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HUGH S. POCOCK

Editorial,  
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Telephone: Waterloo 3333 (50 lines).  
Telegrams: "Ethaworld, Sedist, London."

COVENTRY: Hertford Street.

Telegrams: "Autocar, Coventry." Telephone: 5210 Coventry.

BIRMINGHAM:

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*As many of the circuits and apparatus described in these  
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making use of them, to satisfy themselves that they would  
not be infringing patents.*

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## EDITORIAL COMMENT

### Short-wave Receivers A British Opportunity

**I**N the B.B.C. Annual just published there is included a special article discussing the development of the Empire Broadcasting Service, and much interesting information is included. There is, however, one paragraph on the subject of short-wave receivers to which we should like to call particular attention. The paragraph reads:—

"Not only does the design of the short-wave receiver play a large part in the amount of interference a listener will experience, but it also materially affects the general standard of reception of the Empire Service. The Empire Broadcasting Service has considerably increased the sale of American all-wave receivers, not only in the U.S.A. but also in Empire countries. The 1935 Olympia Radio Exhibition, however, showed that the British manufacturer is at last making an effort to meet the demand for British receivers suitable for use in Empire countries to receive the short-wave service from Daventry. The production of good receivers at a price the Empire listener can pay is a most important factor of the development of the Empire Service."

We have already expressed the view that the British manufacturers have been so slow to market efficient short-wave receivers that their present position in relation to the competition of foreign producers, and in particular those of the U.S.A., makes it seem rather hopeless to begin now with the idea of being able to catch up to a level with competitors in this field unless unusual methods are adopted.

We therefore take this opportunity, on the strength of the views expressed

in the paragraph quoted above, to reiterate our suggestion for a standard short-wave Empire Receiver of competitive design to be agreed upon by British manufacturers collectively and manufactured to the same specification and to sell at an agreed price. We believe that by this means alone could a set be produced having all the necessary features which would ensure a welcome for it whilst keeping the price competitive at the same time. But perhaps the greatest advantage of a standard set for this purpose would be the simplicity of supplying spare parts and servicing.

Great responsibility would rest upon those whose duty it was to approve the final design, but it is a responsibility which we have every confidence could be ably shouldered by technicians in the various manufacturing firms in the radio industry. If success is to attend such a scheme it must be put in hand at once, there is no *more* time to be lost

### Noise Suppression

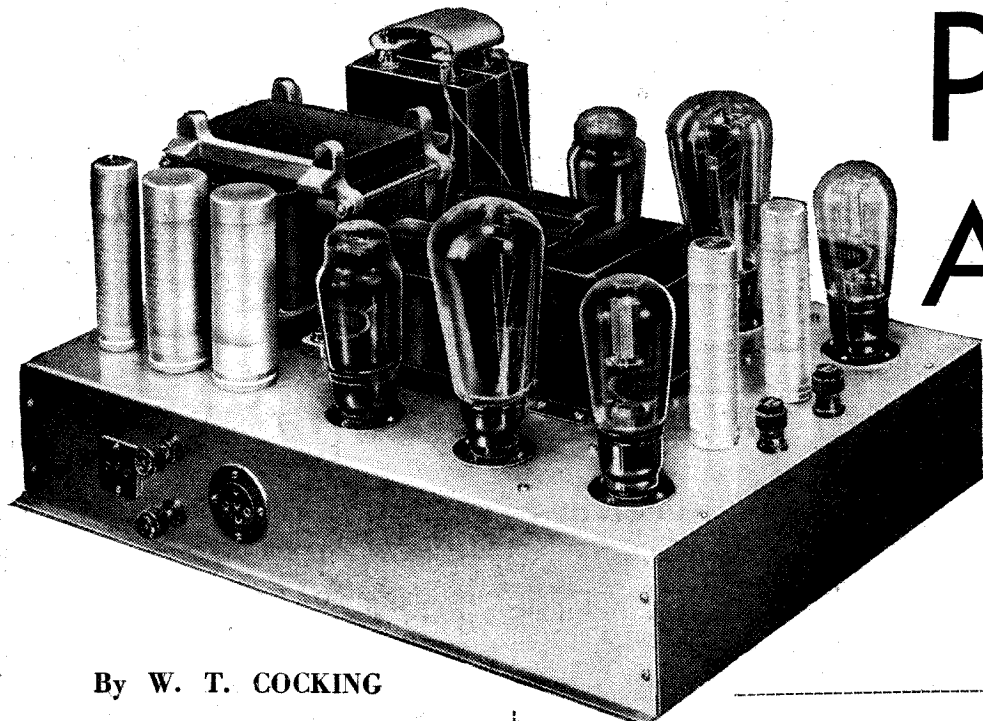
#### Importance of a New Development

**T**HE system of noise suppression just developed in America and described in our issue of last week is one which appears, on theoretical grounds, to show great promise.

The system works when the peaks of interference are short and stronger than the signal.

It seems likely that its most useful application will be in SW reception. It should be clearly understood that the system is not likely to be of any benefit in the case of certain types of interference; the claims made for it, and they are substantiated by theoretical considerations, and practical tests carried out by *The Wireless World*, are only that it will reduce those forms of interference which consist of short and strong pulses.

# Wireless World



# PA Amplifier

TWELVE-WATT  
HIGH-FIDELITY  
EQUIPMENT

By W. T. COCKING

**A**LTHOUGH most domestic requirements are met by an amplifier having an undistorted output of 4-6 watts, there is no doubt that there are many cases where a larger output is needed. When rooms are exceptionally large or it is desired to operate several loud speakers together, an output of about 12 watts becomes necessary, while an output of this order will often suffice for many public address requirements. The figure needed for PA work naturally varies considerably in different cases, but some 12 watts will be found sufficient for most purposes, such as dancing in small halls, announcements at local functions, and so on.

The *Wireless World* PA Amplifier is based on the well-known Push-Pull Quality Amplifier, which has proved itself over a period of years to be reliable and trouble-free while giving practically perfect results from the electrical point of view. The circuit diagram of the amplifier appears in Fig. 1, and it will be seen that the output stage consists of two PP5/400 valves in push-pull operated in accordance with their maker's rating. The maximum undistorted output of 12 watts is secured with a total load impedance of 6,000 ohms, and the stage requires a total input of about 64 volts peak. This is too much to obtain safely from a single valve with resistance coupling, so that the penultimate stage is also of the push-pull type.

In order to prevent parasitic oscillation both grid and anode stopping resistances are employed in the output stage. In the anode circuits R13 and R14 are given the usual values of 100 ohms each, but the resistances R11 and R12 in the grid circuits have values of 1,000 ohms only, since it has been found that higher resist-

ances lead to considerable attenuation of the upper frequencies with the output valves employed. This is because the PP5/400 has a much higher input capacity under operating conditions than the smaller PX4, principally because of its higher mutual conductance.

### The LF Stages

The valves in the penultimate stage are of the MHL4 type, and the coupling resistances R5 and R6 have values of 25,000 ohms. Decoupling is provided by the 10,000-ohm resistances R7 and R8 in conjunction with the 8-mfd. electrolytic condensers C5 and C6. Grid bias is naturally derived from resistances in the cathode circuits, and R3 and R4 have values of 1,000 ohms and are shunted by the 250-mfd. condensers C3 and C4. The grid leaks of the output stage R9 and R10 have values of 0.25 megohm, and the coupling condensers associated with them C7 and C8 have capacities of 0.1 mfd. Since any leak in these condensers would have a disastrous effect not only upon the performance, but also on the life of the output valves, these condensers are of the mica-dielectric type, and are rated for working at 500 volts. In the case of the coupling to the intermediate stage, a leak would not be attended by such serious results, and paper-type condensers of 0.1 mfd. (C1 and C2) are accordingly employed at this point, in conjunction with

0.5-megohm grid leaks R1 and R2.

The two output valves are operated from separate filament windings on the mains transformer, and grid bias is derived from the voltage drop across resistances connected between negative HT and centre-tappings on these windings. These resistances R15 and R16 have values of 500 ohms, and are shunted by the 50-mfd. by-pass condensers C9 and C10.

Turning now to the HT system, two entirely separate supplies are used—one for the output stage alone and the other for all early stages and speaker fields. Although at first sight wasteful, this course is not really so, for at most it involves an extra smoothing choke and a slightly more expensive mains transformer. In compensation, however, most of the smoothing condensers can be of comparatively low voltage rating, no difficulties arise about voltage dropping nor about energising field windings of widely different characteristics, and, furthermore, feed-back effects from the output stage, their usual source, are entirely eliminated.

Referring to Fig. 1, it can be seen that the 500-0-500 volts 120 mA. winding on the mains transformer supplies the HT for the output stage in conjunction with the 406 BU rectifier valve which has its filament heated from one of the 4-volt 2.5-amp. windings. The reservoir condenser C12 has a capacity of 4 mfd., and is rated for 1,000-volts working. Smoothing is

*THERE are many cases where an undistorted output of 12 watts is necessary in sound reproduction, and an amplifier which combines this output with an exceedingly good frequency response is described in this article. Details are also given of a feeder-unit embodying a wide range tone-control circuit of novel design.*

**Wireless World PA Amplifier**—effected by the 12 H. choke Chr in conjunction with another 1,000-volts condenser C11 of 4 mfd. capacity.

The total voltage required by the output stage is some 400 volts for the anodes, 32 volts for grid bias, 6 volts loss in R13 and R14, and, say, 9 volts loss in the output transformer, or roughly 450 volts. The unsmoothed output of the rectifier is some 510 volts, and the requisite voltage drop is obtained partly in the DC resistance of the smoothing choke (200 ohms) and partly in the 300 ohms resistance R17. The 0.5 megohm resistance R18 is included to prevent their being any possibility of the condensers retaining a charge when the amplifier is switched off.

Now the second HT supply is obtained

mA. is drawn a potential of some 250 volts appears across this last condenser and constitutes the HT supply for the early stages. As will be shown later, speaker fields can be energised by being connected across the HT supply at this point.

**The Feeder-Unit**

The amplifier proper, with its mains equipment, can be used with any feeder-unit or receiver which is designed for the Push-Pull Quality Amplifier without alteration to either. A special feeder-unit has been designed for it, however, since in PA work a microphone is commonly employed, and, moreover, a wide range tone-control is often needed. The use of this unit, however, is not confined to this

bias is obtained by the 2,000-ohm cathode resistances R26 and R31 shunted by the 50-mfd. condensers C23 and C26. In the anode circuit of the amplifier a 50,000-ohm coupling resistance R28 is used with a 50,000-ohm decoupling resistance R27 and 8-mfd. decoupling condenser C24. A 0.1-mfd. coupling condenser C25 to the phase-changer is employed and a 2-megohms grid leak R29. This next valve has 50,000 ohms coupling resistances R32 and R30 in anode and cathode circuits respectively, and the AC voltages developed across these are used to feed the push-pull amplifier. Anode circuit decoupling is provided by the 50,000-ohm resistance R33 and the 8-mfd. condenser C27.

The phase-changer gives an effective

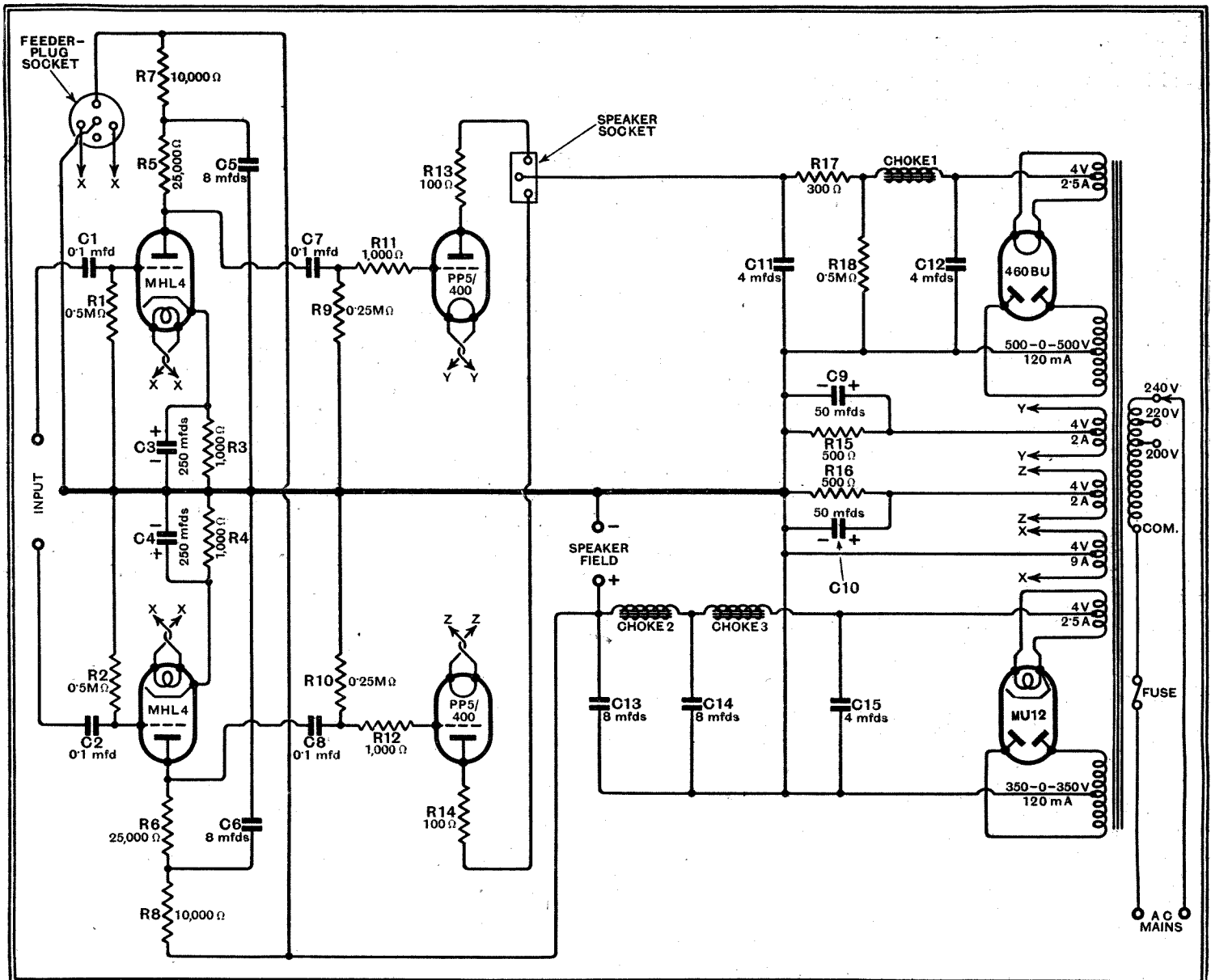


Fig. 1.—The complete circuit diagram of the amplifier. Two separate rectifiers and smoothing systems are used in the HT supply.

from the 350-0-350 volts winding and the MU12 indirectly heated rectifier. The reservoir condenser C15 has a capacity of 4 mfd., and is of the electrolytic type. Preliminary smoothing is effected by means of a 12 H. choke Ch3 and an 8-mfd. condenser C14, and it is completed by the 36H. choke Ch2 and another 8-mfd. condenser C13. When a total current of 120

amplifier, and it can equally well be used with the PPQA when the smaller output will suffice.

The circuit appears in Fig. 2, and three valves are used; of these one is a phase-changer, another an amplifier, and a third a part of the tone-control system. The amplifier and phase-changer are straight-forward; D4 type valves are used and

gain of about 1.8 times, and the amplifier preceding it a gain of roughly twenty-five times, or a total of about forty-five times. This is nearly enough, and the amplification given by the first valve and its coupling is only two or three times. This first valve is fitted primarily to make up for the loss introduced by the tone-control circuit.

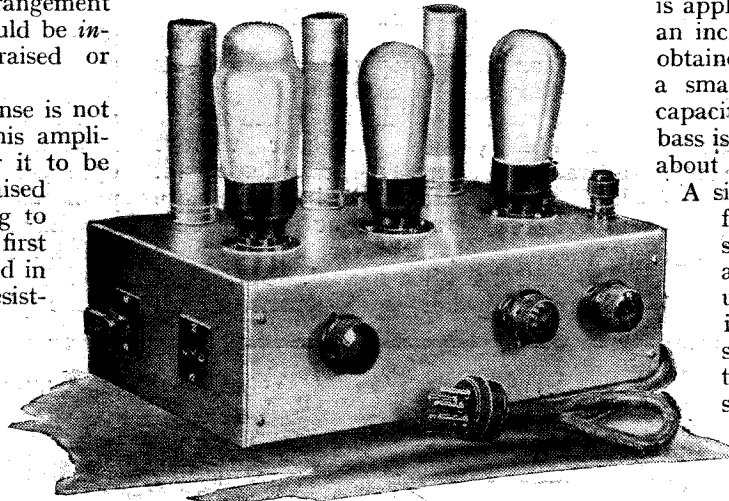
**Wireless World PA Amplifier—**

The tone-control normally fitted to receivers and amplifiers merely permits the response at the upper audible frequencies to be reduced when required. This is by no means an ideal arrangement, but it is the simplest method. A better system would undoubtedly be an arrangement whereby the bass and treble could be independently controlled and raised or lowered as required.

A reduction in the bass response is not often needed, however, so in this amplifier arrangements are made for it to be lifted only. The treble can be raised or lowered, however. Referring to Fig. 2, it will be seen that the first valve is conventionally connected in that a 50,000-ohm coupling resistance R21 is used with a 50,000-ohm decoupling resistance R22 and 8-mfd. decoupling condenser C18. Grid bias is obtained by means of the 2,000-ohm resistance R20 shunted by the 50-mfd. condenser C16, while two input plugs are provided with a fader-volume control R19. This permits a microphone and pick-up to be permanently connected and a rapid change-over from one to the other to be made.

The tone-control circuit comes in the coupling between the two valves. Consider the state of affairs when all switches are in their centre positions. The 3,000-ohm resistance R24 is then connected to the earth line, and it forms a potentiometer with the 50,000-ohm resistance R23, so that only 3/53rds. of the voltage across R21 is applied to the second valve. This

valve is provided with a grid leak R25 of 0.5 megohm in order to prevent an open grid circuit being obtained at certain settings of the switches. In view of the low effective value of the circuit resistances the coupling condenser C17 has the large capacity of 0.5 mfd.



A view of the feeder-unit showing the controls.

Now, in these switch positions the frequency response is normal, and the two resistances R23 and R24 merely throw away most of the amplification given by the first valve. When S1 is moved to the next stud, however, a condenser C20 of 0.25 mfd. is interposed between R24 and the earth line. As long as the reactance of this condenser is small compared with 3,000 ohms it has negligible effect and the response at medium and high frequencies remains normal. At low fre-

quencies, however, the reactance is no longer negligible, for it increases in a manner inversely proportional to frequency. The total impedance between the grid of the second valve and the earth line consequently rises, and a greater proportion of the voltage developed across R21 is applied to the second valve. Actually, an increase at 50 c/s of some 10 db. is obtained. On the next stud of the switch a smaller condenser, C19, of 0.1 mfd. capacity, is inserted, and a greater rise in bass is secured. The rise at 50 c/s is then about 20 db.

A similar arrangement is used at high frequencies, but here a choke is inserted. When S2 is fully rotated in a clockwise direction (on the feeder unit) the 0.54 H. coil L is inserted in series with R24, and a rise of some 20 db. at 10,000 c/s is obtained. The next position of the switch connects R24 to the tapping point on L and the inductance in use is 0.18 H., giving a rise of some 10 db. The switch S3 gives a control reducing the response at high frequencies, again in steps of about 10 db., by shunting R24 by the condensers C21 or C22 of 0.015 mfd. and 0.05 mfd. respectively.

The two switches S2 and S3 are in practice on a common shaft and form the treble control.

When the control knob is fully rotated in an anti-clockwise direction the response at 10,000 c/s is about -20 db.; in the next position it is some -10 db., while in the centre position a flat characteristic is obtained. The two further positions give responses of +10 db. and +20 db. re-

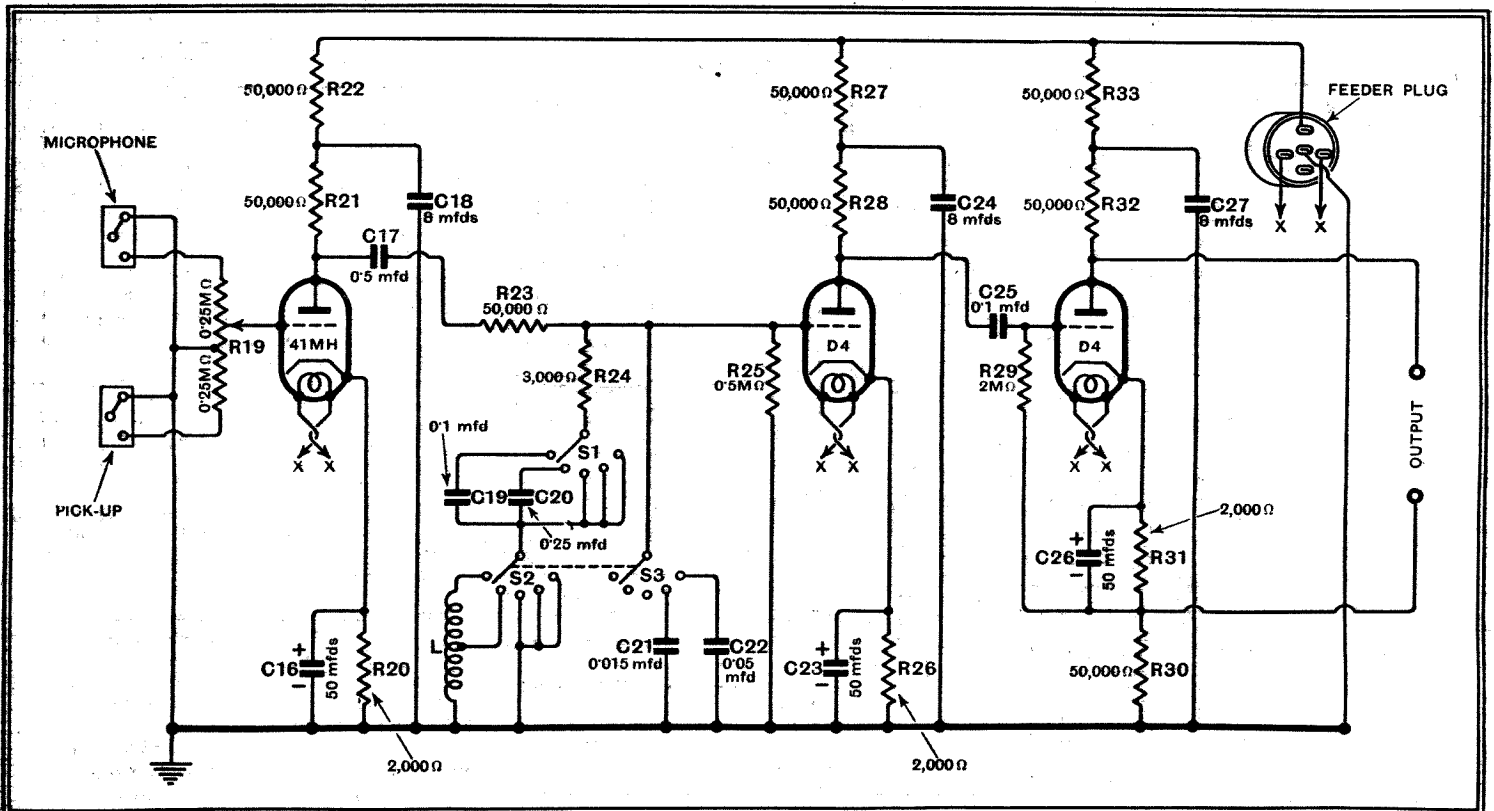
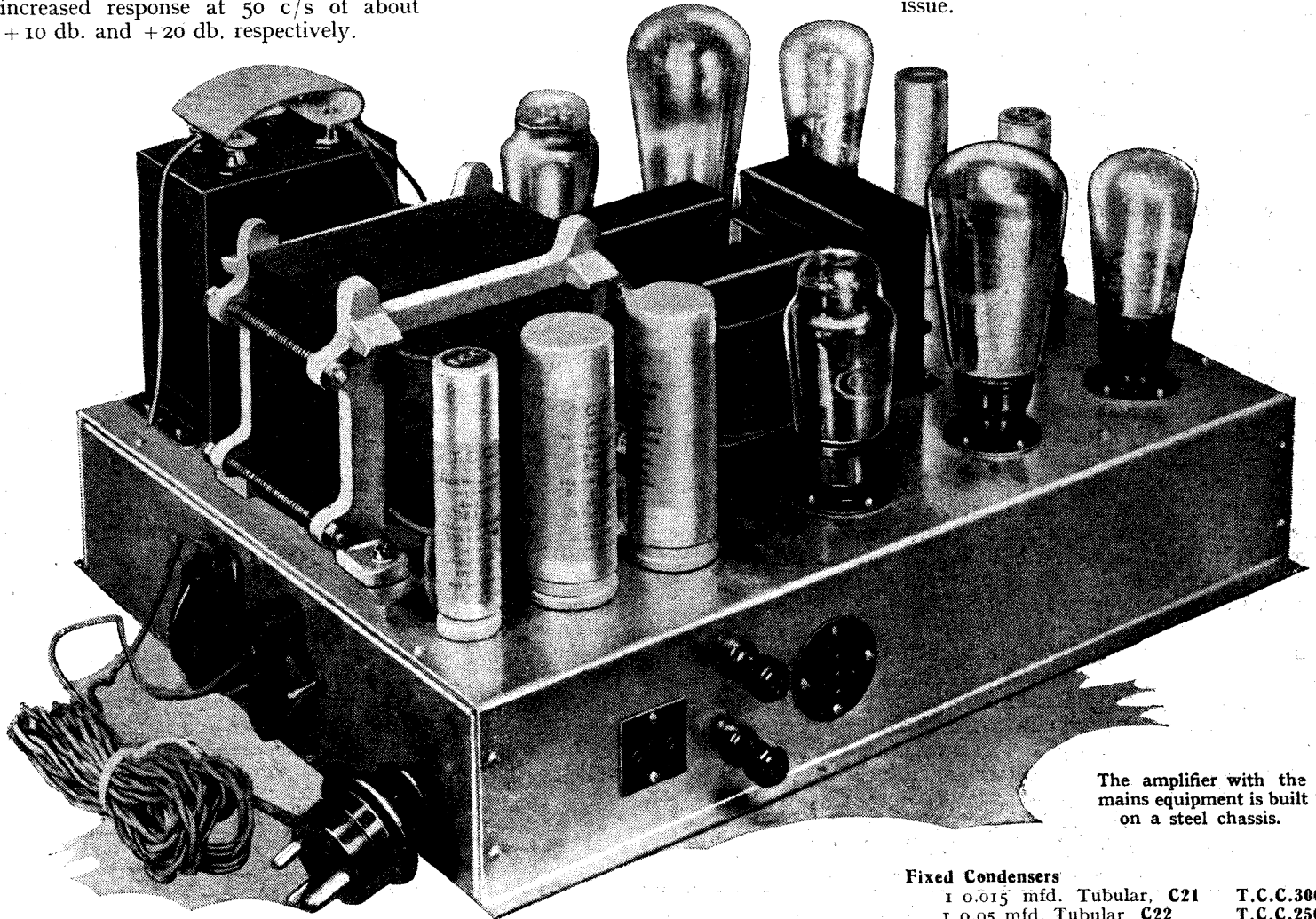


