier. The result, in both cases, is to reduce the overlap that would otherwise occur when the set is being tuned by hand to a distant station.

Murphy Radio, Ltd., and L. A. Moxon. Application date October 1st, 1938. No. 519755.

o o o o

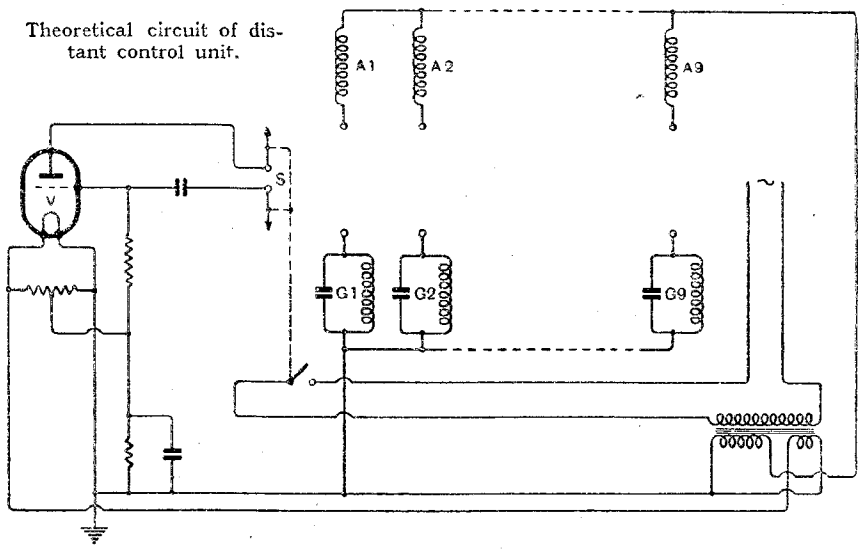
REMOTE TUNING CONTROL

A BROADCAST receiver of the push-button type is tuned to a desired station by an adaptor unit, which is plugged into the electric mains at the distant point, and exercises its control through the mains. The distant tuning unit is shown in the figure. It consists of a valve oscillator V with a number of anode coils A1 . . . A9 and corresponding tuned grid-circuits G1 . . . G9.

The listener can select any one of nine stations by moving a switch S, preferably of the slider type, and so causing the valve V to generate oscillations of a particular frequency. These are fed through the mains to a distant coil, which is coupled to a corresponding number of tuned circuits in the grid of an anode-bend detector valve associated with the receiving set.

The receiver is also provided with a small "acceptor" motor which drives a rotary switch constantly over the points of a bank of nine acceptor circuits.

Theoretical circuit of distant control unit.



When a selecting current is received from the mains, the bias on the anode-bend detector is removed, as and when the rotary switch makes contact with the corresponding "acceptor" circuit. Current from the detector then switches on the HT and LT supply to the set and simultaneously starts up the ordinary tuning motor which proceeds to "home" on to the required setting. The first or acceptor motor is then automatically cut-out until it is desired to select a new programme.

E. K. Cole, Ltd., and A. Herczeg. Application date 7th September, 1938. No. 518890.

o o o o

DIRECTIONAL AERIALS

THE frame aerial used on an aeroplane for "homing," or for taking bearings in flight, must be mounted outside the fuselage if the machine is metal-built, since otherwise the aerial would be heavily screened. On a high-speed machine, an exposed frame offers considerable air resistance, so that it has been proposed to mount it inside a streamlined casing made of some suitable insulating material. However, this is not entirely satisfactory, because if the streamlined casing is fixed to the fuselage, it will still cause some air drag whenever the wind is at an angle to the movement of the craft.

According to the invention, the difficulty is solved by enclosing the aerial in a streamlined casing which is mounted on ball bearings so that it can be freely rotated relatively both to the frame aerial and to the fuselage. Full advantage can thus be taken of the streamlining, irrespective of the particular orientation of the frame aerial, or the prevailing direction of the wind.

Standard Telephones and Cables, Ltd., and B. J. Axten. Application date October 4th, 1938. No. 519809.

o o o o

MICRO-WAVE TECHNIQUE

IT is known that very short waves will travel without attenuation along a hollow tube of metal or insulating material, so long as the radius of the transmission tube—or "dielectric guide," as it is sometimes called—bears a definite relation to the wavelength. If the tube or guide is flared at its end, the waves will radiate out from that end in much the same way as sound waves are propagated from the horn of a loud-speaker.

The invention is concerned with the conditions under which ultra-short-wave

Recent Inventions—

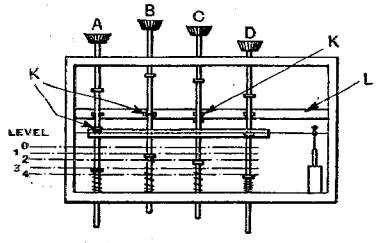
energy can be radiated in this way, and is directed to a construction of a terminal flare or horn intended to give maximum "gain" for a given overall length. The arrangement is particularly suitable for transmitting or receiving signals covering a wide frequency range, such, for instance, as are used in television work.

Electrical Research Products, Inc. Convention date (U.S.A.) April 29th, 1938. No. 519766.

o o o o

"SEQUENCE" TUNING

THE figure shows an arrangement designed to allow a listener to preset the tuning of a receiver, so that several selected stations can be heard in sequence.



Mechanism for "sequence" tuning.

The four knobs marked A—D correspond to four different stations, and each can be depressed to one or other of four different levels, indicated at 1—4. The station set to level 1 will be heard first, that set to level 2 will come next, and so on. The change-over from one station to another in the selected order is effected by applying a definite impulse to the set. This may be done, for instance, by operating the on-off switch, or by tapping a certain part of the set, or even by shining a light on it.

The impulse is applied to operate an escapement, of known type, which allows each of the rods to rise up one step. As shown, the button B will be first heard, because the contact K rests against the common bus-bar L. The presetting may include a period for gramophone reproduction, and also a change-over from ordinary sound broadcasting to television reception.

Kolster-Brandes, Ltd., and C. N. Smyth. Application date 11th October, 1938. No. 520042.

o o o o

SELECTIVITY AND QUALITY

IN the ordinary way any attempt to push the selectivity of a set beyond a certain point automatically leads to a falling-off in the quality of reproduction, because the higher audible notes passed are always attenuated when the carrier is passed through a sharply tuned circuit.