Fig. 2.—A fader-type volume control is used in the feeder-unit, while a wide-range tone control is included. This permits the bass response to be raised and the treble response to be raised or lowered at will.

**Wireless World PA Amplifier—**  
spectively. In the case of the bass control S1, the first three positions are the same, and the two last (clockwise) give an increased response at 50 c/s of about +10 db. and +20 db. respectively.

If it should be required to obtain a reduced bass response this may readily be done by arranging the unused half of the switch assembly to connect additional con-

densers in series with C17. The assembly of the components, wiring and operation of the amplifier and its feeder-unit will be fully dealt with in next week's issue.



The amplifier with the mains equipment is built on a steel chassis.

**AMPLIFIER.**

**1 Mains Transformer, Primary;** 200/250 volts 50. c/s. Secondaries; 4 volts 2.5 amps. C.T., 500-0-500 volts 120 mA, 4 volts 2 amps. C.T., 4 volts 2 amps. C.T., 4 volts 2.5 amps. C.T., 350-0-350 volts 120 mA, 4 volts 9 amps. C.T., with screened primary.

London Transformer Products L.608

(All Power Transformers, Bryce, B.T.S., Challis, Heayberd, Partridge, Savage, Sound Sales, Vortexion.)

**2 Smoothing chokes** 12 H. 120 mA, 200 ohms Ch1, Ch3 N. Partridge WW12

**1 Smoothing choke** 36 H. 120 mA, 500 ohms Ch2 N. Partridge WW36

(Bryce, B.T.S., Davenset, Ferranti, Heayberd, London Transformer Products, Sound Sales, Varley, Vortexion.)

**7 Valve holders** 5-pin (without terminals) Clix Chassis Mounting Type V1

**Fixed Condensers**

- 2 4 mfd. 1,000 volts DC working, C11, C12 T.C.C.111
  - 2 0.1 mfd. Mica, 500 volts DC working, C7, C8 T.C.C.340
  - 2 0.1 mfd. Tubular, C1, C2 T.C.C.250
  - 2 8 mfd. 500 volts peak working, Electrolytic, C13, C14 T.C.C.902
  - 1 4 mfd. 500 volts peak working, Electrolytic, C15 T.C.C.902
  - 2 8 mfd. 450 volts peak working, Electrolytic, C3, C4 T.C.C.501
  - 2 50 mfd. 50 volts DC working, Electrolytic, C9, C10 T.C.C.521
  - 2 250 mfd. 12 volts DC working, Electrolytic, C3, C4 T.C.C.501
- (Dubilier, Ferranti, T.M.C.-Hydra, Peak, Polar-N.S.F.)

**Resistances**

- 2 100 ohms ½ watt, R13, R14 Bulgin HW37

**LIST OF PARTS**

After the particular make of component used in the original model, suitable alternative products are given in some instances.

- 4 1,000 ohms ½ watt, R3, R4, R11, R12 Bulgin HW3
  - 2 10,000 ohms, ½ watt, R7, R8 Bulgin HW15
  - 2 25,000 ohms ½ watt, R5, R6 Bulgin HW20
  - 2 250,000 ohms ½ watt, R9, R10 Bulgin HW28
  - 2 500,000 ohms ½ watt, R1, R2 Bulgin HW31
  - 1 500,000 ohms 1 watt, R18 Eric
  - 2 500 ohms 3 watt, R15, R16 Claude Lyons
  - 1 300 ohms 20 watt, R17 Bulgin PR1
- (Amplion, Bryce, Dubilier, Graham Farish, Ferranti, Claude Lyons, Polar-N.S.F.)
- 1 3-pin plug and socket Belling-Lee 1119
  - 1 5-way connector Bryce
  - 1 Fuseholder complete with 3 amp. fuse Belling-Lee 1045
  - 4 Shrouded terminals, Input (2), LS (2). Belling-Lee "B"
- Miscellaneous:—**
- 6 length systoflex, 2 ozs. No. 18 tinned copper wire, etc. Screws:—4 2BA ¼in., 34 6BA ¼in., 22 4BA ¼in., 12 6BA ½in., all with nuts and washers.
  - Metal baseplate with mounting screws B.T.S.
  - Valves:—
  - 2 MHL4, 1 MU12 Osram or Marconi
  - 2 PP5/400 Mazda
  - 1 460BU Cossor
- FEEDER UNIT**
- 1 Tone correction choke, L B.T.S. WW1

**Fixed Condensers**

- 1 0.015 mfd. Tubular, C21 T.C.C.300
  - 1 0.05 mfd. Tubular, C22 T.C.C.250
  - 2 0.1 mfd. Tubular, C19, C25 T.C.C.250
  - 1 0.25 mfd. Tubular, C20 T.C.C.250
  - 1 0.5 mfd. Tubular, C17 T.C.C.250
  - 3 50 mfd. 12 volts DC working, Electrolytic, C16, C23, C26 T.C.C. "FT" or "AT"
  - 3 8 mfd. 450 volts peak working, Electrolytic, C18, C24, C27 T.C.C.502
- (Dubilier, Ferranti, T.M.C.-Hydra, Peak, Polar-N.S.F.)

**Resistances**

- 3 2,000 ohms ½ watt, R20, R26, R31 Bulgin HW5
  - 1 3,000 ohms ½ watt, R24 Bulgin HW7
  - 8 50,000 ohms ½ watt, R21, R22, R23, R27, R28, R30, R32, R33 Bulgin HW23
  - 1 500,000 ohms ½ watt, R25 Bulgin HW31
  - 1 2 megohm ½ watt, R29 Bulgin HW34
- (Amplion, Bryce, Dubilier, Graham Farish, Ferranti, Claude Lyons, Polar-N.S.F.)

- 1 Volume control 0.25 megohm + 0.25 megohm R19 Dubilier "Fadover"
- 1 4-way connector, light type Bryce
- 1 5-way cable with twin 70/36 leads and 5-pin plug Goltone
- 3 Valve holders 5-pin (without terminals) Clix Chassis Mounting Type V1
- 2 Switches, Double-pole, five-way, with knobs B.T.S. C125
- 2 3-pin plugs and sockets Belling-Lee 1119
- 3 Shrouded terminals, Output (2) Earth Belling-Lee "B"

- Miscellaneous:—** Scientific Supply Stores
- 2 lengths systoflex, small quantity No. 18 tinned copper wire, etc. Screws:—16 6BA ¼in., 2 4BA ¼in., all with nuts.
  - Metal baseplate with mounting screws B.T.S.
  - Valves:—
  - 1 41MH, metallised Cossor
  - 2 D4 Ferranti

# New Electron Multipliers

## HIGH-POWER HF GENERATORS DEMONSTRATED

**R**ECENT advances in "multipactor" tube design, announced by P. T. Farnsworth before the Institute of Radio Engineers in New York on March 4th, make it possible to generate kilowatts of power in a "cold-cathode" tube, at frequencies as high as 300 megacycles. Applications of the new tubes in oscillators and radio-frequency amplifiers give efficiencies not possible with conventional hot-cathode thermionic tubes.

**N**EW tubes, capable of producing several kilowatts of high-frequency power without the aid of a hot filament, at frequencies even higher than the "ultra-high" region, with efficiency as high as ninety per cent., were demonstrated in New York on March 4th by Philo T. Farnsworth, Vice-president in Charge of Research of Farnsworth Television Incorporated. Following closely on the heels of a paper delivered by Dr. V. K. Zworykin on Electron Multipliers (see report in *The Wireless World*, November 22nd, 1935), Mr. Farnsworth's demonstration held unusual interest because, while using the same basic phenomenon, his tubes perform in a manner quite different from those of Dr. Zworykin and lead to results quite as spectacular and perhaps of even greater immediate practical value.

Both the Zworykin and Farnsworth tubes depend on "secondary emission" of electrons from a cold cathode. In the conventional thermionic valve, the electrons are emitted by heating the cathode to a sufficiently high temperature; in the electron multiplier tube electrons are caused to bombard the cathode. As each electron hits the specially prepared surface of the cathode it liberates from three to ten "secondary" electrons—that is, the original electron is multiplied, or "amplified," three to ten times. By this method the electron current in the tube is ampli-

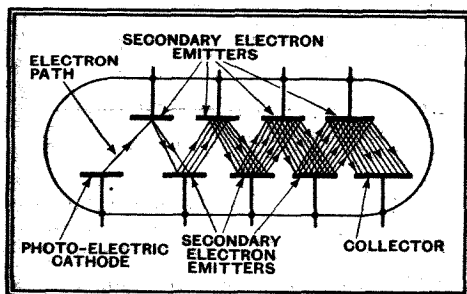


Fig. 1.—Principle of the electron multiplier.

fied, and if the newly liberated "secondaries" are made to strike the cathode again, each one liberates from three to ten additional secondaries. By successive impacts of this kind the electron multiplication is made to build up cumulatively until the original electron impact has been amplified many millions of times. This

manner of operation is the basis of all electron multiplier tubes; it permits exceedingly great amplification to be obtained in a single tube, and because it amplifies the current directly (without the necessity for converting the current into a voltage drop and then amplifying the voltage, as is done in conventional circuits), the signal-to-noise ratio of the electron multiplier tubes is many times higher than that of the usual valve amplifier. A tube of this kind has provided several watts of audio power when its input was a few microamperes of photoelectric current; this feat, accomplished by Dr. Zworykin, was hailed as a great advance. But the power output of the Zworykin tubes was not more than a few watts, although they could probably be made to deliver higher power.

### Up to Four Kilowatts

The Farnsworth tubes, on the other hand, are expressly designed for high-power output. Three distinct forms of "multipactors," as Farnsworth calls his tubes, were shown; their tentative power output ratings are 200, 1,000, and 4,000 watts. The largest size was about a foot long and four inches in diameter. This great increase in power-handling ability is based on two factors: the method of obtaining the electron impacts, which is described below, and the material used in the cathode surface which emits the secondary electrons. The surface used by Dr. Zworykin and other workers in the field of electron multiplication is a caesium-oxide-silver deposited on a silver base, and is very similar to that used in high-vacuum photocells of the caesium type. The disadvantage of this type of surface is the fact that it cannot stand high temperatures, and that it can be destroyed by bombardment of positive ions formed within the tube; because of these limitations, high-power tubes, which must necessarily operate at high temperatures, cannot be built using the caesium-silver surface. A new material, the details of which are not yet available, has been developed by Farnsworth, however, which will operate satisfactorily up to 1,000 deg. C., and which will deliver as many secondaries per electron impact as the caesium-silver surface. The material, which is an alloy

By Our New York Correspondent

having a special surface treatment, can be used even at red heat, making possible compact and efficient high-power multiplier tubes.

The electron multiplication action depends upon many successive impacts of secondary electrons. Various arrangements have been used to obtain the required action. In the Zworykin tubes many separate cathodes are used, each maintained at successively higher positive voltage. The original electron, attracted to the first cathode and liberating several secondaries, produces an amplified electron flow, which is then directed to the second cathode, and so on, each cathode liberating a current multiplication of from three to ten times. This action is shown in Fig. 1. The final amplified current is collected at the plate and conducted to the external circuit. The original electron is produced by illuminating the surface of the first cathode, which is photo-electric.

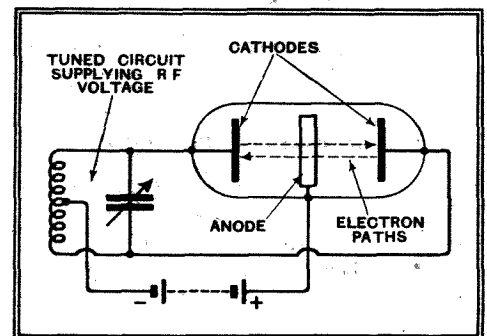


Fig. 2.—The new Farnsworth tube in its elementary form.

In the Farnsworth tube, in its elementary form (see Fig. 2), only two cathodes are used, and they are maintained at the same potential. The electrons are caused to fly back and forth from one cathode surface to the other (multiplying as they go) by applying a very high frequency voltage between the two cathodes. First one cathode and then the other is made positive by this HF voltage, and the electrons fly back and forth in response to the pull of whichever cathode is positive at the time. The central anode is maintained positive at all times by the battery, and serves to attract the electrons in their flight. To prevent the electrons being collected by this anode, in the simple form of tube, a magnetic field has been used to direct the electrons away from the anode and toward the cathodes. In this manner the number of free electrons inside the tube is enormously increased, until a cloud of electrons (a "space charge") is formed. This cloud prevents further increase of current (space-charge equilibrium) unless

**New Electron Multipliers—**

it is removed through the anode to the external circuit.

To do away with the necessity for the magnetic field, and for other reasons, the form of tube shown in Fig. 3 was developed. It consists of an outer cylindrical cathode, with the special electron-emitting surface turned inward. Inside is the anode, a helical coil of wire, very similar in appearance to the grid of conventional valves. Because of the open spaces in this anode, electrons liberated from the surface of the cathode can pass across the tube and hit the cathode on the other side, there liberating still more electrons. The frequency of the HF voltage applied between the cathode and earth is so chosen with respect to the time it takes the electrons to fly across the tube that the electrons make many trips across the tube, each time adding greatly to the current, before they are finally collected by the anode. The same space charge formed in the simple tube of Fig. 2 is thus formed within the cylindrical cathode and is eventually collected, at least in part, by the anode.

**A "Thermionic Multiplier"**

In another form of tube a second cathode is placed in the centre of the tube (Fig. 4). This second cathode does not emit secondaries, but it does emit by thermionic emission, being an ordinary heated filament. The use of this secondary cathode, in addition to supplying initial electrons, is to prevent the elec-

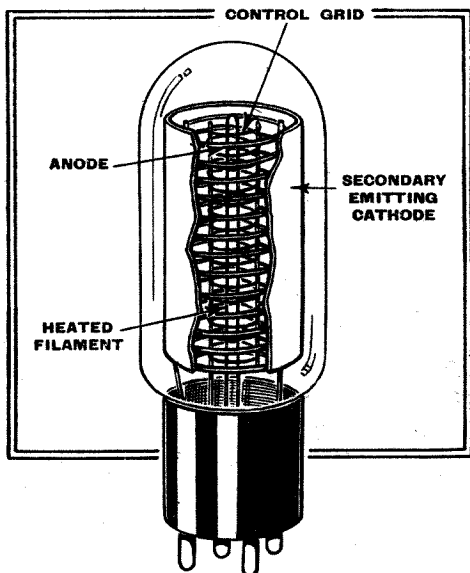


Fig. 4.—Typical thermionic multiplier combining thermionic action with electron multiplication.

trons from flying clear across the tube, resulting in improved performance, especially for radio-frequency amplification.

If the HF voltage used on the multipliers is obtained from the action of the tube itself, the result is a self-sustaining oscillator circuit which takes energy from

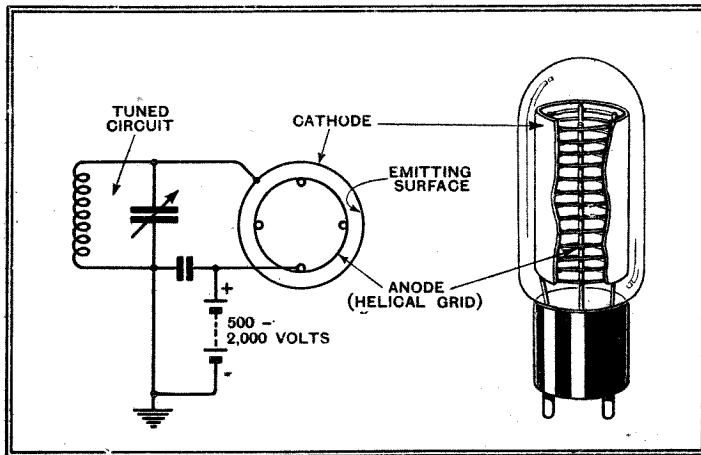


Fig. 3.—Arrangement of electrodes in a practical "multiplier."

the battery in the anode circuit and converts it into radio-frequency energy in a tuned circuit. Such an arrangement is shown in Fig. 3. The initial electron flow needed to "start the ball rolling" is freed by the shock to the tube when the HT battery is suddenly connected across it. Thereafter, the flow of electrons across the tube is so timed that it gives energy to the tuned circuit, and, as a result, oscillations are sustained. Frequencies from as low as 100 kc/s to as high as 300 mc/s have been produced by this method. In the demonstration before the Institute of Radio Engineers a one-tube transmitter, consisting of a multiplier, a single tuned circuit and a HT power supply, was used to transmit music on a carrier frequency of about 10 mc/s. The modulation was obtained from a gramophone record, the modulation voltage being applied in the anode circuit. The power output of the tube thus connected was about 25 watts. Such multiplier oscillators can be crystal controlled, giving all of the desirable frequency stability available in this system, and at the same time can deliver very great amounts of power. The frequency is controlled either in the tuned circuit or by means of a previous driving stage.

The second practical application of the multiplier tube demonstrated by Mr. Farnsworth was its use as a radio-frequency amplifier. When so used, the output HF current from the tube must be

proportional to the input electrons, which means that some means of controlling the input electrons must be provided. Two schemes are available for doing this. The multiplier may be made in two stages (both inside a single glass envelope), the first stage supplying the input electrons to the second. A diagram of such a double tube is shown in Fig. 5. The other system—making use of a more conventional method—uses a heated filament surrounded by a grid (Fig. 4). The input radio-frequency energy is applied between the grid and filament, resulting in a flow of electrons having the same frequency as the input, in a manner exactly analogous to that of the thermionic triode valve. The electrons flowing through the grid strike the surrounding cathode of the multiplier, which then proceeds to amplify the current by electron multiplication, finally delivering the amplified radio-frequency energy to the tuned circuit connected to it. From this tuned circuit the energy may be fed to the aerial or wherever else needed. Such HF amplifiers display efficiencies of from 60 to 90 per cent.

**Future Possibilities**

The high efficiency and high-power output available with the new multiplier tubes indicate that they may become serious competitors to the now universally used thermionic triodes. This statement applies especially to the production of radio power at ultra-high frequencies, where it seems certain that the electron multiplier has many advantages over the thermionic valve. The multiplier is

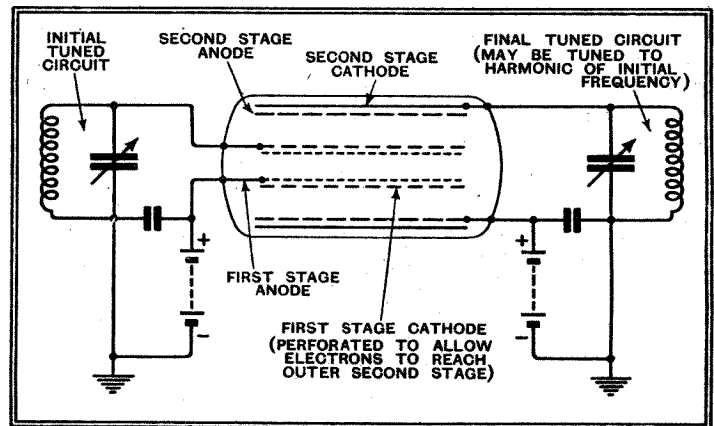


Fig. 5.—Farnsworth tube used as an HF amplifier.

essentially an electronic oscillator, in the same sense that the Barkhausen and magnetron tubes are. It depends for its frequency of oscillation on the transit time of the electrons flying across it, and since this time can be made very small by high voltages and small spacings the upper frequency may be higher than 1,000 megacycles.

The importance of the new tubes in television transmission cannot be overlooked. Not only do they supply power at the required high frequencies, but they are capable of passing the very wide band of

**New Electron Multipliers—**

frequencies made necessary by high definition visual transmission without attenuation.

It seems likely, also, that the electron multiplier principle will be applied to everyday amplification problems, with gratifying results. A single multiplier tube can be made to have a mutual conductance measured in amperes per volt rather than in the microamperes per volt of typical thermionic valves. Likewise frequency conversion, as used in super-heterodynes, can be accomplished by the same multiplication principle, providing conversion gains of 10,000 in a single stage and thus eliminating the necessity for IF amplification. Also, because the output of multipactor tubes can be made very rich in harmonics, a single tube may use a low-frequency crystal control and still supply large amounts of high-frequency power in the output.

The prospect of such revolutionary developments is not immediate, because there are many difficulties in the manufacture and practical application of the tubes to be cleared up first. The preparation of the electron-multiplying surface, on which the characteristics of each tube depend, must be carried out with great care to prevent variations; and such factors as length of life and other service requirements must be established. But there seems to be no doubt that the electron multiplication principles, as exemplified by both the Zworykin and Farnsworth developments, can be expected to take the place of the valves now used in many important applications, particularly for photo-electric purposes and ultra-high-frequency transmission.

**Foundations of Short Wave Therapy.**

Physics and Technics by Dr. Wolfgang Holzer. Medical Applications by Dr. Eugen Weissenberg. Translated by Justina Wilson, F.R.C.P. (Edin.), and Charles Dewse, B.Sc. Eng. (Lond.). 228 pages, 53 illustrations and 10 tables. (Hutchinson, 34, Paternoster Row, E.C.4. 12s. 6d.)

AS the number of works written in English on this subject is very limited, the translation from the German of "Grundriss der Kurzwellentherapie" is very welcome. The translators have succeeded in producing a very accurate translation, having overcome the many difficulties which must exist when translating a technique, which in this instance is of a pioneer nature, from one language to another.

The book is divided into two parts, Physical and Medical. The lay-out of the former is well proportioned.

Anyone studying this subject would no doubt already possess a knowledge of the fundamental theory of electrical oscillations; nevertheless, some forty pages are devoted to "An Introduction to the Characteristics, Phenomena, and Various Methods of Producing Electrical Oscillations." This survey serves as a very useful refresher to the reader about to study the subject more seriously. A further 60 pages are devoted to "The Action of Electrical Oscillations." This section is particularly well written, as it includes a carefully compiled list of electrical

properties of biological materials; this will prove of great use to the physicist hitherto unacquainted with this class of work. The question of "Energy Absorption" is adequately dealt with.

With a further 40 pages devoted to the technics of "Short Wave Measurements and Therapy," the reader is thus furnished with a very comprehensive introduction to the physical problems. The remainder of the book, some fifty pages, is devoted to the medical applications; this is somewhat comprehensive in its nature, and when read in conjunction with the bibliography which appears at the end of the book it should provide a fairly complete survey of the medical literature on the subject, that is if the reader has access to the various references quoted; but it is anticipated that to the physician or biologist reading this section it may, perhaps, appear disappointing.

**A Faithful Translation**

For instance, this section is entirely void of illustrations. This is no fault of the translators, as the book as a whole is a very faithful translation of the original German work. The original includes a list of suitable German valves with their characteristics.

The translators, very advisably, have also included a list of suitable valves manufactured in this country. As a suggestion it is

thought that it would be less confusing to the reader to have the equivalent sizes of condensers in microfarads instead of centimetres, a system to which many workers in this country are not accustomed. Otherwise the translators are to be congratulated on their effort.

R. W. C.

**The Wireless Engineer**

The principal contents are given below of the April issue of *The Wireless Engineer*.

**The Magnetic Recording of Sound.**

**Variable Selectivity and the I.F. Amplifier.** Part II. By W. T. Cocking.

**The Anode to Accelerating Electrode Space in Thermionic Valves.** By J. H. Owen Harries.

**Voltage Measurements at Very High Frequencies—II (Concluded).** By E. C. S. Megaw, B.Sc., D.I.C.

**Abstracts and References.**—Compiled from the world's wireless journals.

**Some Recent Patents.**

**Operadio.**—The equipment for PA announced under this name in our issue of March 20th (p. 16, Adverts.) was incorrectly described as "18 watt Power Amplifier" and "18in. Electrodynamic Speaker." This description should read "One 8 watt Power Amplifier" and "One 8in. Electrodynamic Speaker."

**A New Binaural Deaf Aid**  
**Independent Listening Channels for Each Ear**

EXCELLENT as is the performance of the modern single-microphone deaf aid from the point of view of quality of reproduction, there must inevitably be something missing by comparison with ordinary listening where there are minute differences of intensity and phase at the two ears.

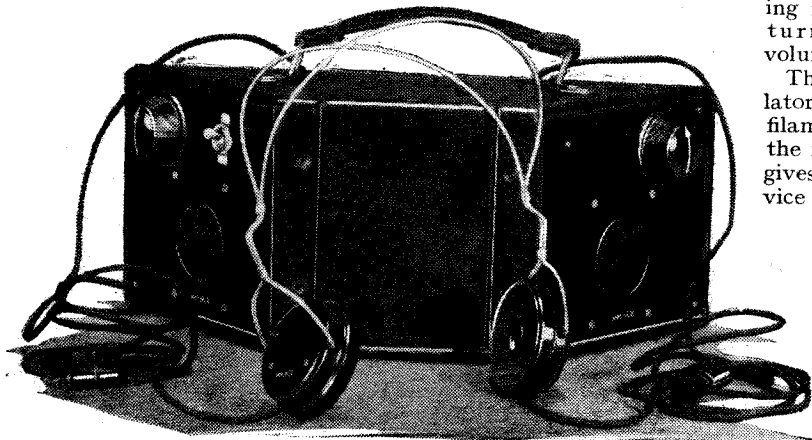
To simulate the conditions of normal binaural hearing, Amplivox, Ltd., 106, George Street, London, W.1, have developed a deaf aid in which entirely separate microphone-amplifier-earphone channels are provided for each ear. Each amplifier consists of three stages, and the microphones are of the piezo-electric type. These are provided with independent volume controls and are disposed on opposite panels of a case measuring less than 12 x 3½ x 4½ inches. The

fewer, than six valves and their associated components, the reduction of the overall dimensions to the figures given must be regarded as no mean achievement.

We have had an opportunity of testing this instrument under a variety of conditions and there can be little doubt that it marks a distinct advance over ordinary "monaural" deaf aids. The directional effect at distances up to five or six feet is most striking, and it is easy for a person blindfolded to point to the exact position occupied by a speaker as he moves about the room.

The directional properties of the instrument do not, however, exhaust its virtues. There is less confusion from room reverberations with binaural listening and a general improvement in naturalness. This is easily proved by starting with one earpiece only and then bringing in the other by turning up the volume control.

The 2-volt accumulator supplying the filament current to the miniature valves gives 20 hours' service on a charge, and



Amplivox binaural deaf aid. Separate microphones and amplifiers are associated with each earpiece.

HT and LT batteries are housed in a central compartment, and when it is realised that space must be found in addition for no

the HT battery life is of the order of two months. We understand that the price of the complete instrument is 30 guineas.



# Set-Making at Hayes

## A TOUR OF THE "HIS MASTER'S VOICE" FACTORY

**C**LAIMED to be the largest of their kind in Europe, the "His Master's Voice" factories at Hayes, Middlesex, cover more than sixty acres. With the exception of valves, every part of an "H.M.V." radiogramophone or radio receiver is made in these factories.

We begin a tour of the works by entering a store wherein can be found no fewer than 1,000 tons of raw material—including

chassis blank goes under a 500-ton press and comes out with all its holes neatly cut out.

On the way out from the deafening noise of the Press Shop one comes across a machine making a completely shaped valve leg in one single punch. It is fed with a coil of nickel silver, and in a day of ten working hours produces a quarter of a million legs.

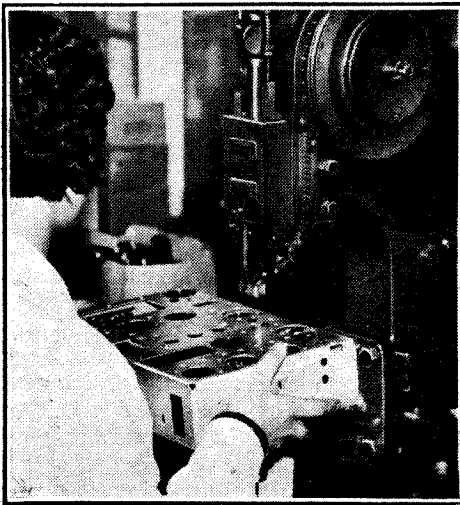
Meanwhile, in the Screw Department machines are making bolts for the chassis from the initial rod metal. A heading plant industriously churns out 7,800 heads for the short lengths of rod that will eventually become bolts. At the same speed other machines successively slot the heads and put on the thread.

In another factory it is possible to see how all these parts from the preliminary unit gradually assume the shape of things to come. Naturally, the first stage is the perforation of the bare chassis to take the various components. The cadmium-plated chassis emerges from the automatic plating process room ready to be bushed and fitted with various small bakelite panels.

All the top deck of the chassis is fitted in these early stages.

the intermediate frequency, ganging and tracking of the main gang condenser unit, as well as exhaustive tests for such effects as images, sensitivity, selectivity, automatic volume control, fidelity and top note cut-off.

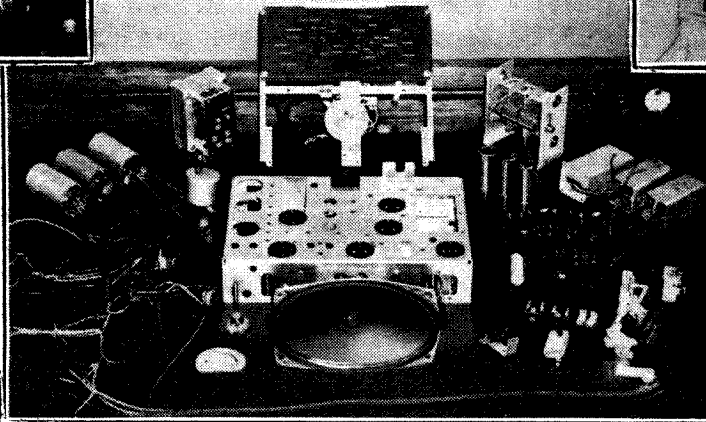
Finally, the set's scale has still to be calibrated under a studio test, this being done not only with local oscillators but on actual local station reception. The tester puts



This riveting machine fixes valve holders to the chassis.

nearly every known type of metal—iron, copper, brass, and, of course, steel.

The first stage in the transition of the material from its raw—but thoroughly tested—state to its appointed place in the final receiver occurs in the



All present and correct! Components of a "Station Selector Ray" receiver ready for assembly.

Between thirty and forty operators share the work between them of fixing coil cans and gang condensers, a specific process being allotted to each operative. At this time, too, the cable form with its coded colour leads is dropped into place underneath the chassis.

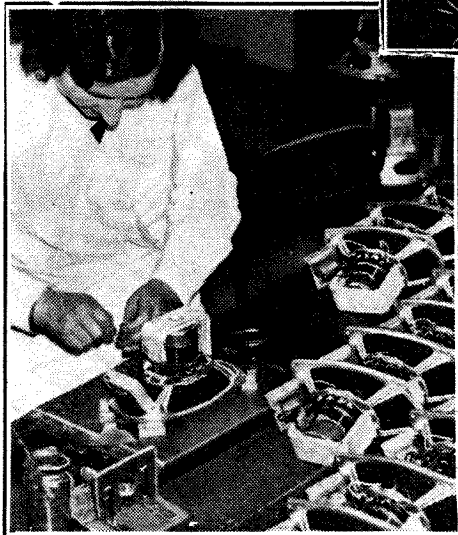
The chassis is now taking shape, passing on to the continuously moving line where the soldering girls are waiting to connect up a certain number of leads. Gradually all the small tubular condensers are wired into the chassis, which then emerges, wired up and ready for its first test. Each chassis is put on the M.C. (main continuity) tester for a general check-over of the wiring. No valves are used at this stage, equivalent impedances being inserted in all the valve circuits. This tester, which is worth an article on its own, is an ingenious arrangement whereby the whole circuit is successively explored by switching the single main meter to each part as needed.

Now follow tests for hum, ganging of



Most of the chassis wiring is carried out on jigs on which colour-plans of the wiring are painted.

himself in the place of the eventual buyer of the set, critically trying all the knobs to see they are properly screwed on and generally giving it a last look-over.



Final adjustments to wide angle loud speakers.

Press Shop. Here, during normal production times, a million piece parts are produced per day. A 1,000-ton press comes down on the tool that "bangs out" the turntables for radiogramophones. The



The final studio test is carried out on local oscillations and actual broadcasts. Note the special cardboard container to prevent damage to the polished receiver.

Nothing has been said of the cabinet factory, where the sets undergo spraying, shellacing, cellulosing and polishing.

# Listeners' Guide for the

## Outstanding Broadcasts at Home



**"YOUTH AT THE HELM."** Owen Nares and Adele Dixon in one of many bright moments in the Globe Theatre production of the comedy by Paul Vulpius which is to be broadcast on Monday at 8.15 (Nat.) and Tuesday at 7.15 (Reg.). Jack Melford will take the part of Ralph Warrender and Ann Trevor will be the typist.

**CUT** out all music and tomorrow would still be a bright Saturday from a broadcasting point of view. At 11.15 a.m. a running commentary on the Oxford and Cambridge Boat Race will be broadcast, the commentator following the race as usual on the launch "Magician," on which it is hoped this year to install a receiver so that the launch crew can listen to their own efforts instead of having to rely on hand signals from the roof of Harrod's Depository, Hammersmith.

At 2.50 p.m. "Soccer" fans, and not a few ordinary folk, will tune in to the National programme for the match between England and Scotland at Wembley. George Allison, the commentator, will give a summary of the game at half-time and a commentary on the second half. England and Scotland have met on 59 occasions. Scotland has won 27 games and England 18, the rest being drawn.

At 4.25 there will be a commentary, with genuine "sound

effects," on the British Empire Trophy Amateur Race at Donington Park, Derbyshire, the commentators being F. J. Findon and W. Graham Walker.

### PICTURE-INSPIRED SYMPHONY

A FAMOUS altar-piece, painted by Matthias Grünewald, in the Colmar Museum, Alsace, inspired Hindemith's symphony, "Mathis der Maler," which the B.B.C. Orchestra is playing in the Orchestral Concert at 9.20 on Sunday under the conductorship of Adrian Boult.

This altar piece, which dates from 1509, has nine painted panels which are considered to be among the greatest in medieval religious art.

### CONQUERING THE AIR

THE "Conquest of the Air" talks have aroused tremendous interest among listeners, and it is fitting that the eighth and last programme, to be given at 10 on Tuesday (Nat.), is to comprise sound records made

by distinguished experts in aviation from all parts of the world. It is hoped that there will be speakers from Russia, France, Germany and the United States. M. Pierre Cot, many times French Air Minister, will contribute. We shall also hear Sir Francis Sheldermine, Director of Civil Aviation; Captain Lehmann, in charge of Germany's new Zeppelin; Admiral Byrd, the Antarctic explorer; and probably M. Kokkinaki, holder of the Soviet altitude record for an ordinary aeroplane without oxygen apparatus.

### WORDS FIRST, MUSIC SECOND

ARE the words more important than the music of a song? Bruce Sievier's "Words—With Music" programmes suggest that they are. The underlying idea of these short presentations—the next one is on Wednesday at 10 (Nat.)—is to concentrate on the lyrical content of the songs chosen. Mr. Sievier chooses works by one dead composer and two living composers, and himself relates the history behind the lyrics.

Next week's fare: "Love's Old Sweet Song," "In Old Madrid," and "Love, Could I Only Tell Thee."

### A PLAY ABOUT BLUFF

THAT delicious satire on modern business methods, "Youth at the Helm," is the main programme feature in next week's programmes. The play, which is adapted by Hubert Griffith from the German comedy by Paul Vulpius, had a successful run at the Globe Theatre a year ago. Owen Nares was in the leading part of a young man who, as a complete stranger, walks into the "Metropolitan Bank" and by sheer bluff dominates the Board of Directors and negotiates loans which set the wheels of industry turning. The part of the young man, Randolph Warrender, will be taken by Jack Melford in the broadcast version; and the part of that charming distraction, Dorothy Wilson, the typist, will be taken by Ann Trevor (Monday, Nat., 8.15; Tuesday, Reg., 7.15).

### MAUNDY THURSDAY

PRIOR to Good Friday the most notable religious feature of Holy Week is the Maundy Thursday programme, entitled "The Passion of Jesus Christ," written by Ellis Roberts, which will be produced on much the same lines as his successful Christmas programme, "Unto Us." It will be of a strictly devotional character, and the cast will include Robert Speaight, Felix Aylmer and Karen Stanley-Alder.

### "LAW AND THE CITIZEN"

ALTHOUGH next Wednesday's National lecture is the seventeenth of the series it will be the first not given from a broadcasting studio or in private, for on this occasion Lord Macmillan will be delivering his lecture, "Law and the Citizen," to the Royal Philosophical Society at Glasgow, and it will be broadcast on the National wavelengths (8.15).

The National lecture broadcasts were inaugurated in 1928 when the late Poet Laureate, Dr. Robert Bridges, delivered the first on "Poetry" on February 28th of that year.

### MAN IN THE STREET

WHO is the "Man in the Street"? Many have been the



By courtesy of the "Daily Express."

**SPICE OF LIFE.** Next Sunday's talk in this interesting series is to be given by The-Man-in-the-Street, who is often known by his other name: Strube's Little Man. (Reg. 9.)

# Week and Abroad

## HIGHLIGHTS OF THE WEEK

### FRIDAY, APRIL 3rd.

Nat., 8.40, "The Crimes of Burke and Hare." 10.20, B.B.C. Contemporary Music Concert.

Reg., 8.30, B.B.C. Orchestra. 9.30, Fred Hartley and Novelty Quintet. 10.30, Lou Preager and his Band.

#### Abroad.

Stuttgart, 7.10, International Music Festival from Baden-Baden.

### SATURDAY, APRIL 4th.

Nat., 11.30 a.m., Oxford v. Cambridge Boat Race. 8.30, Variety, ♪Le Stone and his Band.

Reg., Bernard Crook Quintet. 9.30, Medvedeff's Balalaika Orchestra.

#### Abroad.

Hilversum (II), 7.55, Excerpts from "Boris Godunov" (Mussorgsky).

### SUNDAY, APRIL 5th.

Nat., B.B.C. Empire Orchestra. 7.20, Pianoforte Recital by Harriet Cohen. ♪Old Ballad Concert (B.B.C. Theatre Orchestra).

Reg., Celebrity Trio. 9, "The Spice of Life," by "The Man in the Street." ♪Adrian Boult conducting Sunday Orchestral Concert.

#### Abroad.

Vienna, 9.20, New Benatsky Musical Comedy: "The Richest Man in the World."

### MONDAY, APRIL 6th.

Nat., 8.15, "Youth at the Helm." ♪World Affairs. ♪"The Little Show."

Reg., 8, The Story of the Calliope. ♪B.B.C. Dance Orchestra. ♪Les Allen and his Canadian Bachelors.

#### Abroad.

Kalundborg, 7.45, Slav Orchestral Music.

### TUESDAY, APRIL 7th.

Nat., 7.30, Uncensored Debate on Films. ♪Violin Recital by Carl Flesch. ♪"Conquest of the Air."

Reg., 7.15, "Youth at the Helm." ♪B.B.C. Dance Orchestra.

#### Abroad.

Berlin (Funkstunde), 7.10, Schubert Festival.

### WEDNESDAY, APRIL 8th.

Nat., Geraldo's Tango Orchestra. 8.15, National Lecture by Lord Macmillan. ♪"Words—with Music."

Reg., Leslie Bridgewater's Quintet. 8.15, "The Fol-de-Rols." ♪B.B.C.'s Military Band.

#### Abroad.

Toulouse, 9.10, Operetta: "Les Noces de Jeannette" (Masse).

### THURSDAY, APRIL 9th.

Nat., Carroll Gibbons and his Band. 8.40, Maundy Thursday Programme: "The Passion of Jesus Christ."

Reg., B.B.C. Northern Orchestra. 8.40, Radio Play: "My Lady Frayle." ♪Roy Fox and his Band.

#### Abroad.

Radio-Paris, 8.30, Sacred Concert by French National Orchestra and Raugel Choir.

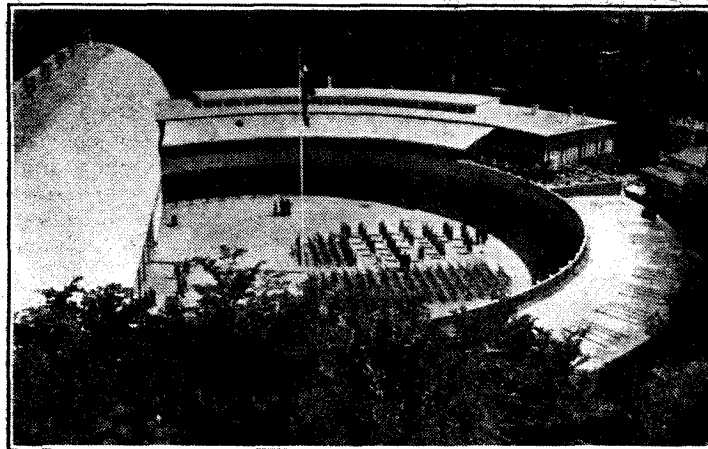
attempts to run this elusive creature to earth, and at last the B.B.C. claim to have been successful, for none other than he is scheduled to speak on "The Spice of Life" at 9 on Sunday (Reg.).

Usually "The Man in the Street" is not supposed to extract much spice from life: all allusions to him suggest the drabest of existences, but there may be revelations in store for us on Sunday.

### "FIRST NIGHT" VIA ETHER

LISTENERS who enjoyed "White Horse Inn" at the London Coliseum two years ago will need no coaxing to tune in a new musical comedy by the same composer, Benatsky, entitled "The Richest Man in the World," part of which Vienna is relaying at 9.20 on Sunday night.

The only other light opera events of note are two Lehar items, "Frederica" at 8.45 to-night (Friday) from Radio-Paris and "Wiener Frauen" at 6.30 to-morrow from the same station.

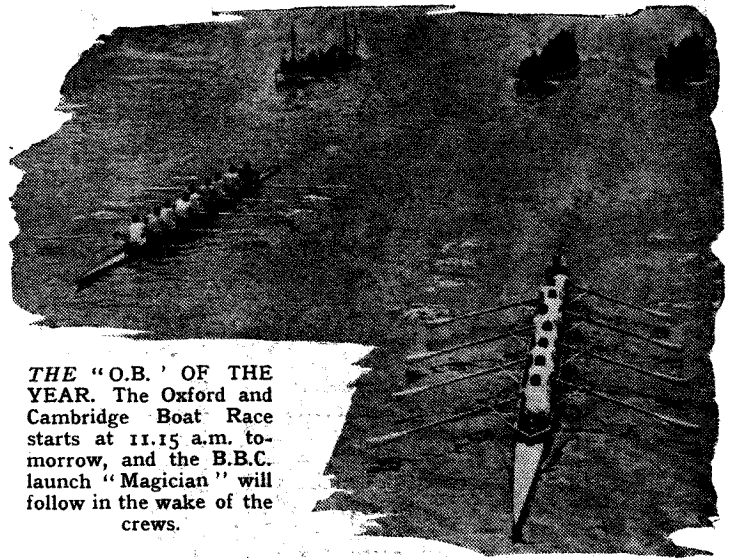


MUSIC IN THE OPEN. The Aalborg Open Air auditorium from which the Aalborg Symphony Orchestra will broadcast a concert via Kalundborg from 1.50 to 3.50 on Monday.

### PUCCINI FESTIVAL NIGHT

CERTAIN of the shorter operas are almost invariably performed together, and this is the case with that interesting Puccini triptych, "Il Tabarro" "Suor Angelica," and "Gianni Schicchi," which Milan is relaying from the Royal Opera, Rome, to-night at 7.35. The first of these one-act operas is tragic to the point of melodrama, the second has a mystic subject, and the third is pure comedy. The contrasts are extremely effective, "Gianni Schicchi" in particular delighting even those listeners who find little to praise in Puccini's other works.

For the unconverted there



THE "O.B." OF THE YEAR. The Oxford and Cambridge Boat Race starts at 11.15 a.m. to-morrow, and the B.B.C. launch "Magician" will follow in the wake of the crews.

is a happy operatic alternative to-night in Verdi's "Il Trovatore" which Munich is relaying from the National Theatre at 6.35. Verdi is also "on the air" on Sunday afternoon, Hamburg giving electrical records of "The Masked Ball" at 4.30.

Other operatic high-lights next week are Warsaw's per-

boxing championships from Cologne at 9.30 on Sunday.