The problem is solved, according to the invention, by providing two separate RF channels, one being sharply and the other broadly tuned. The whole of the signal content of the narrow channel is rectified, whilst a filter circuit in the broadly tuned channel allows only the sidebands corresponding to the high audible notes to pass through. These are rectified and then mixed or combined with the output from the sharply tuned circuit.

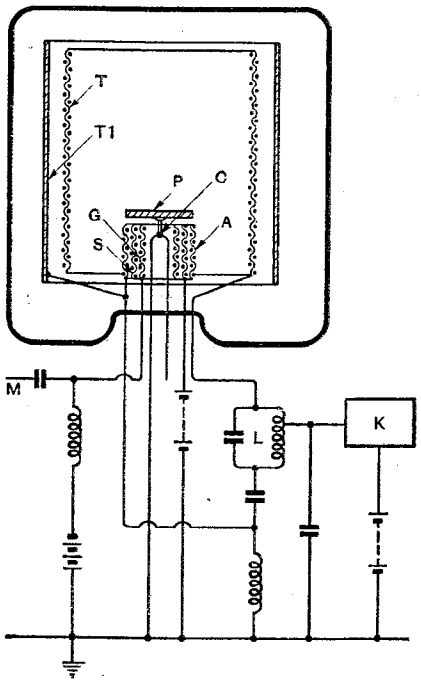
The arrangement allows a better balanced band of audible frequencies to reach the loud speaker than it would get from the highly selective channel alone. The filter in the broadly tuned channel may be adjusted, either automatically or by hand, so as to pass as much of the high-note sidebands as the ether conditions will admit—subject, that is, to the exclusion of interfering signals from other station.

Murphy Radio, Ltd., and L. A. Moxon. Application date December 3rd, 1938. No. 522258.

ELECTRON MULTIPLIERS

THE figure shows a discharge tube of the "multiplier" type designed for use as a modulator. The centre group of electrodes includes a heated cathode C, surrounded by a control grid G, a screening grid S, and an anode A. All of these exercise the usual action upon the electron stream emitted by the cathode, except that they are permeable to the electrons. An impermeable plate P prevents the escape of any electrons except through the control electrodes already mentioned.

Mounted some distance away are two



Electron multiplier used as a modulator.

other electrodes. One, T, is an "open" screen, while the other, T1, is a target electrode coated on its inner surface with highly emissive material which liberates a copious supply of secondary electrons under the impact of the primary stream. The two electrodes T, T1 are connected across a tuned circuit L, and form the RF stage of the tube.

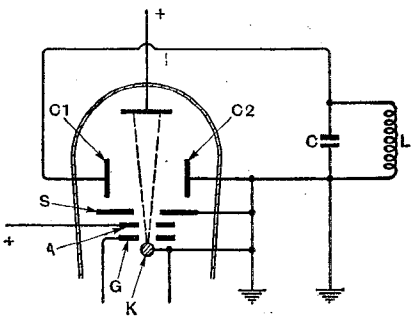
Microphone or other signals applied at M to the grid G control the emission from the heated cathode C in the ordinary way. The electron stream, after passing through the centre group of electrodes reaches the outer pair. The external circuit L is tuned to the "transit time" of the secondary electrons passing from T to T1, and so provides a carrier frequency for the signal applied at M. The modulated output is drawn off at K.

Farnsworth Television Incorp. Convention date (U.S.A.) November 29th, 1937. No. 521347.

ELECTRON "CAPACITIES"

A THERMIONIC valve of the so-called "beam" type is used to convert a variable voltage into a variable capacity.

As shown, the electrons emitted from



Using beam valve for stabilising tuning.

a "line" cathode K are passed through a control grid G, an accelerator electrode A, and a suppressor plate S, all of which are slotted so as to produce a ribbon-like stream. A further pair of electrodes C1, C2 form, in effect, the two plates of a condenser in shunt with the main condenser C of a tuned circuit L C forming part of a wireless set of the ordinary type.

Any variation in the voltage applied to the control electrode G will vary the intensity of the electron stream passing through the valve. This, in turn, alters the dielectric constant between the two electrodes C1, C2, and therefore the value of the shunt capacity across the condenser C in the external circuit to be controlled.

Owing to its "inertialess" character, the arrangement allows a very high frequency variation to be imposed on the tuning of the circuit L C. Also, if the cathode K is allowed to share in the temperature change, the arrangement can be used to compensate for undesirable changes in the tuning of a wireless transmitter as the circuits warm up in the normal course of working.

Marconi's Wireless Telegraph Co., Ltd.; G. F. Brett; and N. Levin. Application date November 12th, 1938. No. 522477.

Wireless World

CLASSIFIED ADVERTISEMENTS

THE CHARGE FOR ADVERTISEMENTS in these columns is

12 words or less, 3/- and 3d. for every additional word.

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

SERIES DISCOUNTS are allowed to Trade Advertisers as follows on orders for consecutive insertions, provided a contract is placed in advance, and in the absence of fresh instructions the entire "copy" is repeated from the previous issue: 3 consecutive insertions, 5 per cent.; 6 consecutive, 10 per cent.; 12 consecutive, 15 per cent.

ADVERTISEMENTS for the December issue are accepted up to First Post on Friday, November 8th, at the Head Offices of "The Wireless World," Dorset House, Stamford Street, London, S.E.1, or one day earlier at the Branch Offices, 8-10, Corporation Street, Coventry; Guildhall Buildings, Navigation Street, Birmingham, 2; 260, Deansgate, Manchester, 3; 26B, Renfield Street, Glasgow, C.2.

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

Cheques and Postal Orders sent in payment for advertisements or deposits should be made payable to ILIFFE & SONS Ltd., and crossed. Notes cannot be traced if lost in transit. They must therefore be regarded as being despatched at sender's risk. Alternatively, they may be sent per registered post.

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

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes. They also retain the right to refuse or withdraw advertisements at their discretion.

For the convenience of private advertisers, letters, other than circulars, etc., may be addressed to numbers at "The Wireless World" Office. When this is desired, the sum of 1/- to defray the cost of registration and to cover postage on replies must be added to the advertisement charge, which must include the words Box 000, c/o "The Wireless World." All replies should be addressed to the Box number shown in the advertisement, c/o "The Wireless World," Dorset House, Stamford Street, London, S.E.1. *Remittances should not be sent through the post to Box Numbers.*

DEPOSIT SYSTEM

Readers who hesitate to send money to advertisers in these columns may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt. Notes and Money Orders save time. Cheques should be made payable to Iliffe & Sons Ltd., and are acknowledged to seller when "cleared."