### LOVE IN FOURTEEN LANGUAGES

TWO Scottish folk songs will be included in an interesting programme which Leipzig is giving at 7.10 on Sunday evening entitled "Melody of Love." It will consist of the love songs of fourteen different European countries, each of which may be regarded as an index to the national character.

### STRAUSS IN PERSON

RICHARD STRAUSS, the famous German composer, will himself conduct the performance of his "Till Eulenspiegel's Merry Pranks" in the Cologne studio at 8.40 on Monday.

### ALL RUSSIAN

DENMARK goes "All Russian" on Thursday, the whole evening being devoted to Russian literature and music. The festival begins at 5.20 with a lecture on Russian literature, followed at 7 by Russian pianoforte music, and at 7.20 by Tchekov's "Three Sisters." At 9.15 there will be recordings of Russian music, and at 9.30 till 10.5 Russian songs and balalaika melodies.

### MUSICAL CONGLOMERATION

"MIXTUM COMPOSITUM" is the queer title of a queer programme which Oslo offers to-morrow night (Saturday) at 7. Actually it will be a potpourri of every type of music from the Chamber variety to cuttings from the film, "Broadway Melody of 1936." This is a challenge to the strongest musical digestion.

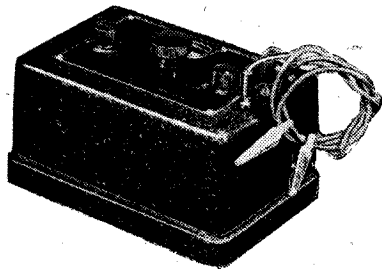
THE AUDITOR.

# New Apparatus Reviewed

## NEW AVO OSCILLATOR

OF the many interesting features of the new Avo Oscillator made by The Automatic Coil Winder and Electrical Equipment Co., Ltd., one that will appeal as much as any to the service engineer is its very small size, for it measures only 6 x 4 x 3 in. overall. Yet it is entirely self-contained and comprises a single-valve HF oscillator covering medium, long and IF wavelengths using the fundamental frequencies only, while provision is made for modulating the output when required. The one valve, a Hivac midget triode, serves both purposes. It contains dry-cell LT and HT batteries, 3 volts for the former and 12 volts for the latter.

Coils with variable iron cores are employed, and the cores are adjusted during the calibration of the oscillator to give exact agreement with the engraved scales, which are graduated in kc/s.



New Avo modulated test oscillator.

The frequency bands covered by the unit are 1,600 to 500 kc/s and 280 to 100 kc/s respectively, the equivalent in wavelengths being 188 to 600 metres and 1,071 to 2,998 metres.

Whilst fundamental frequencies only are employed on these ranges, harmonics of the medium wave-range can be utilised to provide short-wave signals for testing on the lower wave-bands of all-wave sets.

The 100/110 kc/s superhet intermediate frequencies are included in the long-wave range, so is the 500 kc/s one, but a 465 kc/s signal can be obtained from a harmonic of 232.5 kc/s in the long-wave range.

The output is controlled by a variable attenuator, not calibrated, while the signal can be injected into the receiver direct or via a built-in dummy aerial. There are three output sockets, the outer two are used with the dummy aerial and the middle and earth one when it is not required.

A screened output lead fitted with crocodile-type clips is supplied. With the attenuator is ganged the on-off switch. There is one other switch which in one position gives a pure HF output, and in the other a modulated output. Medium- and long-wave switching is duplicated on both HF and modulated positions of this switch for convenience in operation.

We can find no fault with the frequency calibration, and compared with standard instruments very close agreement was found at all parts of the scale. Although quite small dry batteries are fitted, the current taken is so small that replacements will be

## Recent Products of the Manufacturers

needed only at long intervals. For example, the HT consumption is a shade less than 0.3 mA.

This model costs £5 10s., and at this price represents very good value for money.

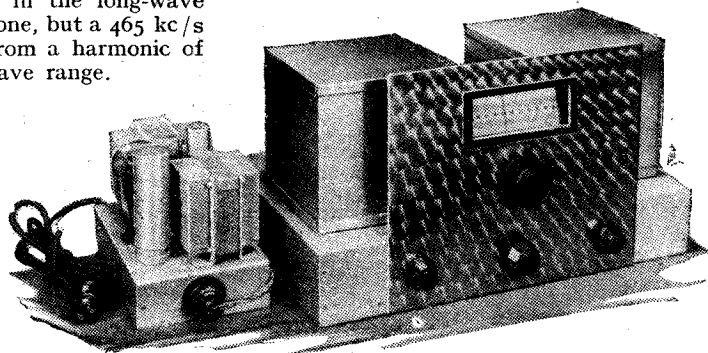
### IMPERIAL SHORT-WAVE SIX

BRITISH TELEVISION SUPPLIES, Ltd., who have been supplying kits of parts for the Imperial Short-Wave Six since its introduction, are now prepared to construct, adjust, test and deliver the set ready for use. Coincident with this decision, they submitted to us a receiver complete with AC power pack for examination and test.

In all essentials the B.T.S. model complies with our original specification, for the fact that some of the components are of different make is of no consequence whatsoever, as their characteristics are identical.

Assembly and wiring are both very well executed, and we have nothing but praise for the adjustment and lining up of the circuits. Its performance could not be improved by any readjustment on our part.

Reporting on its performance is an exceedingly delicate matter, since it is a *Wireless World* design, but perhaps it may be permissible to say that for several days short-wave programmes from America were received as early as 12.30 p.m. on wavelengths below 20 metres, the principal station heard being W8XK on 13.92 metres. That the shorter of the short-waves were particularly good during the period of our tests is apparent by the excellent reception of other U.S.A. stations in this region during daylight. Needless to say, all the principal European short-wave transmitters have been tuned in at different times, and the performance of the set is fully up to expectation.



The Imperial Short-Wave Six constructed by British Television Supplies.

The price of the receiver complete with power pack and valves but less cabinet is £25 10s.

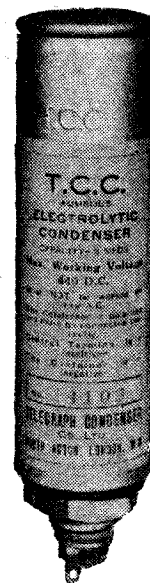
### T.C.C. WET ELECTROLYTIC CONDENSERS

THERE is one feature of the wet-type electrolytic condenser that hitherto has not been given the prominence it would seem to deserve, and that is its ability to act as a voltage regulator in AC receivers. This is rendered possible by the fact that the wet type is virtually indestructible, and voltages much in excess of the working

value only result in internal flash over and the passing of relatively heavy currents until the valves in the set take the load and bring the voltage down to the normal working value.

The condenser is not damaged by use in this manner, and it serves as a

Improved T.C.C. aqueous-type 8-mfd. electrolytic condenser rated for 440 volts DC working.



safeguard to other condensers in the set, possibly not rated to withstand the initial peak voltages present between the time of switching on and the time when the valves take their full load current from the mains rectifier.

The Telegraph Condenser Co., Ltd., not only condone, but recommend, the use of their wet-type electrolytic condenser for use in this manner, and it is also understood that several improvements have been made recently in the design.

The latest models, which are ostensibly the same in appearance as the earlier style, have a much-improved power factor, though the prices remain as hitherto. They are described as the Aqueous type, and are made for normal working potentials of 440, 460 and 500 volts DC. The 440-volt models, Type 802, are available in 4-, 8- and 16-mfd. sizes, their prices being 5s., 6s. and 7s. respectively.

## The Radio Industry

A WELL-PREPARED catalogue dealing with power transformers of all kinds has just been issued by London Transformer Products, Ltd., L.T.P. Works., Cobbold Estate, Willesden, London, N.W.10. The series is exceptionally varied and includes types for medical and cinema purposes, in addition to chokes and such specialised products as *Wireless World* multi-ratio output transformers.

The latest Mullard Valve, Type PM22D, is a high-sensitivity pentode for battery sets.

G.E.C. public address equipment is to be installed by the Southern Railway at Waterloo, Portsmouth and Bournemouth stations. The G.E.C. has also supplied a special receiver for use in relaying programmes by the new Palestine station.

A catalogue describing Clix wall plugs and adaptors, etc., as used in connection with mains receivers, is now available from Lectro Linx, Ltd., 79a, Rochester Row, Westminster, London, S.W.1.

As in previous years, Exide batteries are to be used for the broadcast commentary on tomorrow's Boat Race.

Control of the vast crowds gathered at Southampton Docks for the arrival of the *Queen Mary* was carried out through Marconiphone public address equipment.

# Why Not Frame Aerials?

By "CATHODE RAY"

## BACKGROUND NOISE THE DECIDING FACTOR

ONE gets into the way of thinking that the latest invention in any particular field is an advance on what came before. Wireless telephony, in the general view, is an improvement on line telephony. Yet if the order in which they were made available had been reversed, line telephony would certainly have been regarded as a great and valuable improvement upon the wireless telephony.

It is much the same with frame aerials. Once upon a time, when broadcasting was very new, nearly everybody who wanted to listen had to erect an aerial in the garden. There was a great trade in steel masts, flag staves, and builders' poles. Later, the portable set came, with a built-in frame aerial, and took Britain by storm. In 1928 it was almost as difficult to sell a set requiring an external aerial as a car with acetylene lamps. Then, just when everybody was thoroughly "aerial-less" minded, some people started connecting outdoor aerials to self-contained receivers and discovered that

the range was enormously increased, and the background noise (they were all- mains sets by then) greatly diminished. Eureka! A great discovery! And since then the open aerial has almost entirely displaced the frame variety.

Now that the emphasis, more than ever, is on an impeccable exterior, with no loose parts or trailing wires to introduce a discordant note into the furnishing plan, it seems a monstrously retrograde step to reintroduce aerial and earth leads! The importance attached to self-containedness is certainly not less than it was eight years ago. And now that even cheap receivers are so sensitive, the lower catchment of the frame is not the drawback it once was. Further, the constantly increasing number of stations makes the possibility of cutting out interference by means of a frame aerial still more attractive. There must, therefore, be objections to the frame aerial now that are substantial enough to outweigh even these augmented arguments for retaining it.

It is true that the frame provides the

listener with an extra weapon against interference from other stations. However selective an "open aerial" receiver may be, it cannot possibly cut out interference on the same wavelength as the wanted station. But if the directions from which the two transmissions are arriving at a frame aerial set make a reasonably large angle, it is possible to separate them by turning the frame around so that it is broadside on to the interfering station. It may not then be actually pointing at the wanted station

—which would be the best position to have it—but it is only within, say, plus or minus 30 degrees off the broadside position that reception falls off really badly. (Fig. 1.)

There are several reasons why this scheme is not so useful as it may appear. To be really effective as an interference excluder a frame aerial has to be much more carefully balanced electrically than the average broadcast receiver can manage. Then here, on the edge of Europe, there is an unhappily large probability that the interference is

coming from nearly the same direction as the wanted programme. Moreover, the direction which is best for receiving most stations is usually quite an inconvenient one in which to make a habit of placing the receiver in the room. And if stations are spaced around in different directions the frame aerial becomes a bit of a nuisance when one does not happen to want to cut any of them out.

So in the end this directional business may be more bother than it is worth.

### The Designer's Bugbear

Even the matter of external appearance is one with regard to which the frame, although clearing away the outside wires, introduces problems of its own. To be reasonably efficient as a collector it is bound to be fairly bulky. It is an awkward, uncompromising component for the cabinet designer to enclose along with everything else. He has to be clever if he is not to introduce complications for

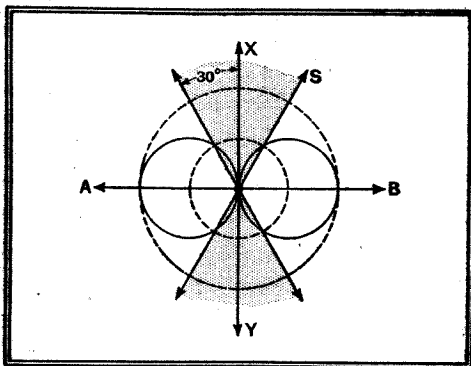


Fig. 1.—The pair of circles in figure-of-eight formation is an angular graph showing relative strength of reception by a perfectly balanced frame aerial standing in the A B line and located at its centre. Reception of transmitters situated in the directions A or B is a maximum, and is zero for those in directions X or Y, but drops below half maximum (as indicated by the inner dotted circle) only within the shaded sectors of  $\pm 30^\circ$ . Therefore a station S may be completely relieved of interference from another X, only  $30^\circ$  apart, without serious weakening of S. (The modern receiver will compensate for variations in received strength in proportions of hundreds to one.)

the service engineer as regards dismantling the set. The modern all-metal chassis introduces yet another thorn into the problem; the radio designer will have a lot to say if anybody proposes to situate the chassis close along the wires forming the frame aerial. And he is generally not too thrilled to find it right inside the frame.

### In the Den of Lions

When all has been done that can be done, the frame is wretched as an aerial. Even the meanest piece of wire around the room or over the window-sill can beat it as a collector. And while it is true that the greatly enhanced sensitivity of modern receivers renders them less dependent on how much the aerial hands to them, that is only one side of the story, and the less important side at that. While the frame is (normally) indoors, more or less screened by the walls from the programme waves without, it is right in the den of lions so far as the rapidly increasing brood of electrical machine noises are concerned (Fig. 2). Even when they do not actually originate within (as interference from vacuum cleaners, switches, fans, etc., does), they are likely to be introduced by the house wiring and picked up with great readiness by the frame. Noise is perhaps the most acute modern problem in radio reception.

Another difficulty is sometimes quoted

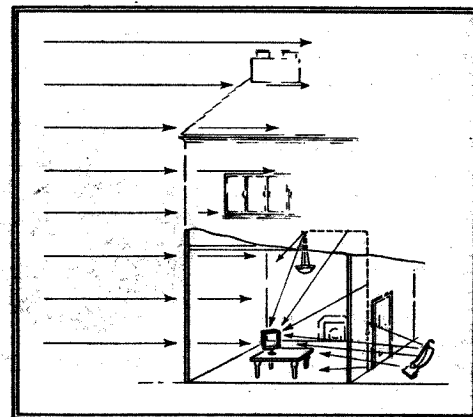


Fig. 2.—The frame aerial indoors picks up very little of the wanted radiation, which is largely kept outside by the exterior walls; but is very susceptible to interference from indoor appliances, or external interference brought in by electric wiring.

against the frame aerial—that involved in matching its tuning to the other circuits so as to allow of effective gang control. But that is the sort of thing that engineers are paid to overcome; and they do it if necessary.

**Why Not Frame Aerials?**

Those comparatively few models that can be bought with frame aerials inside them are not designed by nitwits who are ignorant of the foregoing arguments. The designers have carefully considered the matter and have decided that there are a sufficiently large number of people whose

requirements justify a frame aerial model. There are even now places where electrical noise is slight, where people do not live in steel-framed buildings, and do not want to listen to distant stations most of the time, but where they are anxious to have no more wires about the place than are strictly necessary.

# Below 100 Metres

UNTIL about Sunday, March 22nd, there had been considerable visible sunspot activity, and conditions had been continuously very good since February 28th, but for the last few days—that is, from March 22nd until March 24th—only two sunspots have been visible instead of the five to fifteen of the past weeks.

A direct result of this decrease in activity may be seen in the falling-off in performance of the higher frequencies (above 15 mc/s), particularly after nightfall. This effect is more noticeable on some of the broadcasting stations which use relatively simple antennæ (often merely a vertical half-wavelength of copper tube attached to a wooden telegraph pole) than on the commercial telegraph stations, such as those of the R.C.A. and Mackay Companies near New York, which latter use highly developed transmitting arrays.

A number of observers have noted from time to time that, in spite of a maximum power limitation of 1 kW, quite a number of the U.S. amateurs in the 20-metre band put better signals into this country than do some of the U.S. broadcasters in the 19-metre region, and one feels sure that this difference is directly explainable in terms of, or lack of, high-angle radiation.

Those U.S. amateur stations which give the best results here on 20 metres (I am thinking at the present moment mainly of the 'phone transmitters) will probably be found to be equipped with either long-wire harmonic aerials (of the order of  $4\lambda$ ) with a major lobe directional horizontally on England, or to be employing some form of phased horizontal array.

Starting with Wednesday, March 11th, we can now review conditions during the past fortnight. A very good signal this evening at 10.45 p.m. was the Boston transmitter W1XAL on 25.45 metres.

Little or no direct advertising is ever heard through W1XAL, whose broadcasts appear to be mainly of an educational character, and we may add here that educational broadcasts seem to be growing rapidly in popularity in the U.S.A.

Ultra short-wave reception was logged as nil on Saturday. During the afternoon PMA was a very strong signal on 15.51 metres, and at 11 p.m. HJ4ABA, Medellin, was a very good signal on 25.38 metres.

At this time only weak signals were being intercepted from W2XE on 25.36 metres, and W2XE was also being jammed by RTM. This problem of Russian interference in the broadcasting bands is getting quite serious, but presumably little can be done until the Cairo Conference. In the 19-metre band we have interference to FYA and GSI from RIM, Tashkent—a position aggravated by RIM's over-modulation—and in the 25-metre band PHI is troubled by RSV (?) and GSN, and W2XE by RTM. So far, the 31-metre band is clear, but the

49-metre band seems to be in too bad a tangle which I will not try to unravel.

Another source of trouble comes from the key-clicks of stations situated just outside the bands.

A stranger in the shape of CJRX on 25.6 metres was heard fairly well just clear of TPA4 at 11 p.m. Saturday, and W8XK was rather better on 25 than on 19 metres at this time.

Quite passable signals were obtained from W2XE on 13.94 metres at midday on Sunday, and even W2XEN was quite good on 9 metres at 7 p.m. At 9 p.m. for the first time for some weeks W2XAF was completely blotted out by LKJ1!

Early Monday evening, March 16th, both W3XAL and W2XAD were very good, a temporary improvement in conditions, and later, at 11.45 p.m., CJRX was again fair with muffled quality, whilst W2XAF was excellent, and W1XK fairly good.

The Norwegian transmitter LKJ1 again blotted out W2XAF on Tuesday evening, March 17th, and it was noted that silence reigned below 20 metres by 11 p.m., except for that harbinger of spring, the Chilean transmitter CEA on 17.17 metres.

Nairobi VQ7LO was a fair signal on 49.31 metres at 7.30 p.m. on Thursday, and, although bothered by static and interference, the signal was very steady and of very good quality.

At 8 p.m. the half-wave of PPH on 12.6 metres was heard at R9 (PJN was also heard on 12.5 metres at this time on Tuesday), and it was noted that the floods in Pittsburgh had put W8XK off the air on all frequencies. W3XAL had also announced at 1 p.m. that it, too, was leaving the air, but in this case in order to conduct special transmissions.

By Saturday, March 21st, W2XAF had been reduced to a poor-to-fair signal at 10.40 p.m., but PRF5 was noted as rather better than usual, and HJ1ABD was passable on 31.25 metres.

Later, at 11 p.m., our old friend CNR (Rabat) was heard broadcasting Arabic music on 37.33 metres at full loud-speaker strength and quite good quality.

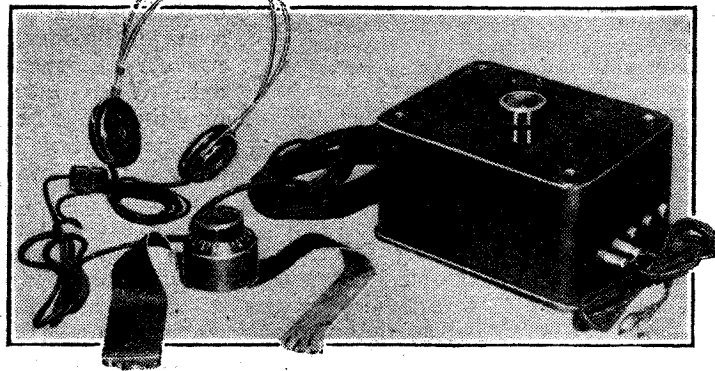
Indications at present are that an improvement in conditions will set in about the end of the month, as it seems unlikely that the sun will be content with a 1934 sunspot performance in 1936, and an increase in activity and the subsequent general improvement in conditions may therefore be expected shortly.

"ETHACOMBER."

## The Multitone "Addaphone"

A Specialised Headphone Attachment

for  
Broadcast  
Receivers



An automatic voltage regulating circuit prevents overloading in the "Addaphone" unit.

THIS unit not only enables a deaf person to listen to broadcasting at a satisfactory volume level without inconveniencing other people, but it also confers the benefits of "unmasked hearing" which is a notable feature of all Multitone deaf-aid devices. Briefly this depends upon the partial separation of the high and low tones, and their application to opposite ears so that the subjective masking effect of high tones by low is reduced.

The instrument is provided with an additional general tone control so that the response may be adjusted to the requirements of the individual. There is also a volume control fitted with a loaded leather strap suitable for use over the arm of a chair.

Probably the most interesting feature of the instrument, however, is the system of automatic volume control. Anyone who has done much headphone listening will have had the disagreeable, if not painful, ex-

perience of accidentally applying inputs which have overstepped the threshold of feeling. In the "Addaphone" this cannot happen as there is an automatic current-limiting device which prevents overloading. This consists of a bridge circuit, one arm of which is formed by the resistance of a flash-lamp bulb. Normally the bridge is out of balance, but as the input is increased the temperature of the filament rises and with it the resistance, so that the bridge approaches a balance and prevents a further increase in the volts applied to the headphones. In practice this scheme works extraordinarily well, and does not introduce distortion over the range of volume used under normal operating conditions.

The input circuit to the instrument is adjustable for matching to high or low impedance extension loud speaker terminals and leads of ample length are provided. The price of the complete instrument is five guineas.

# Five-Metre Field Days

## Notes for the Guidance of Organisers

By Lt-Col. H. ASHLEY SCARLETT, D.S.O.

*AS considerable interest has been shown lately in 5-metre operations with apparatus of a mobile character it is possible that the observations made by the Golders Green and Hendon Radio Scientific Society during last year, and now embodied in this article, may prove useful to other societies.*

**T**HE eccentricities of reception of ultra-high frequencies in an unknown area make it most necessary to reduce the variables to a minima. Reception or non-reception of signals offers quite a large enough field of investigation for the most ambitious. The following points should therefore be given the closest attention by organisers of short-wave field days:—

Watches should be synchronised and a time table of transmissions arranged. It is a good idea to have a signal on view when the station is transmitting.

With new receivers it is worth while at first to test these quite near the transmitter.

Ensure that the frequency to be transmitted is kept constant during the whole period of operations.

Arrange a rendezvous for a general discussion at the close of the meeting, otherwise valuable observations are often entirely lost.

The type of transmitter used at these meetings consisted of a push-pull oscillator mounted in the centre of a half-wave dipole aerial, the whole affixed to the top of a 12ft. pole. The transmitter was modulated by choke control from an amplifier on the ground, and the HT supply of 500 volts obtained from an M.L. converter driven by batteries. The aerial could be pivoted in any direction and arranged as a horizontal or as a vertical dipole.

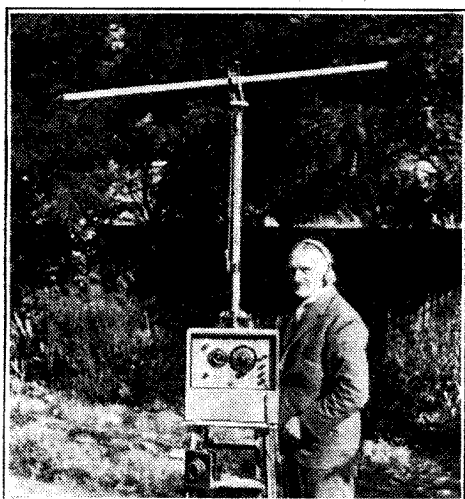


Fig. 1.—A dipole aerial joined direct to a tuned circuit with a remote control was used with this receiver.

A three-valve super-regenerative receiver was used at the transmitting station with a separate half-wave dipole aerial rigged on 10ft. masts and connected to the receiver by a 600-ohm impedance feeder.

Mr. Corfield (5CD) was responsible for the design and construction of the station, which could be erected in ten minutes, and proved most reliable.

The receivers used by the various groups representing the following Radio Societies, Southall, Thames Valley, Northwood and Southgate, were most diverse in circuit design and in construction. Unquestionably the most popular circuit was the super-regenerative type, as this was pro-

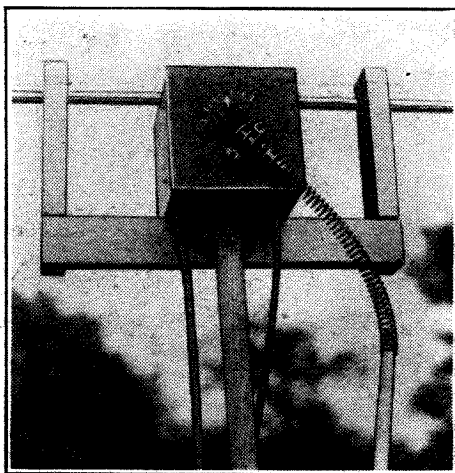


Fig. 2.—In order to avoid the use of feeders the detector circuit was located at the top of the mast and tuned by the remote mechanism shown here.

ductive of easier tuning and greater sensitivity at low cost. A great deal of thought had been given to the design of the aerial arrangements, as will be seen by the illustrations reproduced and briefly described as follows.

The aerial system employed in Fig. 1 consisted of two lengths of copper wire attached for support to oak rods, each 28in. long, and joined between them is a four-turn coil of  $\frac{3}{4}$ in. diameter. This is tuned by an 0.0001 mfd. variable condenser operated by a remote control, the cords of which can be seen in the photograph.



Fig. 3.—A loop of large diameter was used with this receiver, provision being made to orientate it in the vertical and horizontal planes for directional observation.

The dipole can be quickly changed from horizontal to vertical, and orientated for directional reception.

From the coil two  $\frac{1}{8}$ in. brass rods are taken down the inside of a  $1\frac{1}{2}$ in. diameter brass tube and terminated at a small helical coil coupled to the grid circuit of a super-regenerative receiver.

Separate and independently controlled HT supplies for the detector and quench valves are used. A 1,000 c/s filter is incorporated, and this has been found efficacious in reducing background noise when receiving morse signals, the transmitter being modulated by a 1,000 c/s note.

This receiver was constructed and used by Mr. Maurice Child and the author.

### Remote Tuning Control

In order to obviate the use of an aerial feeder the receiver used by Mr. E. J. E. Hubbard, M.I.E.E., the circuit of which was similar to that described in *The Wireless World* last year, was constructed with the tuning circuit and the detector valve in a separate box, hoisted to the top of the pole supporting the aerial rods. Tuning was effected by a thin wooden rod with a flexible coupling, as shown in Fig. 2.

A large loop aerial tuned by a small condenser and with feeders joining it to the receiver at the base of the supporting stand formed the arrangement favoured by Mr. J. C. Emerson, B.Sc., and illustrated in Fig. 3, while a more

**Five-Metre Field Days—**

orthodox dipole system, Fig. 4, mounted on the receiver, was employed by Mr. Stevens, of the Southgate Radio Society, and in Fig. 5 is shown the layout of one of the receivers, the quench coils of which can be seen on the right.

The majority of these sets gave reliable reception at distances up to 40 miles and more in favourable country.

The transmitter was situated on high ground and in very open country near Ivinghoe Beacon. The weather was very

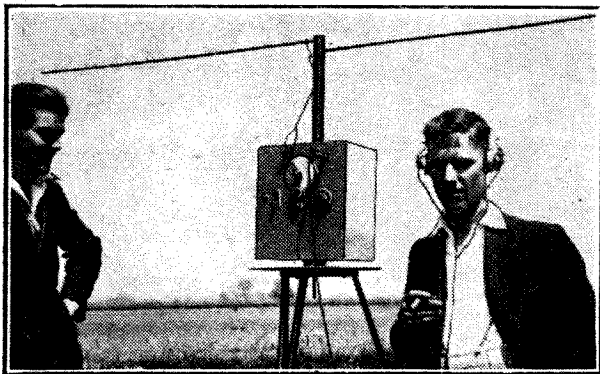


Fig. 4.—A compact portable set with a dipole aerial mounted on top of the case.

sunny and the atmosphere clear and dry. The following general observations were made by the various groups.

After 12 noon signal strength declined, although the transmitter output was constant throughout the day.

A hill at 100 yards distance and 80ft. higher than the transmitter appeared to have no effect on reception at distances of from two to six miles.

Similarly, a range of hills three miles away had no effect on reception at total distances of five to ten miles.

Reception to the north, north-west and south was reported as R6 at distances of 20 miles, but to the east signals were extremely weak at three miles.

The Thames Valley Radio Society group had a car receiver which gave excellent results.

They reported good signals until they entered Fenny Stratford, when signal strength fell off considerably, but on leaving the town and built-up area signals were again received well.

In order to encourage 5-metre work the Golders Green and Hendon Radio Scientific Society are organising meetings on June 21st, July 12th, September 13th, 1936, open to all interested in this aspect of the ultra-short waves. Two field transmitting stations will be erected, and these will work with two or three fixed stations.

Those wishing to join the party are asked to write to Lt.-Col. H. Ashley

Scarlett, D.S.O., 60, Pattison Road, Hampstead, N.W.2, at least two weeks before the day of the meetings, stating whether transport is available or required.

As an introduction to these meetings a

## Random Radiations

### Lisburn

THE new Northern Ireland station at Lisburn seems to be giving a very good account of itself. I haven't yet heard how the anti-fading aerial is working in its own service area, but in my locality, at a range of just about 300 miles, it provides an excellent signal not only after dark but also in daylight hours. It comes in actually nearly as strongly as Midland, though the latter's distance is under 100 miles as the crow flies. The coming of Lisburn increases the number of Regional stations that I can receive with first-rate quality and strength to five: London, West, Midland, Northern and Northern Ireland. Lisburn must cover a great part of these islands, after dark at any rate, and as the Regional pro-

grammes tend to display more individuality it should give many listeners another string to their bow.

Many of us had a shock a few nights after its opening when Lisburn suddenly became silent in the middle of its programme. Luckily there was nothing wrong at the station. The trouble was caused by a failure of the power supply.

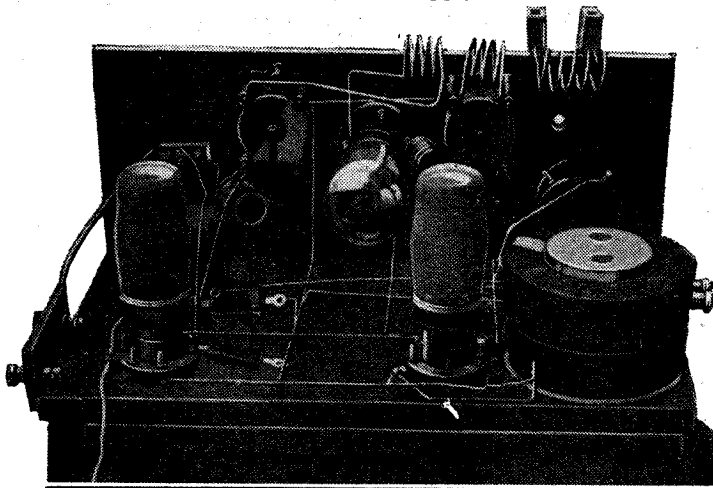


Fig. 5.—Layout of a five-metre super-regenerative receiver, typical of the kind used on these field days.

### The Queen Mary

I WAS listening to the broadcasts first from Clydebank and then from Erskine Ferry of the progress down the river of that wonder ship the *Queen Mary* when Mr. George Blake gave us a picture of all that was happening during the two ten-minute periods that he was allowed. I can't help thinking, though, that the B.B.C. missed a great opportunity in not making more of an event which was of the widest national interest. Surely it could have been arranged for one or more stations to give us reports at, say, half-hour intervals of that amazing journey. It was very disappointing that the first commentary, between 10 and 10.10 a.m., had to come to an end just as the manœuvring of the ship

lecture on 5-metre reception was given by Mr. D. N. Corfield at the Regal Cinema, Finchley Road, N.W.2, on March 25th, a notice of which appeared in *The Wireless World*.

### By "DIALLIST"

out of the fitting-out basin was coming to its most critical moments. One would have liked to hear how they got her across the river and then worked her round until she was pointing downstream. The second commentary at 11.50 was also broken off at a thrilling point; the ship, when it ended, was just about to enter the Bowling bend, the most difficult part of the whole course.

### More Monthly Revues

IT is good to learn that the B.B.C. has had to change its mind about bringing the Monthly Revues to an end. Mr. Eric Maschwitz had thought of giving them a rest for some months, but so great has been the demand from listeners that they should continue that a new series will start again shortly. The B.B.C. has always described them as being of a more sophisticated nature than other entertainments of the kind. I know what they are driving at, but if you care to turn up sophisticate in your dictionary you will find that it means "to spoil the simplicity or purity or naturalness of, to corrupt or adulterate or tamper with." I don't know which, if any, of these processes have been applied to the Monthly Revues! But they are jolly good entertainment in any case. Nelson Keys has appeared, I believe, in every one since they started and I am glad to hear that he is to continue to give his inimitable performances.

### The Finest Invention

THE other day a lay reporter asked that great scientist, Sir William Bragg, what he thought was the finest scientific invention of the past fifty years. He replied without a moment's hesitation, "The thermionic valve." Few will doubt that he is right for the valve has done amazing things for the world. It has enabled wireless to become not only a means of communication but also one of the greatest social and international forces of to-day. It has made long-distance telephony over the land line a completely different thing from what it was but a few years ago. Most of you will remember that any call over a distance of beyond about fifty miles was apt to be faint; but now the repeater, operated by means of valves, makes a call from Land's End to John o' Groats as clear as a local one. Thanks to the valve the submarine cable can be used as well for telephony over great distances and you can now speak with the greatest ease to people in any part of Europe. The short-wave radio-link—due to the valve, again—has made telephony from one side of the world to the other an accomplished fact. Television is another thing that we owe to the valve and in industry nowadays its uses, sometimes in partnership with the photoelectric cell, are legion. There is no saying what the valve may not do for us in the future.



# Current Topics

## Addis Ababa calls "Wireless World"

WAR news from Addis Ababa can now be heard clearly in this country on Sunday evenings, when an English bulletin on 25.09 metres is transmitted from 21.30 to 21.50 G.M.T.

This information was broadcast on Sunday last, coupled with a request for the Editor of *The Wireless World* to publish the times for the benefit of short-wave listeners in this country, from whom reports of reception will be welcomed.

Correspondence addressed to *The Wireless World* and marked "Addis Ababa" will be forwarded to the station.

During the opening bulletin on Sunday the speaker apologised for poor speech quality, stating that an old carbon microphone was being used. The whole bulletin was, however, picked up clearly by Mr. H. G. Dynes, of Chelsfield, Kent, whose report was the first to reach us, and by many other amateurs.

## Japan is Fourth

JAPAN is the fourth country in the world in the matter of receiving licences issued. At the end of December last Japan's total was 2,304,479, closely challenging France with 2,717,387 at the end of January.

## First Radio Taxi

AMERICA recently claimed to have possessed the first radio-equipped taxi, but a strong challenge is issued in the Paris radio Press. It is stated that M. Horace Hurm fitted a taxi with a "Lilliputian" set in 1922. He picked up the Eiffel Tower concerts.

## Growing German Set Market

ONE German radio factory is supplying over 17 per cent. of the entire receiving set market in Europe, excluding Germany, France, and England. This is Telefunken, which announced at a recent Press conference that they were producing over forty different types of receiving set and were conducting export business to most European countries, despite restrictions imposed by Customs' duties and foreign exchange regulations.

In countries where imports from Germany are not possible, Telefunken factories are being erected. There are seven of these—in Italy, Czechoslovakia, Hungary, Austria, Denmark, Latvia, and Poland.

## EVENTS OF THE WEEK IN BRIEF REVIEW

### Amateur Television in Yorkshire

THE Yorkshire Television Association is applying for a licence to erect an ultra-short-wave station at Gildersome, near Leeds, for television experiments.

### World Short-wave Plan

THE Brussels Control Centre of the International Broadcasting Union has been officially empowered to collect short-wave broadcasting data from all over the world. This is the outcome of the recent inter-Continental conference in Paris, when first steps were taken to unify short-wave practice on an international scale.

It is probable that the next year or two may see the formation of a world short-wave plan on the same lines as the Lucerne Plan of Europe.

### Two Road Books

TWO attractive books for road users have just been issued by our publishers. "More Sketches by Casque" will instantly recommend itself to all happy possessors of the first sketch book by S. C. H. Davis, of *The Autocar*. Here, in black and white, we have the startlingly humorous truth about racing, rallies, and trials.

The book, price 2s., is obtainable from all booksellers, stationers, or post free 2s. 3d.

plete guide to the theory and practice of tuning for speed. The price is 2s. 6d. net, or by post 2s. 9d.

### "Radio Marconi"

"RADIO MARCONI," the new broadcasting station which is being erected at Marconi's birthplace, Bologna, is to be officially inaugurated on April 21st.

### A Record

A CORRESPONDENCE record is claimed by the Czecho-slovakian station, Brno, which received no fewer than 12,000 letters following the recent broadcast of an opera in Esperanto, viz., "The Bartered Bride" by Smetana.

### Electric Supply in Birmingham

THE popularity of all-mains sets has no doubt led builders in supply areas to make more general provision for electric lighting in modern houses. The wording of a recent report that the Birmingham Corporation Electricity Dept. was prepared to make special arrangements for the supply of current for radio purposes in houses not already wired is, however, capable of misinterpretation.

We now understand the position to be that an applicant is supplied under statutory terms. Whether the connection is in-



AMPERE STAMP. The anniversary of the death of the great electrical pioneer is to be celebrated at his native Lyons during July. Above is the new commemorative stamp.

should make themselves acquainted with the charges for domestic installations as a whole, together with lighting and power rates.

### "Arabian" Broadcasting

RADIO-MAROC has opened its first Arabian studio in the palace of Dar-si-Said, which is well known to tourists.

### Easter Holidays

THE approach of Easter necessitates slight alterations in our printing schedules. Miscellaneous advertisements intended for the issue of April 17th should be received at this office not later than first post on Thursday, April 9th.

Next week's issue of *The Wireless World* will be on sale on April 9th.

### Ten-minute Politics

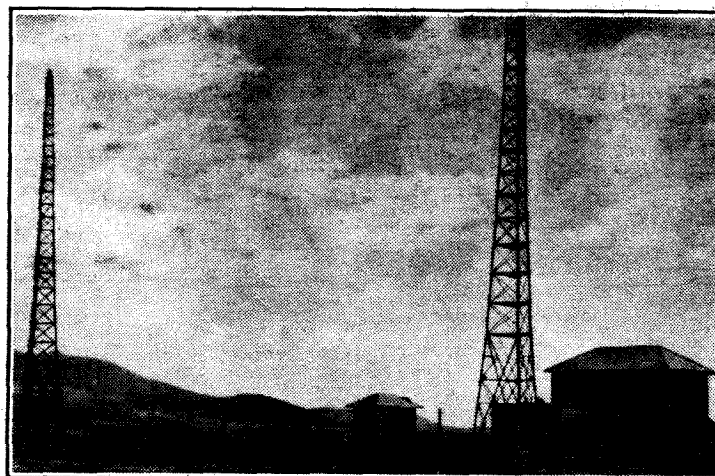
FOLLOWING the example set in Great Britain, France is exerting great care in the allotment of broadcast time to politicians wishing to address the country before the General Elections of April and May next.

M. Mandel, the P.M.G., has arranged for twenty political transmissions of not more than ten minutes' duration.

### "People's Set" : A Misfire

NORWAY'S effort at providing a "People's Receiver" has failed. Four firms submitted tenders for the production of a standard receiver, but all four offers were rejected, partly for price reasons and partly because they did not comply with the technical requirements.

It is understood that a new appeal will be addressed to the industry shortly in an endeavour to emulate the German "Volksempfänger."



Reports of reception from the 3-kW short-wave transmitter at Addis Ababa are invited from readers of *The Wireless World*

from Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

"Speed and How to Obtain It," an invaluable book for the motor cyclist, has reached its fourth edition and is now a com-

tended for lighting or radio or both, the ordinary connection fee, including fixing of meter, etc., is 15s., and there is, therefore, no occasion for a special scheme for a supply of current for radio sets. Local dealers

# BROADCAST BREVITIES

By Our Special  
Correspondent

## Those Women Announcers

TWO months ago I suggested to Mr. Gerald Cock, the B.B.C. Television Chief, that variety would be a boon even in the matter of women television announcers. He readily agreed, and I now understand that two ladies will alternately face the scanning apparatus at the Alexandra Palace.

Even better news—or is it only rumour?—is that both of them are to undergo a period of preliminary training as ordinary announcers at Broadcasting House. In which case they may be expected "on the air" in perhaps a fortnight's time.

## Sir Noel Ashbridge Says: "No"

NO less a person than Sir Noel Ashbridge, Chief Engineer of the B.B.C., denies the truth of one of the most technically interesting "stories" published in the lay Press in recent years. What a pity!

The "news," as it appeared in a journal with a two-million circulation, was that the B.B.C. is now using ultra-short waves as a wireless link between Broadcasting House and the National and Regional transmitters at Brookman's Park.

## Intercepting Studio Output

We all know, of course, that "ultra shorts" go out daily from Portland Place in connection with television experiments and are picked up on mobile vans, sometimes in the neighbourhood of the London transmitters; but the dream of ourselves enjoying high fidelity results is shattered.

## Fillip for 5-Metre Work

It would have been grand to intercept the studio output before it even reached the Control Monitor at Brookman's Park; indeed, the possibility of doing such a thing would have given a real fillip to the 5-metre set industry.

## "No Useful Purpose"

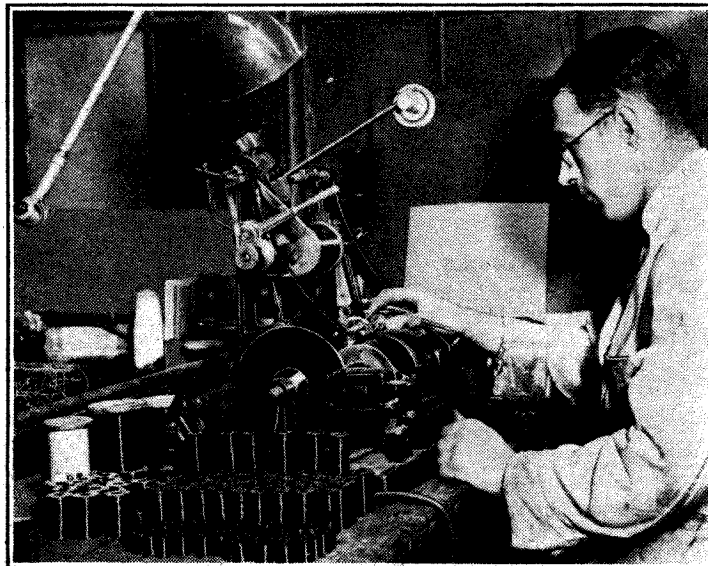
Sir Noel, however, considers that no useful purpose would be served by such a link, as the existing cable gives a frequency range up to 10,000 cycles. No ultra-short wave link has been attempted, and (unless the cable blows up) no such link will be attempted.

But it was a very good "story."

## Lisburn Pleases

THE new Northern Ireland transmitter is giving quite a healthy signal in the London area, without serious interference by Poste Parisien, which is only 7.6 metres up the wavelength scale.

Belfast is apparently so delighted that remarkably few reception reports have reached the B.B.C.—always an indication that all is well. It is when stations fail to please that the British public spends money on stamps.



**£10,000 ORGAN.** The new B.B.C. organ for St. George's Hall is already in course of erection, and this picture shows the winding of some of the coils required for the "all electric" action of the instrument. Every conceivable "cinema organ effect" will be incorporated, though it will be possible to use the organ for rendering serious music.

## Transmitters Must be "Hoop-proof"

I AM surprised that more fuss has not been made of the little boy who stopped the Northern Irish broadcasting service soon after the opening of the Lisburn transmitter. Apparently his steel hoop got out of control, trundled through some railing, and shorted the power supply. The minute-and-a-half delay occurred while the auxiliary plant was being "warmed" up.

The mains cables are now to be made hoop-proof.

## The B.B.C. Annual

SPECULATIONS as to the future of television are not the least interesting feature of the B.B.C. Annual for 1936, just issued. Will the listener of the future watch an orchestra playing throughout an entire

concert or will his impressions of the programme be merely reinforced by vision at intervals? Will there be continuous or intermittent pictures to illustrate the talks? Will speakers be profoundly affected by the thought that they are being seen as well as heard?

## Television Posers

The writer does not venture to answer these questions, but hints that their solution will for a long time tax the powers, no less than they will engage the

tion so interesting that it would grip the imagination of people who have heard nothing of broadcasting, to say nothing of those who have. Altogether, an excellent half-crown's worth.

## America Takes Up "Wireless"

THE good old word "wireless" has been rather buffeted of late, which makes it all the more pleasant to record that America is now taking up "wireless" in preference to "radio."

And this is why. For a long time local relay systems have been mis-called "network radios." A new system is now becoming popular, whereby a central receiving station picks up signals from a distant broadcaster and relays them by wireless to local transmitters of low power for distribution to listeners in the neighbourhood. Obviously, it would confuse everybody to call these "network radios," so we have the "Corn Belt Wireless Network" which has just been established in Indiana.

Others are to follow. So, swings the pendulum.

## Living in the Past

THE first of a new series of fortnightly talks of high entertainment value will be given on April 19th. The series has been given the generic title of "Living in the Past."

The past that the various speakers will tell of is the past that is mentioned in none of the history books. They will describe the humdrum, day-to-day activities of the multitude, which still go on though battles rage and dynasties totter.

## "All the World's a Stage"

Whatever century we live in we cannot escape the trivial activities of living, but though the act remains the same, the manner of it changes. It is of the differences in the conduct of our daily lives throughout the centuries that this series will treat.

The talks describe how our forebears went to the theatre, how they travelled, how they took their meals, how they gambled and made or lost fortunes, how they took their holidays at the seaside, carried on their courtships, and ventured upon the ever-uncharted seas of matrimony.

## Mother-in-Law

BIG BEN is a public benefactor in more ways than one. In a letter to the B.B.C. an Empire listener writes: "When my mother-in-law listens to Big Ben she is silent for ten minutes. Carry on with the good work." The B.B.C. has replied: "We are."

interest, of all concerned. With which everybody who has pondered these problems will almost certainly agree.

## Pictorial Retrospect

As an impressive pictorial record of an impressive year the Annual would be hard to beat. A special supplement deals with the part taken by King George V in the encouragement of broadcasting, and included are the speeches of His Late Majesty on Jubilee Day and at Christmas, 1935.

## Technical Developments

The technical section gives a good summary of station development to date, with new photographs of the Maida Vale studios, the recording equipment, Lisburn transmitter, and the North Scottish Regional in course of erection.

There is a wealth of informa-

# Letters to the Editor

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

## The "Radio Companion"

I AM writing to express my appreciation of the "Radio Companion,"\* and especially when travelling.

At short notice, I had to go to Italy, and decided to make up the "Radio Companion" mainly in order to receive the news bulletin from England, since there is no free Press in Italy.

This part of the Riviera is screened by the Alps, and although only being able to receive on the "frame" London's carrier wave, yet by connecting about 6ft. of wire with crocodile clips to the "grid" end of the frame and allowing the wire to trail along the floor, and "earthing" the other end to the hot-water radiator system of the hotel, London Regional was received at very good strength every day without fail.

It was interesting to keep in touch with England during the journey, but reception was only really satisfactory while the train was stationary, owing to extraneous noises.

It is worth while carrying a few feet of, say, 0.028in. gauge wire as the "earth" connection, and perhaps a short aerial helps considerably when the station is a distant one.

This set is also very convenient, as it fits in the overcoat pocket, thus preventing any questions being raised.