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. Details of any arrangement made between parties which does not concur with any of the above conditions must be advised to us when the deposit is made. For all transactions whether a sale is effected or not a commission of 1 per cent. is charged on and deducted from the amount deposited (minimum charge 2/-). All deposit matters are dealt with by Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

NEW RECEIVERS AND AMPLIFIERS

*

CHALLENGER RADIO CORPORATION.—We still lead with best value money can buy; send 2½d. stamp for illustrated catalogue of finest all-wave receivers, handsome speakers and valves, firsts only at contested prices; every article fully guaranteed; buy now before prices again rise.—CHALLENGER RADIO CORPORATION, 31, Craven Terrace, Lancaster Gate, London, W.2. [9278

ARMSTRONG AW125PP, £18/15; McClure P.P. amplifier, £9/7/6; Mighty Gem battery portable, £6/6; McMurdo Silver Olympic Autoradiogram, £75; Scott Philharmonic chassis, £150.—A.C.S. Radio, 44, Widmore Rd., Bromley. [9257

£11/10 Only.—Usual price £22; *Wireless World* 2 R.F. Receiver with push-pull quality amplifier, 10 valves, including tone control stage, 8 watts triode output, ideal for quality reproduction from radio and gramophone; limited number.—Bakers Selhurst Radio, 75, Sussex Rd., South Croydon. [9262

RECEIVERS AND AMPLIFIERS

SECOND-HAND, CLEARANCE, SURPLUS, ETC.

SOUND Sales.—DX-Plus receiver, feeder unit, valves, for "WWQ" amplifier; perfect, £5.—Bell, chemist, Earl Shilton, Leics. [9275

H.M.V. 907 All-wave Radio and Televisor, £25; Baird T5C televisor, £25; Murphy A28C Console, £8/8; Crosley 1938-9 Table Model, £8/8; Marconi Table Model 346, £9/9; Philco Console, 290, £6/17/6.—A.C.S. Radio, 44, Widmore Rd., Bromley. [9258

BANKRUPT Bargains, brand new 1939-40 models, makers' sealed cartons, with guarantees, at 25 to 40% below listed prices; also mains and battery, portables and midgets; send 1½d. stamp for lists.—Radio Bargains, Dept. W.W., 261-3, Lichfield Rd., Aston, Birmingham [9220

Wanted

SUPER Skyrider, S×16, or similar, wanted for cash.—Stead, 2, Cliff Road Gardens, Leeds, 6. [9266

WANTED, good communication receiver, with crystal filter; cash down.—Symonds, Kirksyde Hotel, Harrogate. [9270

PUBLIC ADDRESS

V

VORTEXION P.A. Equipment

IMITATED, but unequalled.

WE Invite You to a Demonstration.

A.C.-20 15-20-watt Amplifier, 38-18,000 cycles, independent mike and gram., inputs and controls, 0.037 volts required to full load, output for 4, 7.5, and 15 ohms speakers, or to specification, inaudible hum level, ready for use; 8½ gns. complete.

C.P. 20 12-volt Battery and A.C. Mains Model, as used by R.A.F., output as above; 12 gns.

A.C.-20, in portable case, with Collard motor, Piezo pick-up, etc., £14; C.P.20 ditto, £17/17.

50-WATT Output 6L6s, under 60-watt conditions, with negative feed back, separate rectifiers for anode screen and bias, with better than 4% regulation level response, 20-25,000 cycles, excellent driver, driver transformer, and output transformer matching 2-30 ohms impedance electronic mixing for mike and pick-up, with tone control, complete with valve and plugs; £17/10.

COMPLETE in Case, with turntable, B.T.H. Piezo pick-up and shielded microphone transformer; £22/10.

80-WATT Model, with negative feed back; £25, complete.

120-WATT Model, with negative feed back; £40, complete.

250-VOLT 250 m.a. Full Wave Speaker, field supply unit; 25/-, with valve.

WE are Compelled Through Rising Costs to Increase our Prices by 10%.

ALL P.A. Accessories in Stock; trade supplied.

SEE Our Display Advertisement on page 477 (Edit.).

VORTEXION, Ltd., 257, The Broadway, Wimbledon, S.W.19. 'Phone: Lib. 2814 [9232

NEW MAINS EQUIPMENT

VORTEXION Mains Transformers, chokes, etc., are supplied to G.P.O., B.B.C., I.P.T.B.; why not you?

WE are Compelled Through Rising Costs to Increase our Prices by 10%.

VORTEXION, Ltd., 257, The Broadway, Wimbledon, London, S.W.19. 'Phone: Lib. 2814. [9233

NEW LOUD-SPEAKERS

BAKERS Brand New Surplus Speaker Bargains.

EVERY Music Lover Interested in Realistic Reproduction should write for free descriptive leaflet now.

£4/15; usual price £10.—Brand new permanent magnet infinite baffle speaker, complete with beautifully finished cabinet in polished walnut.

£2/7/6; usual price £5.—Brand new super quality triple cone speaker, permanent magnet model; exceptional bargain; limited number.

SECURE One of These Exceptional Bargains Now.

BAKERS SELHURST RADIO, 75, Sussex Rd., S. Croydon. [9263

BAKERS Triple Cone Conversions Will Immensely Improve Reproduction of Your Present Speaker. ("For a few shillings you have converted a speaker scheduled for the scrap heap into one worth pounds.—W. E. Darby, Grad. I.E.E.")

SPECIAL Offer.—We will loan you a speaker free of charge whilst we fit a triple cone to your present unit; write for details.

BAKERS SELHURST RADIO, 75, Sussex Rd., Sth. Croydon. [9264

SHORT-WAVE EQUIPMENT

G5NI for Short Wave Equipment; largest stocks in the country; communication receivers; National agents; American and British Valves, etc. See advertisement on page 9.—44, Holloway Head, Birmingham. [0531

CABINETS

A CABINET for Every Radio Purpose.

SURPLUS Cabinets (Undrilled) from Noted Make.

WE Have Hundreds in Stock (no Catalogues); send measurements of chassis, etc., and say what kind of cabinet required; stamp for reply.

INSPECTION Invited.

H. C. SMITH and Co., Ltd., 289, Edgware Rd., W.2. Tel: Pad. 5891. [0485

DYNAMOS, MOTORS, ETC.

ALL Types of Rotary Converters, electric motors, battery chargers, petrol-electric generator sets, etc., in stock, new and second-hand.

A.C. D.C. Conversion Units for Operating D.C. Receivers from A.C. Mains, 100 watts output, £2/10; 150 watts output, £3/10.

WARD, 46, Farringdon St., London, E.C.4. Tel.: Holborn 9703. [0518

Wanted

WANTED.—Rotary Converter, any size.—Hull, 221, City Rd., London, E.C.1. [9253

RADIO Converter, 110 D.C. to 230-250 A.C., 100-150 watts, in silent cabinet.—Roberts, Carharthen, Tresillian, Truro. [9276

GRAMOPHONE MOTORS

Wanted

CASH Waiting for New or Second-hand Electric Gram Motors or Record Players, if in good condition.—Details to R. N. Fitton, Ltd., Brighouse, Yorks. [9255

RECORDING EQUIPMENT

AMERICAN Presto Junior Recorder, complete, as new, £42/10; 1940 V.G. Simplat recording amplifier, as new, £30; Permarec DT4 recording tracking head, £3/15.—A.C.S. Radio, 44, Widmore Rd., Bromley. [9260

VALVES

ALL Types of American Tubes in Stock of Impex and Arcturus makes at competitive prices.

WE Can Also Supply a Full Range of Guaranteed Replacement Valves for Any British non-ring, American or Continental type at an appreciably lower price.

SEND for Lists of These, and also electrolytic condensers, line cords, resistances, etc.

CHAS. F. WARD, 46, Farringdon St., London, E.C.4. Tel.: Holborn 9703. [0452

METROPOLITAN RADIO SERVICE.—American Valves, in all types, trade supplied.—1021, Finchley Rd., N.W.11. Speedwell 3000. [0436

METERS, ETC.

WESTINGHOUSE Instrument Rectifiers, latest 0/1mA type, boxed, 15/6; complete A.C./D.C. multimeter kits supplied.—MacLachlan and Co., Strathyre. [9281

IMMEDIATE Delivery.—Ferranti 2½in. dial moving coil; milliammeters, 0-10, 0-20, 0-100, 0-250; ammeters, 0-1, 0-2.5, 0-15, 0-20, 0-30, 22/6 each; portable thermal H.F. ammeters, 0-5, 0-10, 0-20, 35/- each. Spotless.—Green, 34, Chester Rd., Hulme, Manchester. [9273

TEST EQUIPMENT

ONE Radiomete Type U.V.T All-valve Tester; £4.—F. A. Boggis, 22, Sackville Rd., Bexhill-on-Sea. [9269

AMERICAN General Radio 603-A Battery Standard Signal Generator, complete, cost £125, bargain £35; Clough-Brengle OM-A calibrated sweep-frequency modulated oscillator, £20; new Triplett D.C. milliammeters, 0-50 or 0-100 mA, each 27/6.—A.C.S. Radio, 44, Widmore Rd., Bromley. [9259

Wanted

ALL-WAVE Mains Oscillator.—Write Box 400, Rays, Cecil Court, W.C.2. [9274

COMPONENTS

SECOND-HAND, CLEARANCE, SURPLUS, ETC.

PREMIER RADIO.

PLEASE See Our Displayed Advertisement on page 5. [0488

RADIO CLEARANCE, Ltd.

TO All Our Customers.—Owing to enemy action we are temporarily located at 38, Lambs Conduit St., W.C.1.

WE Can Still Supply Your Needs.

ENQUIRIES Invited. [9250

SOUTHERN RADIO'S Wireless Bargains.

ALL Goods Previously Advertised Still Available.

SOUTHERN RADIO, 46, Lisle St., London, W.C. Gerrard 6653. [9238

A.C. Eliminators, £1; with trio. chargers, 30/-; all guaranteed, carriage paid.—Bunton, 12, Yewcroft Ave., Newcastle-on-Tyne, 5. [9272

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. [9265

COULPHONE RADIO, New Longton, Preston.—Prompt personal attention. Brand new goods only. Tungsram valves, Cosmocord crystal pickups, Bulgin components, all advertised chassis, Rola G.12 speakers with transformer, 1,250 and 2,500 ohms, 55/-; 8in. Goodmans P.M., 15/6; guaranteed American valves, 4/6; Octal, 5/6; Dubilier 1 watt resistors, 3/6 doz.; B.I. electrolytics, 8+8 mfd., 550 volt, 3/6; Plessey 8+8 mfd., 525 volt, aluminium can., 3/-; C.T.S. volume controls with switch, 3/-; Armstrong, K.B., Ferguson, R.G.D., Decca, Pilot and G.E.C. 1941 models; stamp for new bargain list. [9254

VAUXHALL.—Rola 8in. P.M. speakers, 14/9; Rola 10in. P.M. speakers, 18/6; Rola G12 P.M. speakers, 69/6; Rola energised 6in. 1,500 ohm, 12/6; all with transformers. Gramophone pick-ups, 11/- and 18/9: Niclet 3½-1 L.F. transformers, 5/9; electrolytic condensers, cardboard case, 8 mfd. 500v., 2/-; 8+8 mfd. 500v., 3/6; 50 mfd. 50v., 1/9; 0.1 mfd. 300v., 3d., tubulars, 0.25 mfd., 6d.; volume controls, 2/-; with switch, 3/-; bar-type 2-gang condensers, straight, trimmers, 6/6; skeleton HT10 rectifiers, 11/-; iron-cored tuning coils on base, terminals, switch, 2-gang, 12/6; 3-gang, 19/6; 1-watt resistors, 4d. each; Colvern Colpak G128, superhet 110 k/cs, 35/-.