As a matter of fact, many people here who have seen me using this piece of apparatus have mistaken it for some deaf-aid equipment.

ROBERT SHUTE, Grad. I.E.E.

San Remo.

## Transmission Quality

MR. ELLIS considers that the B.B.C. Dance Band is in no way deficient in bass. If that is so, then there are a lot of transmissions which are overdone in this region. It must be one thing or the other!

C. R. MOSCROP.

Aylesbury.

IN support of Mr. Beasley's contention that there is much scope for improvement in the quality of certain of the B.B.C. transmissions I append two complaints.

First, with reference to the top cut-off in the case of orchestral relays from Northern Ireland and South Wales and occasionally from Bournemouth and Edinburgh. The quality of these transmissions is dull in the extreme and reminiscent of 2LO days and receivers cutting off at about 4,000 cycles.

Presumably, the orchestras at the aforementioned places do possess triangles, but as at present relayed they are rarely, even feebly, heard. As a result, the relay is just as good (or should I say as bad?) with one's tweeter disconnected. Is it not time that the landlines concerned, which are presumably the cause of the trouble, were brought up to date?

My second complaint refers to the quality of speech in the news bulletins. Need this

\*The details for constructing this receiver were given in *The Wireless World* for October 25th, 1935, and further notes appeared in the issue for November 29th, 1935.

be as "boomy" as it is? In practically no other B.B.C. transmission is it so bad. Speech in plays and talks is generally more natural and in the "Unrehearsed Debates" series is excellent. Even in the news bulletin when a commentator comes to his microphone and "takes over" from the announcer a noticeable improvement in quality is apparent. Why is this? Is the B.B.C. aware of the importance of these matters in these days of "quality" receivers?

GUY CLAYTON.

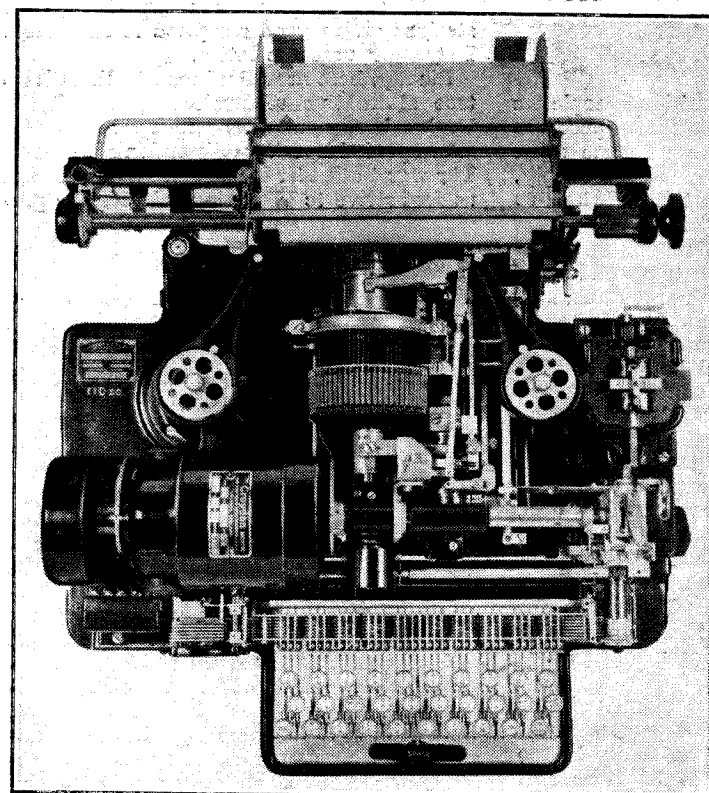
Rotherham.

## Recording

IT was with extreme gratification that I read your Editorial on the present system of recording.

There is little doubt that had the "hill and dale" system been developed with modern electrical recording there would now be very little difference in quality of reproduction obtainable from such records as compared with broadcasting.

Furthermore, one of the worst of all the defects in the present system, that of seriously impaired quality due to rapid wear, could be entirely eliminated. I have at the present time some hundreds of Blue Amberols, recorded twenty-five years ago, many of which, when reproduced on a modern amplifier, by means of quite a poor pick-up adapted with a diamond point, are infinitely superior in quality to similar records of recent date.



These Amberols must have been reproduced thousands of times by three generations, and, in spite of being stored like so much firewood, in cupboards, and without cases, the surfaces are apparently as perfect as when new.

I feel certain that countless lovers of quality records will be grateful for your

expressed opinion, and sincerely trust that we may hope for an early revival of a recording system which should never have been neglected.

J. R. WRIGHT.

Canterbury.

## CW Interference

A TYPE of interference with broadcast programmes which seems totally unnecessary is that by continuous-wave telegraphy. We know that spark transmissions by ships have such a "spread" that they must interfere; but why should I get CW telegraphy on Paris PTT, for example (from a four-letter "G" call)? And why the high-speed CW working on Stuttgart and Beromunster, as another example? (Hard to read, but one transmission appeared to be OAF from EAA).

It looks like harmonics; but surely it is an easy matter to suppress these? Will the commercial interests explain?

R. RAVEN-HART.

La Ciotat, France.

## Freak Reception

I HAVE a truly remarkable freak reception to report. The Air Ministry weather forecast from Heston for commercial aircraft, which, I believe, is broadcast by radio-telephony on about 250 m., was heard here to-day at 2.30 G.M.T., as interference to the B.B.C. Empire transmitter, GSF, on 19.82 m. This must have been a harmonic of the Heston transmitter.

If harmonics are going to get out like this it would appear that the great improvement in propagation on the lower short waves which is now being observed, due to the sunspot maximum approaching, is not going to be an unmixed blessing.

HEPTODE.

Singapore,

March 3rd, 1936.

A reader has written to point out that in a letter to the correspondence columns which appeared on page 250 of our issue of March 6th, the word "telewriter" is used where teleprinter is intended.

The accompanying photograph which he sends us illustrates the teleprinter so extensively used to-day.

## Hunnings Microphone

MAY I point out an error, probably typographical, in your article, "Microphones," by H. B. Dent in the March 20th issue.

The first microphone illustrated should be the "Hunnings," not "Humblings,"

as printed. It was invented by my great-uncles, the Rev. Henry Hunnings and his brother John, who collaborated in this and other experimental work.

Although patented by, and generally ascribed to the former, the latter, John, carried out most of the research.

Incidentally, its evolution was at least contemporary with, and probably prior to, Hughes' pencil type.

As early as 1872 my mother spoke through one of the early models on the telephone line between the house and the laboratory, some distance away.

C. EDINGTON SUTTON.

Wimbledon, S.W.19.

### 5-Metre Activity

"ETHACOMBER'S" note in your issue of March 6th of increasing signs of activity on the 5-metre band is encouraging to those who are working in that part of the radio spectrum.

I am rather isolated here for ultra-short wave work, but would be glad to hear from stations within, say, twenty to thirty miles for collaboration in tests.

ERNEST H. ROBINSON

"Langmead," (G-5YM).  
Pirbright, Woking, Surrey.

### The Little Nationals

I NOTE there is again talk of the Little Nationals being extinguished. I sincerely hope that this will not occur until a better substitute than Droitwich is available.

This wish is prompted by the fact that Droitwich has a rather severe cut-off in the upper register, and the finest quality is not, therefore, obtainable from this station.

P. G. A. H. VOIGT.

London, S.E.

### Hot-air Gramophone Motors

THERE are many thousands of people we feel sure who would be glad to purchase a record changer if there were some other means of operating it than electric supply, for it must be realised that those who live in places not fed by electric power cannot avail themselves of this innovation.

Some time back we wrote to a well-known British firm, makers of such apparatus, suggesting that a caloric motor (similar to the well-known KyKo fan) would do the work admirably, for this could be operated by kerosene, gas, or, in fact, any form of heating.

The first reply indicated that this firm considered the idea worth looking into, but after some months they wrote saying ours was the only request for such a thing, and, therefore, not worth considering.

We are inclined to suggest this is rather a short-sighted policy. How came the first changer to be marketed? Was it by the request of a large number of enquiries, or did the makers put it on the market and wait results?

With any electric element there is always a risk of burning out or some breakdown. Spring motors would not, we think, be too good; they would have to be large and cumbersome, and would be costly to manufacture. The caloric motor, on the other hand, is simple, and, we suggest, cheap to make. We feel confident if some enterprising firm put a caloric drive gramophone record-changer on the market, such a step would not be regretted.

Some years ago we saw a table gramophone of, we think, German manufacture,

on sale in this country, operated by a miniature caloric motor. We timed the running with one fill of spirit; it ran over fifty records, but from what we remember it was at that time rather an expensive affair.

W. J. D. TRENGOVE.

Kuala Lumpur,  
Federated Malay States.

### Programme Distribution

YOU ask for readers' views on programme distribution, together with reception reports. I must confess that, being accustomed to your firm leadership in high technical common sense, particularly in respect of quality of reproduction being the main objective of the art of wireless, this leader of yours struck me with dismay. Here are my reasons:

(1) The service area of any medium-wave station (approximately 80 miles) in which fadeless and distortionless reception is possible, is not appreciably extended after dark by even very large power increase of the transmitter.

(2) From this I deduce that high quality reception can never be achieved from more than two stations, Droitwich and the local Regional.

(3) The adoption of more alternative programmes from more stations must therefore be accompanied by an inevitable decline in quality. AVC and variable selectivity cannot achieve the impossible, and they alone are responsible for this proposed plan, which will involve this sacrifice.

Thus the issue appears quite clear—either the available programme material should be further divided among more stations, thereby reducing the choice of material by the discerning listener, or the best material should continue to be radiated by two stations giving good reception in each area. I strongly urge the latter.

Finally, here near Portsmouth, there is no true alternative to Droitwich, for all the Regional programmes fade hopelessly, accompanied by severe distortion after dark. The worst offender is London Regional. Let us first strive to obtain one alternative programme!

G. W. HARPER,

Havant.

Lieut.-Comdr.

I MUST endorse everything Mr. A. K. Gordon writes in his letter published by you in *The Wireless World* dated March 6th, re alternative programmes from more distant stations.

I am situated eighteen miles from Charing Cross, on the banks of the Thames but about 300ft. above sea level. During daylight the West and North Regionals give good programme value, apart from the Locals. Scottish is usually lost under a heavy cloak of atmospherics. After dark the Scottish Regional gives the best programme value of the three being almost free from fading, but the North and West fade so badly that at times their signal is completely lost under the prevailing atmospherics.

The Midland Regional is useless as a programme at any time owing to electrical interference from gas cleaning plant at a factory over a mile away. (This has been with us for three years.) On one occasion an aerial roof-top high was temporarily rigged up here and daylight reception was possible above the interference from Midland, but after dark fading again caused the signal to fall below the prevailing interference.

I must disagree with you when you state that £10-£12 can purchase a superhet with

AVC which will overcome the fading. This may be true when a mains supply is available, but in this district electricity is scarce and battery sets are very prominent. It is my experience of battery sets that three pre-detector stages are necessary to obtain anything like the requisite gain control. This necessitates a minimum of five valves, and I have yet to find a well-designed battery set of this size under £15-£18.

Mr. Gordon suggests that there are millions of licence holders who cannot afford £10-£12 for a set. I have yet to find the labouring man earning 50s. or considerably less a week who has not got a set costing £10-£20 and not more than two years old. But conditions are far superior in the southern industrial area to those prevailing elsewhere.

As a final note I must express my welcome of the B.B.C.'s new late evening programmes, more particularly the late "News." There are an enormous number of shift workers in this district who arrive home from work about 11 p.m. It is also useful to hear the latest before going to bed.

Greenhithe,  
Kent.

A. W. GRIMSEY.

I AM sending you these notes in response to your Editorial. As I am situated pretty far North, the position as regards reception of the B.B.C. stations is probably a good deal worse than that of the great majority of listeners.

First let me say that for some years past I have concentrated on quality, as far as a reasonable amount of long-distance reception permits, and am now using a 1936 Monodial Super coupled to an autophase and push-pull amplifier and a Voigt domestic speaker.

With this equipment all the B.B.C. 50 kW stations and the synchronised Nationals, and, of course, Droitwich, can be received to a moderate extent in daylight in the winter. I do not yet know as to summer conditions.

There is bad fading on some, and one could not call it absolutely reliable reception. North Regional is generally the best; on the others noise ratio is apt to be troublesome. These remarks do not, of course, apply to the two Scottish transmissions, both of which are perfectly reliable.

At night, however, they are all easily receivable at excellent signal strength apart from the inevitable fades, and I can even open out the selectivity control to some extent on most of them.

The synchronised Nationals, although giving fair signal strength, are not very much use here for reliable quality, as, due no doubt to the reflected waves coming from different distances, there are some weird distortion effects at times.

Droitwich is, unfortunately, not very reliable for quality, and fades at times.

On broadcasts which originate in the South I frequently tune in to the transmitter which is radiating the original, and by so doing very often obtain much improved quality. Possibly this is due to imperfect land-lines.

If the 50 kW stations were increased to 100 kW or thereabouts, as most of the principal Continental stations have been, it would result in a greatly improved service to the country as a whole and would extend the service area of each transmitter, bringing the possibility of high-quality reproduction within the reach of a greater number. Alternative programmes might

thus be extended somewhat. Even now, however, there are very frequently alternative programmes on the various Regionals in the evenings, which is, after all, generally the chief and often the only possible listening time for most people.

At the same time, the alternative programme idea might easily be overdone, especially in the daytime. Much increase in this direction would involve a questionably justifiable increase of expense on what would for the most part be mediocre talent.

On this question of power one feels that our country is getting left behind somewhat. If the B.B.C. say they cannot afford it, then surely a greater proportion of the licence fees should be allocated to them. The country is paying a large sum and has a right to the best possible service, and whatever proportion of the licence receipts is necessary for the purpose should be forthcoming. This, I feel, is a moderate view! In addition to increase in power, one could

suggest many other improvements. I put forward two: the provision of the best microphones for *all* transmissions, and the more frequent engagement of really good talent to speak, sing, or play before them. I gather that the difficulty about the latter is that the fees are not sufficiently attractive.

One other suggestion: Plays, films, and books are criticised publicly in the general Press. Why not broadcasts? No doubt this is a little difficult, but I should like to see something of this nature done, not only as regards the performance, but as to its delivery to the listener.

It would be a pity if there should be a slowing-down of progress, and plenty of publicity is generally the best way to keep things on the move.

If I have rather wandered from the point, I apologise, but the whole subject appears to me to hang together.

Forfar.

JOHN OGILVY.

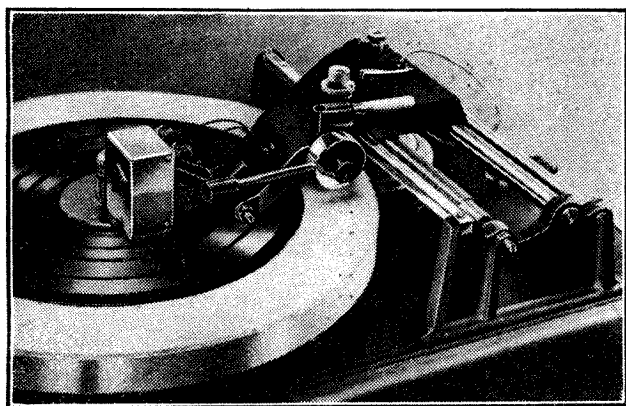
## PARMEKO EQUIPMENT

## RECORDING

Well-designed  
Apparatus  
Suitable for  
Home Use



It is by no means an easy matter to give a precise definition of a home recorder, as a large percentage of the apparatus evolved for recording sound could be so described, for it can be acquired by anyone to whom the initial cost is of no consequence. A price limitation seems hardly practicable at this stage of development, so in an arbitrary classification we might be justified in including all apparatus that will operate from wireless receivers and amplifiers of the type designed for ordinary broadcast reception.



Close up of the recording machine.

Within this category, which is admittedly a wide one, since price does not enter into the question, can be included the recording apparatus made by Parmeko, Ltd., of Leicester, for with an amplifier giving an undistorted output of about four watts perfectly satisfactory records can be made.

Thus, *The Wireless World* Quality Amplifier is quite capable of operating the recorder, though for best results its frequency characteristic, which is practically uniform throughout the audible scale, will require slight modification to match the characteristics of the cutting head. We understand that the makers of the machine will be able to advise interested experimenters as to the degree of tone correction necessary to achieve this end.

The recording machine and its motor are embodied in two separate units joined together by a driving shaft with flexible couplings. Solid teak cabinets are used for both units. The former comprises a gear box, turntable, cutting head, and traversing mechanism, while the latter houses a heavy-duty synchronous electric motor. An endless rubber belt drives the traversing mechanism from a three-speed pulley on the turntable spindle, the three ratios available giving respectively 85, 95, and 120 grooves to the inch on the recording disc.

A steel worm driven from the belt pulley by a two-to-one reduction gear propels a cast gunmetal carriage, to which the cutting head is attached, the carriage being engaged with the lead screw by a split nut, and released or engaged by a quick-acting pawl. The cutting head can be raised or lowered

by a lever, while the depth of the cut is controlled by an adjustable counter-weight.

The cutter has an impedance of 600 ohms, and is designed for use on cellulose acetate discs only. It requires approximately six watts for full modulation, though adequate amplitude is obtainable with four watts, as we have found by test.

The amplifier supplied with this apparatus is a four-stage model terminating in two PX25 valves in push-pull, and gives between 10 and 12 watts output when fully loaded. Frequency correction circuits to suit the cutter are embodied, and, as full correction is not required for reproduction, for which three amplifying stages only are usually sufficient, the change-over switch from recording to play-back automatically adjusts the frequency response. Separate volume controls are fitted for all input points.

Recordings of broadcast as well as of speech were made, and for the latter we used the Parmeko Junior microphone, a good-quality carbon model at a reasonable price.

Excellent results were obtained, though the radio version was somewhat superior to the microphone recording, which is perhaps quite natural, for to achieve comparable quality a really high-grade microphone would be necessary. However, Parmeko include a Piezoelectric microphone among their various recording accessories.

The impression gained from our tests was that a little too much high-note lift remained on the reproduction side of the amplifier, for when the records were played with *The Wireless World* Quality Amplifier there was a noticeable improvement in general balance. On the other hand, the correction is necessary for recording as records made with the Q.A. receiver and amplifier, uncorrected, but for fitting a suitable ratio output transformer, were less brilliant than with the Parmeko model. A corrected Q.A. would undoubtedly produce a first-class record.

Most noticeable of all was the almost tire absence of surface noise, or needle scratch. Steel trailing needles were used for the reproduction.

The whole equipment is a fine engineering job, soundly made, and capable of hard wear. It is AC operated, and comparatively simple to handle. The one criticism we venture to make regarding the play-back side of the amplifier is of small consequence, as it could be corrected with very little trouble.

Prices are as follows: Recording machine and motor unit, £70; recording amplifier, £68. Junior microphone and battery box with table stand, £5 10s.; and crystal microphone with pre-amplifier, £35.

Recording blanks cost 2s. 6d. each for double-sided roin, and 3s. for 12in. Single-sided blanks cost 1s. 9d. and 2s. each in roin. and 12in. sizes respectively. H. B. D.

# PRINCIPAL BROADCASTING STATIONS OF EUROPE

Arranged in Order of Frequency and Wavelength

(This list is included in the first issue of each month. Stations with an aerial power of 50 kW. and above in heavy type)