VAUXHALL UTILITIES, 163a, Strand, London, W.C.2. Postage extra orders under 3/-; stamp for list. [9280

MARCONI 2.7:1 "Ideal," 12/6; A.F.5c, 12/6; R.I. 8:1, 7/6; R.I. 1:1 driver, 5/-; R.I. tapped class B choke, 9/-; "Novotones," 10/-; Polar 4-gang 0.0005, 9/-; H.M.V. 3-gang 0.0005 and drive, 7/6; Murphy 2-gang 0.00035 and drive, 5/-; Celestion 8in. P.M.s, 15/-; R. and B. choke, 32H, 150Ω 300 ma., £1; Rothermel £4/4 p/u, £1/10; B.T.H. crystal p/u, cartridge, 7/6; Kinva Crystal, p/u, filters, 10/-; G.E.C. A.C., gram. motor, £1/7/6; H.M.V. magnetic, p/u's, 12/6; G.E.C. brass s/m, 0.0005's, 3/6; Simpson's turntable, £1; Phillip's 7A rectifier and 2 barretters, 10/-; R. and B. transformer, 1-0-1v. 10a., and 2/20v. 7a., £2, as new; Colvern G11, G12, G13, G14, 10/-.—Al. Oldacre, Baslow Rd., Bakewell, Derbyshire. [9277

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

G. A. RYALL, "Arnehurst," Marsh Lane, Taplow, Bucks (late Ryalls Radio of London), offers radio goods, all new, unless otherwise stated. Post free. Minimum orders 1/3, please.

ROLA 10in. 2,000 ohm Energised Speakers, pentode transformers, with over 11 yards 3-way rubber cable with 5-pin plug, with 4-prong winder, in portable rexine carrying case, leather handle, brown finish, nickel plated corners. Note, speaker aperture is 8in. only, made for Pathe cine outfit, in original wrappings, size 16½ square, 7½in. deep; 17/9 each.

SPEAKER Only, as above, 9/6; cable and plug only, as above, 2/9; case with cable holder, as above, 7/9.

MAINS Transformers, made by Standard Telephones for Pathe amplifier, input 110-250v. A.C., outputs 350-0-350v. 120 ma., 4v. 2½ amp., 4v. 4-5a., special heavy primary, used as 250w. Auto trans. for other items below; can be used as 300w. auto transformer, drop through type size, 5¾×4⅝×2in. deep; 10/9 each, used, as new.

A.C. Induction Motors, fitted with fan-cooling, 1,500 revs, one-tenth horse power, 110v., for use with above transformer, supplied 8 mf. paper block condenser, as used motors fitted 4-pin plug; 14/9, used, as new.

A.C. Transformer, input 110v., for use with above transformer, secondaries 10v. and 20v. at 5 amps and 8 amps; 4/9.

HUNT'S 8 mf. Wet or Dry Type Electrolytics, 500v. peak, upright alni cans, used, good condition, 1/6 each; Mansbridge blocks, for chassis mounting, 2 mf.×1 mf., 400v working, 1/3.

TWIN Mains Leads, 23/36, in single rubber container, double vulcanised leads, 13ft. with 2-pin to bayonet adaptor; 1/6 each.

SIX-WAY Group Boards, with insulation sheet, for mounting, complete with 6 resistances, 1,200 ¼w., 500 1w., 4,700 2w., 1,200 1w., 10,000 3w., 100,000 ½w.; 1/6 each.

R.C.C. Units on Small Paxolin Panel, comprise T.C.C. 0.01 mica condenser, 0.15 non-inductive tubular, 2 meg and 4 meg. ½-watt resistances; two for 1/6.

CELESTION Speakers, 600 ohm field with push-pull transformer, with 5-pin plug, 10in. cone, 9/6; Celestion 1,000 ohm speaker, with push-pull transformer with 5-pin U.S.A. plug, 10/6; Celestion 700 ohm speakers, with pentode transformers, heavy magnet type, 10/6; Magnavox 1,000 ohm, type 152, with pentode transformers, 10/6; Celestion-Magnavox type 750 ohm, push-pull transformers, heavy magnet type, 1in. speech coil, 10/6; Celestion 6,500, with push-pull transformer, heavy open magnet type, 10/6; all above have 10in. cones.

MAGNAVOX 152 Speakers, less transformers, 1,000, 2,250, 3,000 ohm, 7/9 each; Magnavox 1,000 ohm special type with ringed cone, less transformer, 8/9 each; Magnavox type III oval (elliptical), less transformers, 800 ohm heavy magnets, 6/9; 660 ohm ditto; all above are 10in. speakers, mostly rated to handle 8 watts, all are new oddments purchased from Messrs Celestion, and are used normally in various commercial sets and radiograms.

NOTE.—All above speakers are energised types, and not permanent magnet, of which we have none to offer at present, and are not suitable for use as extension speakers, unless suitably energised.

AMERICAN Valves, sets three, 2-volt American bases, 1A4 VM/HFP, 1B4 HFP, 2101 ½-watt output Pentode; 6/6 the set of three; suit Philco sets.

SPECIAL Offer Europa Valves, AC/L, for power grid detector, and first stages amplifier, impedance 7,000 ohms, 2/3 each; AC/HP 5-pin with earth pin at side for metal screening, a fine SG detector or HF valve, 2/3 each; both are 4-volt lamp valves with British bases.

SPECIAL Note.—We are obliged for the many letters of sympathy we have received from customers in connection with our recent difficulties caused by enemy action at our London address. We are now confining our business to mail orders, and shall be able to give prompt attention from a quiet situation.—G. A. Ryall, "Arnehurst," Marsh Lane, Taplow, Bucks. [9267

REPAIRS AND SERVICE

EPOCH Diaphragms, genuine replacements, 66, 99, 101, etc.—R.E.C.S., Crown St., Reading. 'Phone: 2796. [9247

GUARANTEED Repairs, any transformers, choke, motor armature, converter, dynamo, etc.; keenest prices, immediate quotation, prompt, dependable service.—See below.

L.T.P. (LONDON TRANSFORMER PRODUCTS, Ltd.), Willesden, N.W.10. Willesden 6486 (3 lines). [9227

MAINS Transformer Service, repairs, rewinds, or construction to specification of any type, competitive prices and prompt service.—Sturdy Electric Co., Dipton, Newcastle-on-Tyne. [0516

GALPINS
ELECTRICAL STORES
75, LEE HIGH ROAD, LEWISHAM, LONDON, S.E.13

Telephone: LEE GREEN 5349

Terms: Cash with Order

ELECTRIC LIGHT CHECK METERS, small, late type, well-known makers, in good condition, electrically guaranteed for 200/250 volts 50 cy. 1 phase A.C. mains. 5 amp. type, **6/-**; 10 amp., **7/6**; 20 amp., **9/-** each. Post 1/- on all types.

"CRYPTO" D.C. TO A.C. ROTARY CONVERTOR, 500 watts 220 D.C. to 200 volts 50 cycle, 1 phase, in perfect condition. **£6/10/-,** carriage forward.

"CRYPTO" SHUNT WOUND DYNAMO, 30 volts 10 amps., 1,900 r.p.m., in good condition, **65/-,** carriage forward.

JOHNSON & PHILLIPS 8in. DIAL 0 to 500 VOLTMETER (Hot Wire), first grade, in new condition, **30/-** each.

"CROSSLEY" APPROX. 1 H.P. GAS ENGINE, tube ignition, in good condition, **65/-,** carriage forward.

D.C. ELECTRIC LIGHT CHECK METERS, 200/250 volts 5 and 10 amps., **4/6** each, post 1/- (in new condition).

A SPECIAL LINE—MAINS TRANSFORMER for Dug-out lighting off 12 volt car bulbs, input of Transformer is 200/240 volts, output is 12 volts at 3 amps. Price **7/6** each, 6d. post.

VOLTAGE CHANGER TRANSFORMER, 2,000 watts, 110 to 200/240 volts or vice versa. Price **75/-.** Guaranteed 12 months.

PHILIPS HIGH VOLTAGE CONDENSERS. Infd. at 4,000 volt working, **5/6** each, carriage paid. T.C.C. Electrolytic Condensers, 2,000 mfd., 12 volt working **2/6** each, post 4d.

REGULATORS, STARTERS AND LARGE DIMMER RESISTANCES. Stud Switch-arm type. Please state requirements.

SWITCHBOARD VOLT AND AMPMETERS MOVING COIL AND MOVING IRON. All first-class makers. Please state requirements.

TEN LINE CORDLESS TELEPHONE PORTABLE EXCHANGE BOARD, complete with calling generator in new condition, **£6/10/-,** carriage forward.

PORTABLE VOLTMETER IN OAK CASE, 7×6×4in. First grade moving coil, 0 to 12 volts, **10/6,** post 1/-; ditto, size 5×4×2½in., **7/6** each, post 9d.

EX R.A.F. MORSE KEYS, massive silver contacts, well-balanced movement, **7/6,** post 9d.

EVER READY TORCH CASES, 5×4×2½, high grade, complete with switch and handle, oak case, brand new, **2/6** each, post 6d.

MANGIN LENSES, convex, 4½in. dia., new, **7/6** each.

EX R.A.F. WALL FITTING LAMP, brass case, glass dome, complete with 12 volt 15 watt bulb, **3/6** each post 6d.; ditto, wing type, complete **3/6** each, post 6d.

EX R.A.F. PORTHOLE AEROPLANE LAMP, 6in. dia., complete for red, white or green light, solid metal construction, complete with 12/14 volt 50 watt bulb (new). **6/6** each, post 6d.

OSRAM 100 VOLT 15 WATT PEARL LAMPS, 8d. each, or **7/-** per dozen.

VOLTAGE CHANGING TRANSFORMERS (Auto Wound). 100/110 to 200/240 volts or vice versa. Guaranteed 12 months. 250 watts, **25/-**; 500 watts, **32/6**; 1,000 watts, **50/-**; 1,500 watts, **62/6.** Delivery 7 days from date of order.

SMALL ELECTRIC ROTARY CONVERTOR, 110 volts D.C. input, 10 volts at 30 amps. output. Useful for garage charging, **55/-,** carriage forward.

D.C. MOTOR BLOWERS, 2in. inlet and outlet. Aluminium body, laminated field, ideal for dug-out ventilation. 100 volt, **25/-.**

CRYPTO SHUNT WOUND DYNAMO, 12/18 volts, 8/10 amps., 2,200 r.p.m., in new condition, **37/6,** carriage forward.

X-RAY TUBES by well-known makers, 7in. bulb Tungsten Targets, **15/-** each, carriage forward.

CROMPTON, self-exciting 50/100 cycle **ALTERNATOR,** 70 volts 500 watts, **£3/10/-,** carriage forward.

HIGH-VOLTAGE TRANSFORMERS, useful for all test work, or television. Input 200/240 volts, output 5,000 and 7,000 volts, **6/6** each, post 1/-.

MAINS TRANSFORMERS, 200/250 volts input, 12 and 24 volts at 4/6 amps. output, suitable for model trains, etc., **15/-** each, post 1/-.

EX R.A.F. AUTOMATIC CHARGING CUTOUTS AND VOLTAGE REGULATORS, for 12 to 20 volt up to 20 amp. circuit (new) and complete in metal case, **3/6** each, post 9d.

EX R.A.F. GLASS ACCUMULATOR TANKS, 5×5×8in., new and unused, **3/6** each, post 1/-.

EX R.A.F. SWITCH PANEL, with case (new), fitted 6 small knife switches, leads, cords and cleats, complete in wood case, **2/6** each, post 6d.

EX R.A.F. AEROPLANE DYNAMOS, for accumulator charging, 12 volt 8 amp., 1,750 r.p.m., **10/-** each, carriage 2/6.

EX R.A.F. NEW NECO MOTOR BLOWER, 100 volt motor, shunt wound, 1,800 r.p.m., ball bearing, fitted to Cyclone fan, 4½in. inlet 5in. outlet, massive aluminium casing 11in. dia., new and unused, **55/-** each, carriage 4/-.

REPAIRS AND SERVICE

"SERVICE with a Smile."—Repairers of all types of British and American receivers; coil rewinds; American valves, spares, line cords.—F.R.I., Ltd., 22, Howland St., W.1. Museum 5675. [8934

METROPOLITAN RADIO SERVICE.—Guaranteed repairs to American and British receivers; American valves, condensers, volume controls, linecord resistances, Majestic I.F. transformers, and rewinds, trade supplied.—1021, Finchley Rd., N.W.11. Speed well 3000. [0435

SERVICE With a Guarantee.—Let Challenger overhaul your radio and bring it up to date for the winter; low prices, best workmanship; 3 months' guarantee card given with every job; all replacements; valves 6/- each.—Challenger Radio Corporation, 31, Craven Terrace, London, W.2. [9279

SITUATIONS VACANT

AIR MINISTRY.

DIRECTORATE of Signals.

APPLICATIONS are Invited for Appointments as Civilian W/T Operators at Certain Air Ministry W/T Stations. These appointments are of a temporary nature in the first instance, but it may be possible to absorb a proportion of temporary posts into the permanent establishment after conclusion of hostilities.