Station.	kc/s.	Tuning Positions.	Metres.	kW.	Station.	kc/s.	Tuning Positions.	Metres.	kW.
Kaunas (Lithuania)	155		1935	7	London Regional (Brookmans Park)	877		342.1	50
Brazov (Romania)	160		1875	150	Graz (Austria). (Relays Vienna)	886		338.6	7
Kootwijk (Holland) (Relays Hilversum) (10 kW. till 2.40 p.m.)	160		1875	100	Helsinki (Finland)	895		335.2	10
Lahti (Finland)	166		1807	40	Hamburg (Germany)	904		331.9	100
Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)	172		1744	500	Toulouse (Radio Toulouse) (France)	913		328.6	60
Paris (Radio Paris) (France)	182		1648	80	Brno (Czechoslovakia)	922		325.4	32
Istanbul (Turkey)	187.5		1600	5	Brussels, No. 2 (Belgium). (Flemish Prog'mme)	932		321.9	15
Deutschlandsender Zeesen (Germany)	191		1571	60	Algiers, P.T.T. (Radio Alger) (Algeria)	941		318.8	12
Droitwich	200		1500	150	Göteborg (Sweden). (Relays Stockholm)	941		318.8	10
Minsk, RW10 (U.S.S.R.)	208		1442	35	Breslau (Germany)	950		315.8	100
Reykjavik (Iceland)	208		1442	16	Paris (Poste Parisien) (France)	950		312.8	60
Motala (Sweden). (Relays Stockholm)	216		1389	150	Odessa (U.S.S.R.)	968		309.9	10
Novosibirsk, RW76 (U.S.S.R.)	217.5		1379	100	Northern Ireland Regional (Lisburn)	977		307.1	100
Warsaw, No. 1 (Raszyn) (Poland)	224		1339	120	Genoa (Italy). (Relays Milan)	986		304.3	10
Luxembourg	230		1304	150	Torun (Poland)	986		304.3	24
Ankara (Turkey)	230		1304	7	Hilversum (Holland). (15 kW. till 4.40 p.m.)	995		301.5	60
Kharkov, RW20 (U.S.S.R.)	232		1293	20	Bratislava (Czechoslovakia)	1004		298.8	13.5
Kalundborg (Denmark)	238		1261	60	Midland Regional (Droitwich)	1013		296.2	50
Leningrad, RW53 (Kolpino) (U.S.S.R.)	245		1224	100	Chernigov (U.S.S.R.)	1013		296.2	5
Tashkent, RW11 (U.S.S.R.)	256.4		1170	25	Barcelona, EAJ15 (Radio Asociación) (Spain)	1022		293.5	3
Oslo (Norway)	260		1153.8	60	Cracow (Poland)	1022		293.5	2
Moscow, No. 2, RW49 (Stehelkovo) (U.S.S.R.)	271		1107	100	Königsberg No. 1 (Heilsberg) (Germany)	1031		291	100
Tiflis, RW7 (U.S.S.R.)	280		1071.4	35	Paredo (Radio Club Português) (Portugal)	1031		291	5
Finmark (Norway)	355		845.1	10	Leningrad, No. 2, RW70 (U.S.S.R.)	1040		288.5	10
Rostov-on-Don, RW12 (U.S.S.R.)	355		845.1	20	Rennes-Bretagne, P.T.T. (Thourie) (France)	1040		288.5	120
Budapest, No. 2 (Hungary)	359.5		834.5	20	Scottish National (Falkirk)	1050		285.7	50
Sverdlovsk, RW5 (U.S.S.R.)	375		800	50	Bari (Italy)	1059		283.3	20
Banska-Bystrica (Czechoslovakia)	392		765	30	Paris (Radio Cité) (France)	1068		280.9	0.8
Geneva (Switzerland). (Relays Sottens)	401		748	1.3	Tiraspol, RW57 (U.S.S.R.)	1068		280.9	4
Moscow, No. 3 (RCZ) (U.S.S.R.)	401		748	100	Bordeaux, P.T.T. (Lafayette) (France)	1077		278.6	50
Voroneje, RW25 (U.S.S.R.)	413.5		728	10	Zagreb (Yugoslavia)	1086		276.2	0.7
Oulu (Finland)	431		696	1.2	Falun (Sweden)	1086		276.2	2
Ufa, RW22 (U.S.S.R.)	436		688	10	Madrid, EAJ7 (Union Radio) (Spain)	1095		274	10
Tartu (Estonia)	517		580	0.5	Madona (Latvia)	1104		271.7	50
Hamar (Norway). (Relays Oslo)	519		578	0.7	Naples (Italy). (Relays Rome)	1104		271.7	1.5
Innsbruck (Austria). (Relays Vienna)	519		578	1	Moravska-Ostrava (Czechoslovakia)	1113		269.5	11.2
Ljubljana (Yugoslavia)	527		569.3	5	Fécamp (Radio Normandie) (France)	1113		269.5	5
Viiuri (Finland)	527		569.3	10	Alexandria (Egypt)	1122		267.4	0.25
Bolzano (Italy)	536		559.7	1	Newcastle	1122		267.4	1
Wilno (Poland)	536		559.7	16	Nyiregyhaza (Hungary)	1122		267.4	6.2
Budapest, No. 1 (Hungary)	546		549.5	120	Hörby (Sweden). (Relays Stockholm)	1131		265.3	10
Beromünster (Switzerland)	556		539.6	100	Turin, No. 1 (Italy). (Relays Milan)	1140		263.2	7
Athlone (Irish Free State)	565		531	60	London National (Brookmans Park)	1149		261.1	20
Palermo (Italy)	565		531	4	North National (Slaithwaite)	1149		261.1	20
Stuttgart (Mühlacker) (Germany)	574		522.6	100	West National (Washford Cross)	1149		261.1	20
Grenoble, P.T.T. (France)	583		514.6	15	Kosice (Czechoslovakia). (Relays Prague)	1158		259.1	2.6
Riga (Latvia)	583		514.6	15	Monte Ceneri (Switzerland)	1167		257.1	15
Vienna (Bisamberg) (Austria)	592		506.8	100	Copenhagen (Denmark). (Relays Kalundborg)	1176		255.1	10
Rabat (Radio Maroc) (Morocco)	601		499.2	25	Kharkov, No. 2, RW4 (U.S.S.R.)	1185		253.2	10
Sundsvall (Sweden). (Relays Stockholm)	601		499.2	10	Nice (La Brague) (France)	1185		253.2	60
Florence (Italy). (Relays Milan)	610		491.8	20	Frankfurt (Germany)	1195		251	25
Cairo (Abu Zabal) (Egypt)	620		483.9	20	Prague, No. 2 (Czechoslovakia)	1204		249.2	5
Brussels, No. 1 (Belgium). (French Programme)	620		483.9	15	Lille, P.T.T. (Camphin) (France)	1213		247.3	60
Lisbon (Bacarena) (Portugal)	629		476.9	20	Trieste (Italy)	1222		245.5	10
Trøndelag (Norway)	629		476.9	20	Gleiwitz (Germany). (Relays Breslau)	1231		243.7	5
Prague, No. 1 (Czechoslovakia)	638		470.2	120	Cork (Irish Free State). (Relays Athlone)	1240		241.9	1
Lyons, P.T.T. (La Doua Tramoyes) (France)	648		463	90	Swedish Relay Stations	1240		241.9	1
Cologne (Langenberg) (Germany)	658		455.9	100	Saarbrücken (Germany)	1249		240.2	17
North Regional (Slaithwaite)	668		449.1	50	Kuldiga (Latvia)	1258		238.5	10
Sottens (Radio Suisse Romande) (Switzerland)	677		443.1	25	Rome, No. 3 (Italy)	1258		238.5	1
Belgrade (Yugoslavia)	686		437.3	2.5	San Sebastian (Spain)	1258		238.5	1
Paris, P.T.T. (Palaiseau Villebon) (France)	695		431.7	120	Nürnberg (Germany). (Relays Munich)	1267		236.8	2
Stockholm (Sweden)	704		428.1	55	Juan-les-Pins (Radio Côte d'Azur) (France)	1276		235.1	0.8
Rome, No. 1 (Italy)	713		420.8	50	Christiansand and Stavanger (Norway)	1276		235.1	0.5
Kiev, RW9 (U.S.S.R.)	722		415.5	36	Dresden (Germany). (Relays Leipzig)	1285		233.5	0.25
Tallinn (Estonia)	731		410.4	20	Aberdeen	1285		233.5	1
Madrid, EAJ2 (Radio España) (Spain)	731		410.4	3	Austrian Relay Stations	1294		231.8	0.5
Seville (Spain)	731		410.4	5.5	Danzig. (Relays Königsberg)	1303		230.2	0.5
Munich (Germany)	740		405.4	100	Swedish Relay Stations	1312		228.7	1.25
Marseilles, P.T.T. (Realtor) (France)	749		400.5	90	Magyarovar (Hungary)	1321		227.1	1.25
Katowice (Poland)	758		395.8	12	German Relay Stations	1330		225.6	2
Scottish Regional (Falkirk)	767		391.1	50	Montpellier, P.T.T. (France)	1339		224	0.8
Stalino (U.S.S.R.)	776		386.6	10	Lodz (Poland)	1339		224	1.7
Toulouse, P.T.T. (Muret) (France)	776		386.6	120	Dublin (Irish Free State). (Relays Athlone)	1348		222.8	0.5
Leipzig (Germany)	785		382.2	120	Milan, No. 2 (Italy). (Relays Rome)	1357		221.1	4
Barcelona, EAJ1 (Spain)	795		377.4	7.5	Turin, No. 2 (Italy). (Relays Rome)	1357		221.1	0.2
Lwow (Poland)	795		377.4	16	Basle and Berne (Switzerland)	1375		218.2	0.5
West Regional (Washford Cross)	804		373.1	50	Warsaw, No. 2 (Poland)	1384		216.8	2
Milan (Italy)	814		368.6	50	Lyons (Radio Lyons) (France)	1393		215.4	25
Bucharest (Romania)	823		364.5	12	Tampere (Finland)	1420		211.3	0.7
Moscow, No. 4, RW39 (Stalina) (U.S.S.R.)	832		360.6	100	International Common Wave	1429		209.9	0.5
Berlin (Germany)	841		356.7	100	Miskolc (Hungary)	1438		208.6	1.25
Bergen (Norway)	850		352.9	1	Paris (Eiffel Tower) (France)	1456		206	20
Sofia (Bulgaria)	850		352.9	50	Pecs (Hungary)	1465		204.8	1.25
Valencia (Spain)	850		352.9	3	Antwerp and Courtrai (Belgium)	1465		204.8	0.1
Simferopol, RW52 (U.S.S.R.)	859		349.2	10	Bournemouth	1474		203.5	1
Strasbourg, P.T.T. (France)	859		349.2	100	Plymouth	1474		203.5	0.3
Poznan (Poland)	868		345.6	16	International Common Wave	1492		201.1	0.5
					International Common Wave	1500		200	0.25
					Liepāja (Latvia)	1737		173	0.1

NOTE.—Since the publication of the previous list alterations have been made to the following stations: Moscow No. 1 (U.S.S.R.).

# SHORT-WAVE STATIONS OF THE WORLD

Arranged in Order of Wavelength and Frequency

(N.B.—Times of Transmission given in parentheses are approximate only and represent G.M.T.)

Metres.	kc/s.	Call Sign.	Station.	Tuning Positions.	Metres.	kc/s.	Call Sign.	Station.	Tuning Positions.
75.0	4,000	CT2AJ	Ponta Delgada (Azores). (Wed., Sat., 22.00 to 24.00.)		36.5	8 214	HCJB	Quito (Ecuador). (Daily ex. Sun., Mon. 00.45 to 04.45, Sun. 21.45 to 04.15.)	
70.2	4,273	RV15	Kharbarovsk (U.S.S.R.). (Daily 06.00 to 14.00.)		34.29	8,750	ZCK	Hong Kong (China). (Daily 10.00 to 14.00.)	
67.11	4,470	YDB	Sourabaya (Java). (Daily 03.30 to 06.30)		32.88	9,125	HAT4	Budapest (Hungary). (Sat. 23.00 to 24.00)	
58.31	5,145	OKIMPT	Prague (Czechoslovakia). (Experimental)		31.8	9,428	COCH	Havana (Cuba) (Daily 16.00 to 17.00, 22.00 to 23.00, 01.00 to 02.00.)	
51.28	5,850	YV5RMO	Maracaibo (Venezuela). (Daily, 22.00 to 02.00.)		31.56	9,500	PRF5	Rio de Janeiro (Brazil). (Daily 22.30 to 23.15.)	
50.60	5,930	HJ4ABE	Medellin (Colombia). (Daily, 16.30 to 18.30, Sun., Tues., Thurs., 23.30 to 03.00 also.)		31.55	9,510	GSB	Empire Broadcasting	
50.26	5,969	HVJ	Vatican City. (Daily 19.00 to 19.15, Sun. 10.00 also.)		31.54	9,518	VK3ME	Melbourne (Australia). (Wed. 10.00 to 11.30, Sat. 10.00 to 12.00.)	
50.16	5,980	HIX	Trujillo (Domenica). (Daily, 12.00, Sun. 00.38 also.)		31.48	9,530	LKJ1	Jeløy (Norway). (Relays Oslo.) (Daily 10.00 to 13.00.)	
50.00	6,000	XEBT	Mexico City (Mexico). (Daily 00.00 to 09.00.)		31.48	9,530	W2XAF	Schenectady, N.Y. (U.S.A.). (Relays WGY.) (Daily 23.30 to 04.00, Sat. 19.00 to 22.00 also.)	
50.00	6,000	RW59	Moscow (U.S.S.R.). (Relays No. 1 Stn.) (Daily 00.00 to 23.00.)		31.45	9,540	DJN	Zeesen (Germany). (Daily 08.45 to 12.15, 13.00 to 16.30, 22.15 to 03.30.)	
49.95	6,005	VE9DN	Montreal (Canada). (Daily 04.30 to 05.00.)		31.38	9,560	DJA	Zeesen (Germany). (Daily 13.00 to 16.30, 22.15 to 03.00.)	
49.95	6,005	HJ3ABH	Bogotá (Colombia). (Daily 21.00 to 23.00, 01.00 to 03.00, Sun. 04.30 to 06.30 also.)		31.36	9,565	VUB	Bombay (India). (Sun. 13.30 to 15.30, Wed., Thurs., Sat. 16.30 to 17.30, irregular Mon.)	
49.92	6,010	COCO	Havana (Cuba). (Daily 21.00 to 23.00, 01.00 to 03.00, Sun. 04.30 to 06.30 also.)		31.35	9,570	W1XK	Millis, Mass. (U.S.A.). (Relays WBZ.) (Daily 12.00 to 06.00.)	
49.85	6,018	ZHI	Singapore (Malaya). (Mon., Wed., Thurs. 23.00 to 01.30, Sun. 03.40 to 05.10.)		31.32	9,580	GSC	Empire Broadcasting	
49.83	6,020	DJC	Zeesen (Germany). (Daily 22.30 to 03.30, 17.00 to 21.30.)		31.32	9,580	VK3LR	Lyndhurst (Australia). (Daily ex. Sun. 08.15 to 12.30.)	
49.75	6,030	HP5B	Panama City (Central America). (Daily 17.00 to 18.00, 01.00 to 03.30.)		31.28	9,590	W3XAU	Philadelphia, Pa. (U.S.A.). (Relays WCAU.) (Daily 17.00 to 24.00.)	
49.75	6,030	VE9CA	Calgary (Canada). (Thurs. 14.00 to 07.00, Sun. 17.00 to 05.00.)		31.28	9,590	VK2ME	Sydney (Australia). (Sun. 06.00 to 08.00, 10.00 to 14.00, 14.30 to 16.30.)	
49.67	6,040	W1XAL	Boston, Mass. (U.S.A.). (Sun. 22.00 to 24.00, Wed., Fri. 00.30 to 01.45.)		31.27	9,595	HBL	Radio Nations, Prangins (Switzerland). (Sat. 22.30 to 23.15.)	
49.67	6,040	W4XB	Miami, Fla. (U.S.A.) Daily 17.00 to 19.30, 22.30 to 05.00.)		31.13	9,635	2RO	Rome (Italy). (Tues., Thurs., Sat. 00.45 to 02.15.)	
49.67	6,040	PRA8	Pernambuco (Brazil). (Daily 20.00 to 00.30.)		31.09	9,650	CT1AA	Lisbon (Portugal) ...	
49.59	6,050	GSA	Empire Broadcasting		31.0	9,677	CT1CT	Lisbon (Portugal). (Thurs. 21.00 to 23.00, Sun. 12.00 to 14.00.)	
49.5	6,060	W8XAL	Cincinnati, Ohio (U.S.A.). (Daily 12.00 to 01.00, 04.00 to 06.00.)		30.43	9,860	EAQ	Madrid (Spain). (Daily 22.15 to 00.30, Sat. 18.00 to 20.00 also.)	
49.5	6,060	W3XAU	Philadelphia, Pa. (U.S.A.). (Relays WCAU.) (Daily 01.00 to 04.00.)		29.24	10,260	PMN	Bandong (Java). (Sun., 12.00 to 15.00.)	
49.5	6,060	OXY	Skamlebaek (Denmark). (Relays Kalundborg.) (Daily 18.00 to 24.00, Sun. 16.00 also.)		29.04	10,330	ORK	Ruyssciele (Belgium). (Daily 18.30 to 20.30.)	
49.42	6,070	OER2	Vienna Experimental. (Daily 14.00 to 22.00.)		28.01	10,710	JVM	Tokio (Japan). (Tues., Fri., 19.00 to 20.00)	
49.4	6,072	CT1AA	Lisbon (Portugal). (Tues., Thurs., Sat. 21.30 to 24.00.)		27.93	10,740	JVM	Tokio (Japan). (Tues., Fri. 19.00 to 20.00.)	
49.35	6,079	DJM	Zeesen (Germany) ...		25.6	11,720	FYA	Paris, Radio Coloniale (France). (Colonial Stn. E-W.) (Daily 06.00 to 03.00, 01.00 to 06.00.)	
49.33	6,080	ZHJ	Penang (Malaya). (Daily ex. Sun., 11.40 to 13.40; Sun. 12.40 to 14.40)		25.6	11,720	CJRX	Winnipeg (Canada). (Daily 00.00 to 05.00, Sat. 21.00 to 06.00 also, Sun. 22.00 to 03.30 also.)	
49.33	6,080	W9XAA	Chicago, Ill. (U.S.A.). (Relays WCLF.) (Sun. 19.00 to 20.30.)		25.57	11,730	PH1	Huizen (Holland). (Daily ex. Tues., Wed. 13.00 to 15.30, Sun., Sat. to 16.30.)	
49.33	6,080	CP5	La Paz (Bolivia). (Daily 00.45 to 02.15)		25.53	11,750	GSD	Empire Broadcasting	
49.31	6,083	VQ7LO	Nairobi (Kenya Colony). (Daily 16.00 to 19.00, Sat. to 20.00, Mon., Wed., Fri. 10.45 to 11.15 also, Tues. 08.00 to 09.00 also, Thurs. 13.00 to 14.00 also, Sun. 17.45 to 19.00 also.)		25.49	11,770	DJD	Zeesen (Germany). (Daily 17.00 to 21.30)	
49.3	6,085	2RO	Rome (Italy). (Mon., Wed., Fri. 23.00 to 00.30.)		25.45	11,790	W1XAL	Boston, Mass. (U.S.A.). (Daily 23.00 to 00.30.)	
49.26	6,090	VE9BJ	St. John (N.B.). (Daily 00.00 to 01.30) ...		25.40	11,810	2RO	Rome (Italy). (Mon., Wed., Fri. 23.00) ...	
49.26	6,090	CRXC	Bowmanville, Ont. (Canada). (Mon., Tues., Wed. 20.00 to 05.00, Thurs., Fri., Sat. 12.00 to 05.00, Sun. 18.00 to 02.00.)		25.38	11,820	GSN	Empire Broadcasting	
49.2	6,097	ZTJ	Johannesburg (S. Africa). (Daily ex. Sun. 04.30 to 05.30, 08.30 to 12.00, 14.00 to 20.00 (Sat. to 21.45), Sun. 13.00 to 15.15, 17.30 to 20.00.)		25.36	11,830	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 20.00 to 03.00.)	
49.18	6,100	W3XAL	Bound Brook, N.Y. (U.S.A.). (Relays WJZ.) (Mon., Wed., Sat. 22.00 to 23.00, Sat. 05.00 to 06.00 also.)		25.29	11,860	GSE	Empire Broadcasting	
49.18	6,100	W9XF	Chicago, Ill. (U.S.A.). (Daily ex. Mon., Wed., Sun. 21.00 to 07.00.)		25.27	11,870	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 21.30 to 03.00.)	
49.1	6,110	GSL	Empire Broadcasting		25.23	11,880	FYA	Paris, Radio Coloniale (France). (Colonial Stn. N-S.) (Daily 16.15 to 19.15, 20.00 to 23.00.)	
49.1	6,110	VUC	Calcutta (India). (Daily 07.06 to 08.06 irregular 13.06 to 16.36, Sat. from 12.36 to 03.36.)		25.09	11,955	ETA	Addis Ababa (Abyssinia) ...	
49.08	6,112	YV2RC	Caracas (Venezuela). (Daily ex. Sun. 15.30 to 17.30, 21.00 to 03.00, Sun. 14.30 to 15.30.)		25.0	12,000	RW59	Moscow (U.S.S.R.). (Relays No. 2 Stn.) (Sun. 03.00 to 04.00, 11.00 to 12.00, 15.00 to 16.00.)	
49.02	6,120	YDA	Randoeng (Java). (Daily 10.30 to 15.00)		24.83	12,082	CT1CT	Lisbon (Portugal). (Sun. 14.00 to 16.00, Thurs. 20.00 to 21.00.)	
49.02	6,120	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 03.00 to 04.00.)		24.52	12,235	TFJ	Reykjavik (Iceland). (Sun. 18.40 to 19.00.)	
48.92	6,130	ZGE	Kuala Lumpur (Malaya). (Sun., Tues., Fri. 11.40 to 13.40.)		24.2	12,396	CT1GO	Paredo (Portugal). (Sun. 15.00 to 16.30, Tues., Thurs., Fri. 18.00 to 19.15.)	
48.92	6,132	COCD	Havana (Cuba) (Daily 23.00 to 05.00.)		23.39	12,830	CNR	Rabat (Morocco). (Sun. 12.30 to 14.00) ...	
48.86	6,140	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 21.30 to 06.00.)		22.94	13,075	VPD	Suva (Fiji). (Daily ex. Sun. 05.30 to 03.60)	
48.78	6,150	CSL	Lisbon (Portugal). (Daily 11.00 to 12.30, 18.00 to 22.00.)		22.00	13,635	SPW	Warsaw (Poland). (Daily 16.30 to 17.30.)	
48.78	6,150	YV3RC	Caracas (Venezuela). (Daily 20.30 to 01.30.)		21.42	14,005		Band of wavelengths allotted to amateur transmitters.	
48.78	6,150	CJRO	Winnipeg (Canada). (Daily 00.00 to 05.00, Sat. 21.00 to 06.00 also, Sun. 22.00 to 03.30.)		20.84	14,395	JVH	Nasaki (Japan). (Tues., Fri., 19.00 to 20.00.)	
48.4	6,198	CT1GO	Paredo (Portugal). (Daily ex. Tues. 00.20 to 01.30, Sun. 16.30 to 18.00 also.)		20.55	14,600	HVJ	Vatican City. (Daily 10.00, 15.30 to 15.45)	
47.50	6,316	HIZ	Trujillo (Domenica). (Daily 21.40 to 22.40, Sun. 16.00 to 17.30 also.)		19.84	15,123	GSF	Empire Broadcasting	
47.05	6,375	YV4RC	Caracas (Venezuela). (Daily 21.30 to 03.30.)		19.82	15,140	GSF	Empire Broadcasting	
46.89	6,425	W3XL	Bound Brook, N.J. (U.S.A.). (Experimental)		19.76	15,180	GSF	Empire Broadcasting	
46.52	6,447	HJ1ABB	Barranquilla (Colombia). (Daily 21.30 to 03.30.)		19.74	15,200	DJB	Zeesen (Germany). (Daily 03.45 to 12.15)	
46.21	6,490	HJ5ABD	Cali (Colombia). (Daily 00.00 to 03.00) ...		19.72	15,210	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 13.00 to 21.15.)	
46.0	6,520	YV6RV	Valencia (Venezuela). (Daily 17.00 to 18.00, 23.00 to 03.00.)		19.71	15,220	PCJ	Eindhoven (Holland). (Experimental) ...	
45.31	6,620	PRADO	Riobamba (Ecuador). (Fri. 02.00 to 03.40)		19.68	15,243	FYA	Paris, Radio Coloniale (France). (Colonial Stn. E-W.) (Daily 12.00 to 16.00.)	
45.0	6,667	HC2RL	Guayaquil (Ecuador). (Sun. 22.45 to 12.45, Wed. 02.15 to 04.15.)		19.67	15,250	W1XAL	Boston, Mass. (U.S.A.). (Daily 15.50 to 18.30.)	
42.86	7,000		Band of wavelengths allotted to amateur transmitters.		19.66	15,260	GSI	Empire Broadcasting	
41.10	7,300				19.64	15,270	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 18.00 to 20.00.)	
42.02	7,140	HJ4ABB	Manizales (Colombia) ...		19.63	15,280	DJQ	Zeesen (Germany). (Daily 04.30 to 06.00)	
41.8	7,177	CR6AA	Lobito (Angola). (Wed., Sat. 19.30 to 21.30.)		19.60	15,310	GSF	Empire Broadcasting	
39.95	7,510	JVP	Tokio (Japan). (Tues., Fri., 19.00 to 20.00)		19.6	15,300	CP7	La Paz (Bolivia) ...	
39.37	7,620	ETA	Addis Ababa (Abyssinia) ...		19.56	15,330	W2XAD	Schenectady, N.Y. (U.S.A.). (Daily 19.30 to 20.30.)	
38.48	7,797	HBP	Radio Nations, Prangins (Switzerland). (Sat. 22.30 to 23.15.)		19.52	15,370	HAS3	Budapest (Hungary). (Sun. 13.00 to 14.00.)	
					17.33	17,310	W3XL	Bound Brook, N.J. (U.S.A.). (Daily 16.00 to 22.00.)	
					16.89	17,760	DJE	Zeesen (Germany). (Daily 13.00 to 16.30)	
					16.89	17,760	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 16.00 to 18.00.)	
					16.87	17,780	W3XAL	Bound Brook, N.J. (U.S.A.). (Relays WJZ.) (Daily except Sun. 14.00 to 15.00, Tues. Thurs., Fri. 20.00 to 21.00 also.)	
					16.86	17,790	GSG	Empire Broadcasting	
					16.42	18,270	ETA	Addis Ababa (Abyssinia) ...	
					15.93	18,339	PLE	Randoeng (Java). (Tues., Thurs., Sat. 15.00 to 15.30.)	
					13.97	21,470	GSH	Empire Broadcasting	
					13.94	21,520	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 12.30 to 16.00.)	
					13.93	21,530	GSJ	Empire Broadcasting	
					13.92	21,540	W8XK	Pittsburg, Pa. (U.S.A.). (Daily 12.00 to 14.00.)	

# Recent Inventions

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

## LOUD SPEAKERS

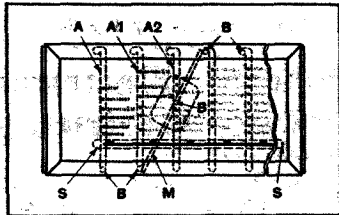
A LOUD SPEAKER of the cone type is fitted with a baffle or disc inside the cone. The disc is made like an iris diaphragm so that its external diameter can be varied, and it is carried on a screw spindle which allows its distance from the apex of the cone to be adjusted. The object is to modify the tone response of the speaker at will.

R. R. Glen. Application date July 4th, 1934. No. 440726.

## TUNING INDICATORS

THE names of the stations are printed on the dial in a series of vertical columns. Behind each column is a slot such as A, A1, A2 containing a metal ball B, which is moved up to indicate the station being received by a bar magnet M. The latter is moved horizontally along the back of the dial by the tuning-control. A lower transverse slot S is marked with the wavelength scale.

As the magnet M moves from right to left it carries the ball in each slot from the bottom of the slot to the top, where it drops for the time being into a recess. For instance, as shown, it has de-



Magnetically operated tuning indicator.

posited the ball B in the two right-hand slots in the top recess, and is about to pick up the ball in the bottom of the second slot from the left of the panel. Meanwhile, the ball in the centre slot has been carried half-way up, to indicate the station to which the set is tuned.