APPLICANTS, who should be between the ages of 21 and 45 years at the date o fmaking application, should preferably possess the 1st Class Postmaster-General's Certificate or the Air Operator' Certificate in Wireless Telegraphy and have had experience in radiotelephony, direction finding and maintenance work.

SALARY is at the Rate of 7/- a Week for the First Two Years, thereafter rising by annual increments for approved service to a maximum of 125/- a week. In addition, a temporary war bonus of 5/- a week will be paid.

THE Normal Hours of Duty are 45 a Week, exclusive of meal times, day or night, or 180 in periods of four weeks.

ARRANGEMENTS Will be Made for Suitable Candidates to be Interviewed at Renfrew, Manchester, London or Bristol.

REQUESTS by Postcard for Forms of Application Should be Addressed to the Under-Secretary of State, Air Ministry (S.1.e). Julian Rd., Bristol, 9, and should state the town at which an interview is desired. [9255

CROWN Agents for the Colonies.

COLONIAL Government Appointments.

APPLICATIONS from Qualified Candidates are Invited for the following post:—

WIRELESS Engineer Required for the Posts and Telegraphs Department of Malaya for three years with possible permanency. Salary $400 a month, rising by annual increments of $25 a month to $800 a month. (The Government rate of exchange is now 2/4 to the dollar.) A children's allowance is payable to married officers with children. Free passages and, if married, for wife and children not exceeding four persons. Liberal leave on full salary. Candidates, age 23-28, must have been definitely trained as Electrical Engineers for Telecommunication work and have had not less than two years' experience in wireless work. They must be Associate Members of the Institution of Electrical Engineers or, alternatively, possess educational qualifications carrying exemption from the Associate Membership examination of that Institution.

APPLY at once by Letter, stating age, whether married or single, and full particulars of qualifications and experience and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/9383. [9263

EXPERIENCED Radio Service Engineer Wanted for Inside Work; good wages; old-established firm.—Barkers, Oxford Rd., Worthing, Sussex. [9271

VACANCIES Exist for Civilian Wireless Instructors at the Electrical and Wireless Schools, Royal Air Force, at a rate of pay of £5/2/6 a week, rising by annual increments of 2/6 a week to a maximum of £5/10 a week.

CANDIDATES Must be Capable of Lecturing and Must have a Sound Knowledge of Electrical Principles and their Application to Radio and Low-power Electrical Engineering.

APPLICATIONS Should be Addressed to the Under Secretary of State, Air Ministry (S.5 D.), Dept. J.K., London, W.C.2, giving full particulars as to previous experience, age, etc.

CANDIDATES, who must be over 30 years of age, will be required to appear before a Selection Board at the schools for interview and test, but may be re-imbursed the cost of third class locomotion expenses for this purpose. The test will include the giving of a lecture on any subject which may be chosen by the candidate involving the principles of modern radio. Lecturing sequence and style are most important. [9155

SITUATIONS VACANT

PUBLIC Address Manufacturers (London) Require Experienced Engineer.—Box 2543, c/o *The Wireless World.* [9261

RADIO Service Engineer, experienced, and exempt military service preferred, write, stating age, experience, wage required, enclose copies references; congenial, well equipped workshop; area considered safe.—Chattell, Murphy Dealer, 40, High St. North, Dunstable, Bedfordshire. 'Phone: 340. [9173

VACANCIES Exist for Civilian Morse and Procedure Instructors at the Electrical and Wireless Schools, Royal Air Force, at an initial rate of pay of £4/12/6 per week, rising by annual increments of 2/6 a week to a maximum of £5/2/6 per week. Candidates must be able to send and receive morse at not less than 25 w.p.m. and should have had experience of lecturing and teaching, but consideration will be given to others who consider themselves capable.

APPLICATIONS Should be Addressed to the Under Secretary of State, Air Ministry (S.5.D.), London, W.C.2, giving full particulars as to previous experience, age, etc.

CANDIDATES Will be Required to Appear Before a Selection Board at the Schools for Interview and Test, but may be reimbursed the cost of third-class locomotion expenses for this purpose. [9154

MORSE EQUIPMENT

FULL Range of Transmitting Keys, practice sets, oscillators, recorders and other radio Telegraph apparatus, designed and manufactured by T. R. McElroy, world champion telegraphist. Sole distributors, Webb's Radio, 14, Soho Street, London, W.1. 'Phone: Gerrard 2089. [8768

PATENT AND TRADE MARK AGENTS

GEE and Co. (H. T. P. Gee, Mem. R.S.G.B., etc.), 51-52, Chancery Lane, London, W.C.2. Holborn 4547-8. Handbook free. [C001

PARTNERSHIPS

REQUIRED, technician to take over long established and remunerative business (chiefly postal) for duration of war, operating from own address; some business experience necessary; knowledge of instruments and laboratory practice desirable.—Box 2544, c/o *The Wireless World.* [9282

TECHNICAL TRAINING

GREAT Possibilities Exist for Technically Qualified Engineers, key men in wartime and afterwards. Through the home-study courses of The T.I.G.B. take a recognised engineering qualification such as A.M.I.Mech.E., A.M.I.E.E., A.M.I.R.E., A.F.R.Ae.S., A.M.I.Chem.E., C. and G., etc., in which examinations the T.I.G.B. students have gained 25 FIRST PLACES. Write to-day for "The Engineer's Guide to Success"—Free—containing the world's widest choice of engineering courses covering all branches, including Aeronautical, Mechanical, Electrical, Wireless, Chemical, etc.

THE TECHNOLOGICAL INSTITUTE OF GREAT BRITAIN, 82, Temple Bar House, London, E.C.4 [9251

BUSINESSES AN D FROPERTY FOR SALE, TO BE LET, OR WANTED

"THE Wireless and Electrical Trader" is an essential part of the equipment of every Wireless Trader; its pages reflect the very latest turn of trade events, and it is read by all the leading dealers and manufacturers, for particulars of businesses offered or wanted. By subscription, to the trade only, 17/6 per annum, post free.—Send your trade card for specimen copy to Dorset House, Stamford St., London, S.E.1. [0614

TUITION

MORSE Code Courses.—"Book of Facts," free.—Candler System Co. (Room 55 WO), 121, Kingsway, London, W.C.2. [9074

WIRELESS Officers.—Short courses of training for young men for marine and air services.—Marine School, South Shields. [9166

PRACTICAL Postal Courses, radio television, test equipment design, trade-test coaching for R.A.F. post, I.P.R.E. and I.W.T. exams.; booklet free.—Secretary, I.P.R.E., 3, Shirley Rd., London, W.4. [8838

RADIO Engineering, Television and Wireless Telegraphy; comprehensive postal courses of instruction.—Apply British School of Telegraphy, Ltd., 179, Clapham Rd., London, S.W.9 (Estd. 1906). Also instruction at school in wireless for H.M. Merchant Navy a 1 R.A.F. [9249

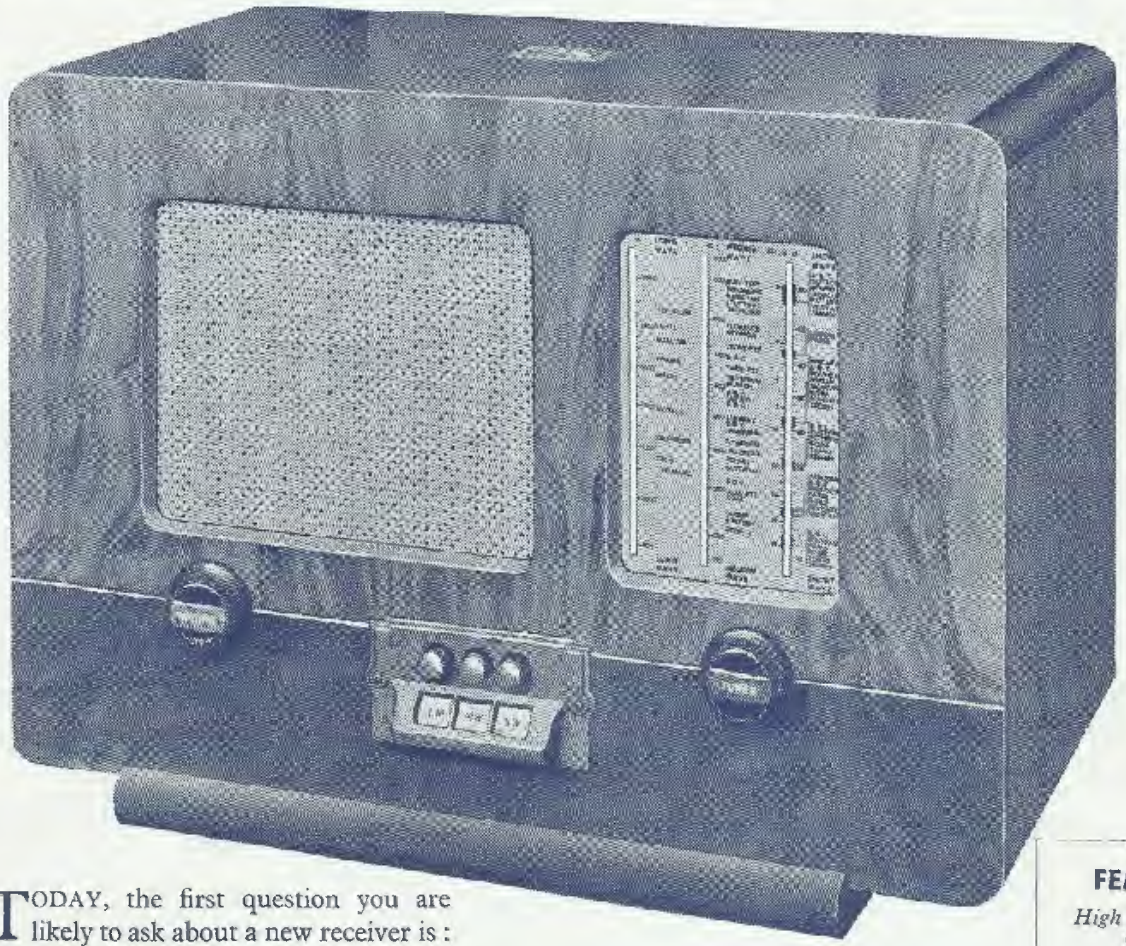
VACUUM CLEANERS

HOOVER, with accessories, £5/5, perfect; also Goblin, 50/-.—R.E.C.S., Crown St., Reading. [9248

INDEX TO ADVERTISEMENTS

Printed in England for the Publishers, ILIFFE AND SONS LTD., Dorset House, Stamford Street, London, S.E.1, by THE CORNWALL PRESS LTD., Paris Garden, Stamford Street, London, S.E.1. "The Wireless World" can be obtained abroad from the following: AUSTRALIA: Gordon & Gotch, Ltd., Melbourne (Victoria), Sydney (N.S.W.), Brisbane (Queensland), Adelaide (S.A.), Perth (W.A.), and Launceston (Tasmania). NEW ZEALAND: Gordon & Gotch, Ltd., Wellington, Auckland, Christchurch and Dunedin. INDIA: A. H. Wheeler & Co., Bombay, Allahabad and Calcutta. CANADA: Imperial News Co., Toronto, Winnipeg and Vancouver; Benjamin News Co., Montreal; Gordon & Gotch, Ltd., Toronto. SOUTH AFRICA: Central News Agency, Ltd.; Wm. Dawson & Sons (S.A.), Ltd., Cape Town. UNITED STATES: The International News Co., New York.

What is it like on SHORT WAVES?



TODAY, the first question you are likely to ask about a new receiver is: "What is it like on short waves?" For most people realise that they are now increasingly dependent on the short wave bands for variety and quality of news and entertainment.

"His Master's Voice" Model 1107 embodies fundamental technical improvements which give from aerial to mixer anode *up to a four-fold gain in sensitivity and signal-to-noise ratio as compared with previous equivalent types of receiver.*

In terms of performance this means greatly increased entertainment value from a wider range of stations, *especially on short waves.*

Push-button wavechange; more effective A.V.C.; improved tone control; generous output; unimpeachable quality; pre-war standards of construction; moderate price — all these make up a specification which meets your radio needs at every point.

FEATURES:

High Gain Aerial Circuit

★

New Type Steep Slope Mixer

★

All-wave reception: 16.5-52 metres, 192-570 metres, 720-2,000 metres.

★

Specially designed Tone Control

★

Pick-up and external speaker sockets

★

5 watts rated output

★

Suitable for A.C. Mains, 195-255 volts, 50-100 cycles.

MODEL 1107 5-valve all-wave superhet for A.C. Mains **11 GNS.**

"His Master's Voice"

THE GRAMOPHONE COMPANY LIMITED · HAYES · MIDDLESEX