Ideal Werke Akt. für drahtlose Telephonie. Convention date (Germany) 16th April, 1934. No. 440535.

## MEASURING DISTANCES

IT is possible for a navigator to estimate his distance from a radio beacon station by measuring the field strength of the received signals. The rate of attenuation with distance follows a straight-line law, within say a near limit of 2 to 3 and an outer limit of fifty miles. For use in this connection, a high-frequency coupling is provided with a cam-shaped slot which, as it is rotated, gives a reading directly calibrated in miles on the scale of the receiver.

Marconi's Wireless Telegraph Co., Ltd., S. B. Smith, and F. M. Wright. Application date July 6th, 1934. No. 440745.

## TELEVISION FROM FILMS

THE standard "talkie" film is recorded at the rate of 25 frames a second, and is normally projected at the same speed in order to preserve the speech fre-

## Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

quencies at their proper value. On the other hand, for "interleaved" scanning, each frame must be repeated at the rate of 50 per second, and some adjustment is therefore required if one wishes to televise the picture with the sound accompaniment. Usually, too, interleaving involves a fractional relation between the line and frame frequencies, and this further complicates the problem.

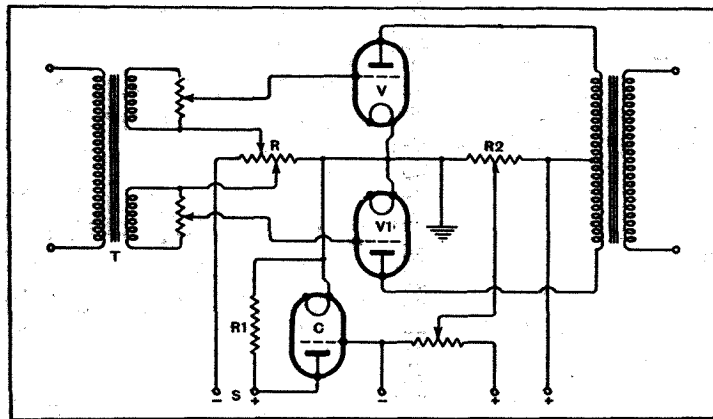
The difficulty is overcome, according to the invention, by using two synchronous driving motors, and compounding their motion through "step-down" epicyclic gearing to give the required fractional relation between the film and the scanning-drum.

C. O. Browne. Application date 4th July, 1934. No. 440729.

## PUSH-PULL AMPLIFIERS

A CLASS "B" amplifier is arranged so that any difference in the operating characteristics of the valve is automatically balanced out. The two push-pull valves V, V1 are fed through separate secondary windings from the input transformer T. Grid bias is derived from a source S, which is in series with a resistance R and with the anode-cathode space of a control valve C, the latter being shunted by a resistance R1. The push-pull valves are initially biased from the tapings shown, the control valve C then acting automatically to offset any subsequent fluctuations in the supply voltages. For instance, if the anode DC voltage varies, a corresponding change occurs in the bias applied from the resistance R2 to the grid of the control valve C, and this is reflected in the voltage-distribution along the resistance R.

Telefunken Ges. für drahtlose Telegraphie m.b.h. Convention date (Germany) 29th May, 1934. No. 440612.



Class "B" amplifier circuit.

## FLUORESCENT MATERIALS

FOR producing fluorescence substantially free from after-phosphorescence, a mixture of zinc and cadmium sulphides is freed from heavy-metal impurities

up to one part in 200,000 and a small trace of silver is then added as a phosphorogen, together with a very minute trace of nickel to inhibit the after-glow. The nickel content should not be more than one part in five million. The mixture is subsequently dried and heated to a temperature of 1,200 deg. C.

L. A. Levy and D. W. West. Application date 20th July, 1934. No. 440818.

## CATHODE-RAY TUBES

WHEN magnetic control is used either for concentrating the electron beam in a cathode-ray tube, or for deflecting it in scanning, difficulties arise owing to the stray fields, which amongst other things, tend to produce the so-called "ionic cross" on the fluorescent screen. Also owing to the fact that the coil control is located outside the glass bulb, relatively large energising currents must be used.

According to the invention these difficulties are overcome by using a magnetic system which is located partly outside and partly inside the tube. Two permanent half-ring magnets, for instance, are located outside and as close to the glass surface as possible, and near the cathode-structure. Two corresponding pole-pieces are similarly placed against the glass wall but inside the bulb, so that they apply the required magnetic field at close quarters to the electron beam. The internal pole-pieces may also be given a biasing-potential and used for electro static control.

Radio Akt. D. S. Loewe. Convention date (Germany) 27th May, 1933. No. 440560.

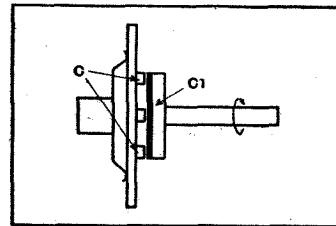
ALTHOUGH magnetic fields have been used to control the frame-scanning electrodes in a

difficulty is overcome by using a magnetic core of low hysteresis loss and high permeability, such as carbonyl iron powder, or an alloy of aluminium, iron, and nickel. The core is prepared from strips of paper which are coated with a mixture of the magnetic powder and an insulating "binder" of low dielectric loss.

Radio Akt. D. S. Loewe. Convention date (Germany) 8th July, 1933. No. 440810.

## DRY-CONTACT "OSCILLATORS"

IT is known that a metal to metal-oxide contact can be used to produce sustained oscillations in a suitable circuit. In



Metal-oxide contact oscillator.

order to facilitate the use of such an "oscillator," one electrode is provided with a number of projecting, flat-ended metal points C, which are pressed against a flat surface C1 covered with an oxide layer. The metals may be aluminium or magnesium or their alloys. The two electrodes may be rotated, relatively to each other, and are kept in contact by spring pressure.

W. Luden and Helmut Bruders. Convention date (Germany) 16th July, 1934. No. 441107.

## OSCILLATION GENERATORS

A THERMIONIC valve comprises a pair of disc electrodes, which are mounted, with their faces parallel to the electron stream, between the first grid and the anode. Owing to mutual repulsion, some of the electrons in the stream spread towards and impinge upon the disc electrodes, thus producing a flow of current which gives the valve a negative-resistance characteristic. The oscillations so produced are built up in a tuned circuit connected to the disc electrodes, and are fed to the transmitting aerial through a coil in the anode circuit.

E. H. Yonkers. No. 2002238. (U.S.A.)

## SINGLE SIDE-BAND RECEPTION

A METHOD of dividing a given frequency-band into sub-bands is based upon the use of phase-discrimination after the band has been modulated by a carrier wave, which is subsequently suppressed. The method may be applied to receive one only of the two side bands of a modulated carrier-wave, thereby increasing the selectivity of a set.

E. I. Green (Assignor to American Telephone and Telegraph Co.). No. 2020409. (U.S.A.)



# The Wireless World

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

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## EDITORIAL COMMENT

### Broadcasting in Foreign Languages

#### *A Proposal of Doubtful Merit*

**I**N the interest of British prestige and influence in world affairs, we think that the appropriate use of languages other than English should be encouraged."

This suggestion is put forward in the Report of the Ullswater Committee on Broadcasting, and since there are no reservations to it we may assume that the Committee has expressed this view unanimously.

The proposal is made in connection only with the Empire Service, so that it may be assumed that it is not intended that foreign language broadcasts should be extended to the medium- and long-wave stations.

But if on short waves it is necessary "in the interest of British prestige and influence," then surely the effect would be the greater on the more normal wavelengths with an enormously larger audience.

It would be interesting to know what has prompted the Committee to make this recommendation, particularly at a time when it might have been considered inadvisable, in view of the political situation in Europe, to embark upon such activity which could hardly fail to cause resentment in those countries whose languages were adopted.

As far as we are aware, there is nothing either in the B.B.C.'s present charter or in the licence from the Postmaster-General which expressly rules out broadcasting in languages other than English, so why should provision now be made for what is already provided for? The very fact that the B.B.C. already possess the necessary authority makes it all the more curious that this recommendation should have found its way into the Report.

In discussing this subject in these pages some months ago, we said that if it was proposed that broadcasts of a political nature should be made in foreign languages, then they should be banned. If they were an exchange of ideas intended to acquaint nations with each other's point of view, then they might prove very helpful. But, we added, "the difficulty is that almost any talk of this kind made in Europe at the present time would be regarded by some nationals as in the nature of propaganda."

We cannot see that any change of circumstances has come about to justify an alteration in this attitude to the question, and we hope that the B.B.C., in spite of the Committee's emphasis on their authority to conduct such broadcasts, will move very warily indeed in the matter.

### Twenty-five Years Old "The Wireless World"

**T**HIS month we celebrate twenty-five years of publication. It is a long life in the history of wireless, and we may be forgiven if, on looking back through all those volumes of the past, we feel that we can count on the endorsement of our readers that our existence has not been in vain and that we have contributed something, however small it may be, to the progress and successes of the science.

In a very early number the objects of *The Wireless World* were summed up in these words: "This, then, is our policy: to be of use and interest to our readers and, through them, to be a factor for progress." This, our guiding principle of the past, will equally direct our future efforts.

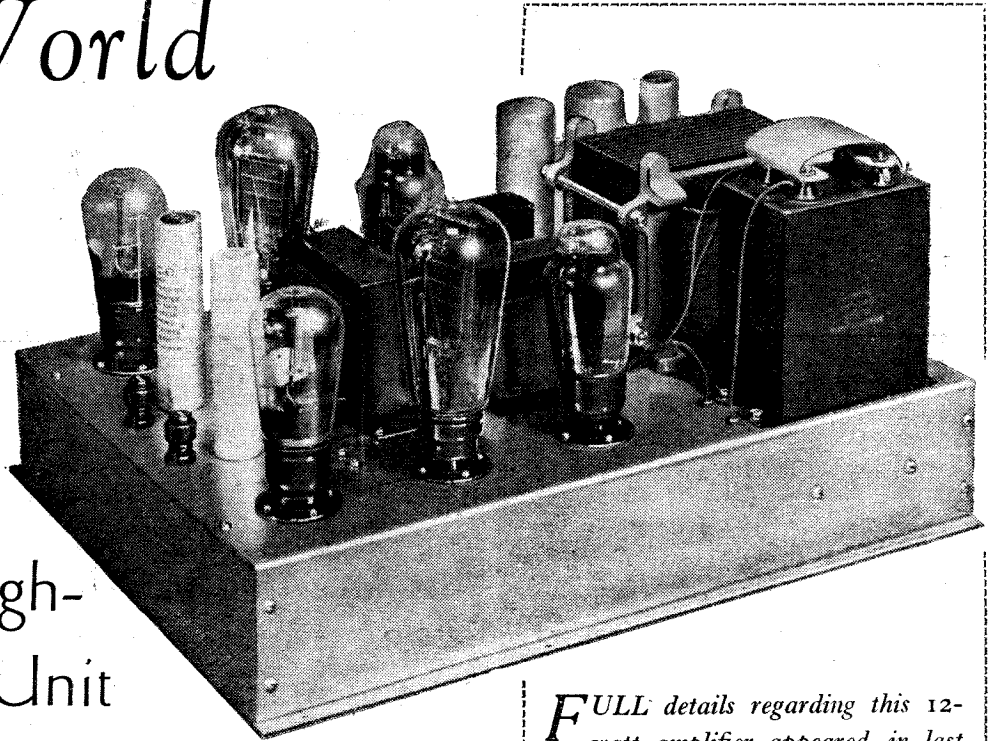
Our issue of May 1st will be in the nature of a souvenir of twenty-five years: a milestone on the road which lies ahead.

# Wireless World PA Amplifier

## Construction and Operation of a High- Quality 12-watt Unit

(Concluded from page 335 of last  
week's issue)

By W. T. COCKING



*FULL details regarding this 12-watt amplifier appeared in last week's issue of "The Wireless World," and in this article the construction and operation are dealt with in detail. The amplifier is one which is well adapted to the needs of those requiring large volume, and will be found particularly suitable for operating several loud speakers and also for home-recording purposes.*

**T**HE tone-control circuit fitted to the feeder-unit permits the bass response to be raised and the treble response to be raised or lowered at will. The results obtainable are shown by the curves of Fig. 3, in which the full-line curve is the normal

positions in which the switches are set any of the five different curves in the treble region can be obtained in conjunction with any of the three curves in the bass region. Thus no fewer than fifteen different response curves are obtainable at will.

In general, for high-quality reproduction when the apparatus is used in conjunction with a receiver the normal response curve should be used, but if the receiver gives any appreciable degree of sideband cutting the treble should be increased. On gramophone, however, with nor-

recording; the treble response should be flat or reduced to avoid needle scratch.

When the amplifier is used with recording apparatus, the ability to increase the treble will be found extremely useful. In most cases, the best results will be secured by recording with a flat bass characteristic and the maximum rise in the treble. In reproducing records cut in this way, a rising bass characteristic is needed and a falling response in the treble in order that the overall response shall be flat. The reproduction of the various frequencies is then as good as if a flat characteristic were used both for recording and reproducing, but there is a marked diminution of needle scratch.

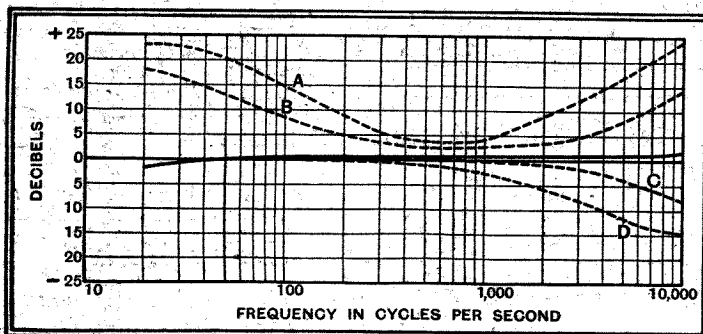


Fig. 3.—The overall frequency response curve of the amplifier and feeder-unit is shown by the heavy line, while the dotted curves indicate the effect of the tone-control system.

overall response of the amplifier with its feeder unit. At as low a frequency as 20 c/s, the response falls by 2.4 db. only as compared with that at 400 c/s, while at 10,000 c/s it is actually +0.8 db. The dotted curves show the effect of the tone control, curve A giving the response when both bass and treble controls are set for full lift, and curve B when they are set for reduced lift. At 50 c/s, a maximum lift of 20 db. is obtained, and in the intermediate position an increase of 13 db., while at 10,000 c/s the figures are 24 db. and 14 db. Curves C and D show the effect of the treble control in reducing the upper register, with the bass control set for normal response. It should be clearly understood that according to the precise

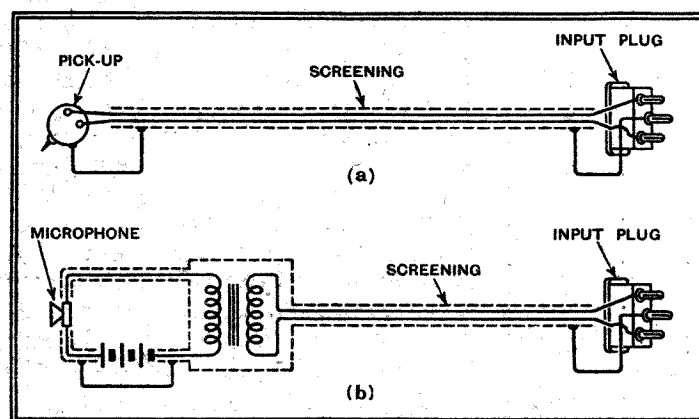


Fig. 4.—The connections to the input plugs of a pick-up and a microphone are shown here.

mal recordings and pick-ups, the bass response should be increased to compensate for the deficiencies of

With the switches specified, the tone controls will be found to be quite silent in action and to have no appreciable effect

**"Wireless World" PA Amplifier—**

on the volume. It is important, however, to note that it is necessary to take great care to avoid amplitude distortion being caused by any apparatus, such as a pick-up, which precedes the feeder unit, if the ability to increase the treble response is to be any advantage. This is because if the input is distorted, the rising characteristic increases the percentage of harmonics. Thus, suppose that the input waveform is at 1,000 c/s and contains

harmonic 2.45 per cent. If the rising characteristic is used to correct for a falling characteristic in the loud speaker, of course, there will be no increase in the harmonic content of the actual sound output, but if it is used to correct for side-band cutting in a receiver, and the distortion is due to the detector, then it will certainly appear. The indiscriminate use of a rising characteristic is thus to be avoided, but there are many occasions when it can be usefully employed.

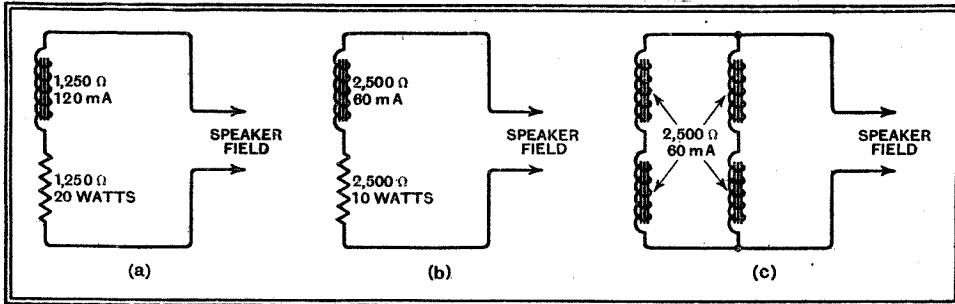


Fig. 5.—The connections for single 1,250 ohms and 2,500 ohms field windings are shown at (a) and (b) respectively, while the method of energising four 2,500-ohm fields is indicated at (c).

1 per cent. of both second and third harmonics, and that the full treble lift is being used. The second harmonic in the output will become 1.7 per cent. and the third

The actual construction of the amplifier is entirely straightforward and needs no description beyond the remark that the high-voltage smoothing condensers have

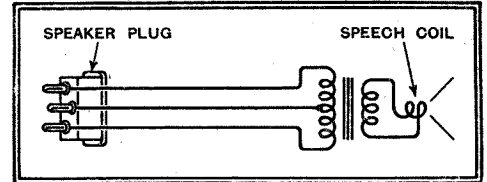
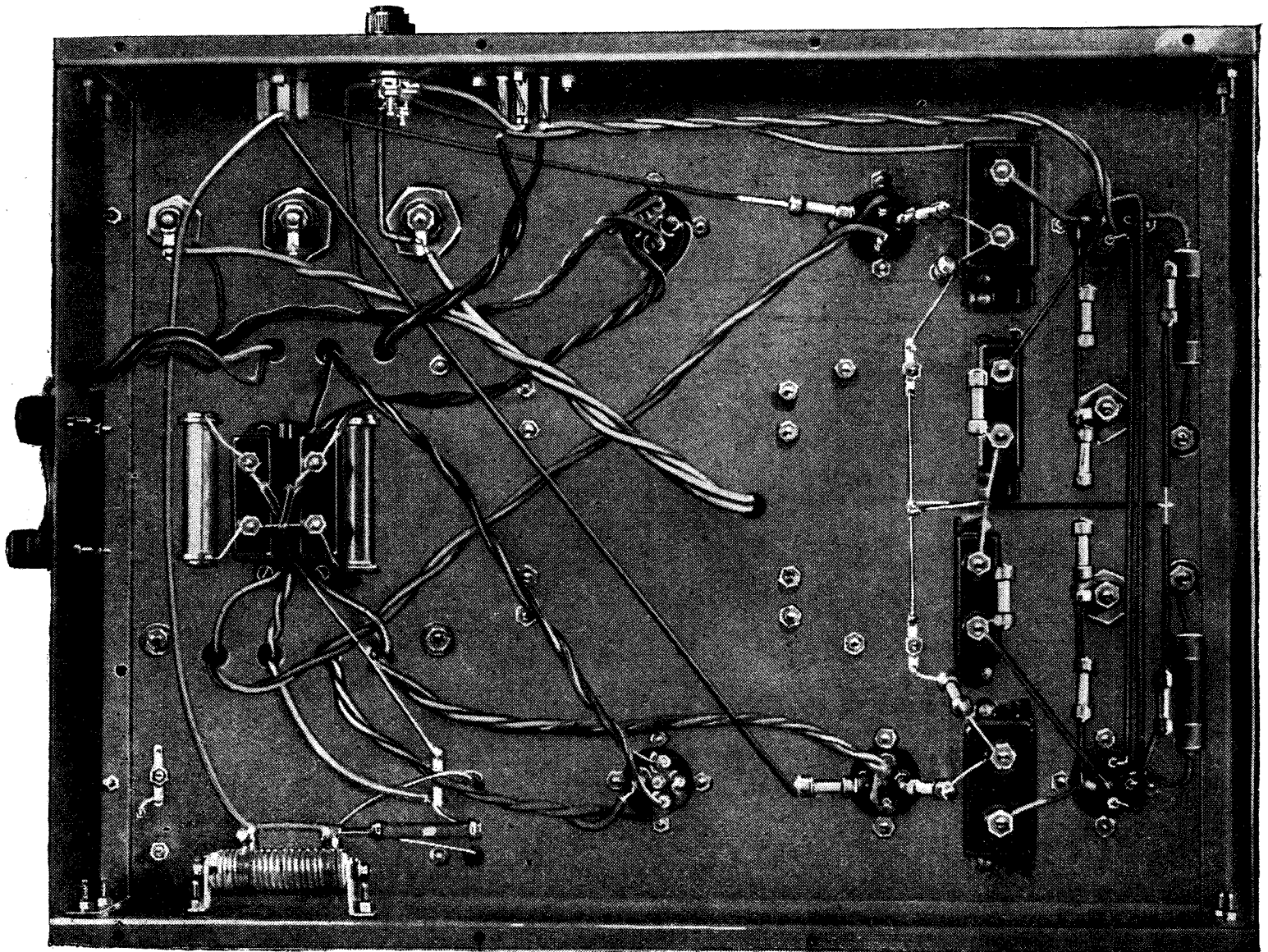


Fig. 6.—The primary of the output transformer should be joined to the speaker-plug in the way shown here.

their terminals protected by a strip of Presspahn or other convenient insulating material. The uses of the equipment are also obvious. The input to the feeder-unit should be by means of screened leads connected as in Fig. 4, a microphone being preferably energised by a battery to avoid hum troubles. The connections between the feeder unit and amplifier can be made with twisted flex and can be up to two feet in length, for the two units should not be immediately adjacent. Should it be found that hum appears when the tone control is set to lift the treble, it is due to pick-up by L from the mains transformer, and it can be avoided by moving the feeder-unit.

Turning now to the loud speaker, a single 5,000-ohm 60-mA field or two in



Underneath the amplifier chassis, where all the small components are housed,

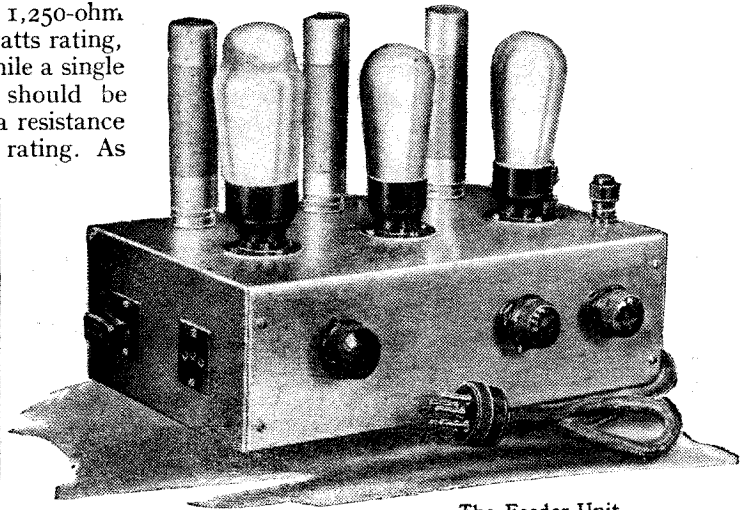
**"Wireless World" PA Amplifier—**

parallel can be connected directly to the "field" terminals provided, as also can a single 2,500-ohm 120-mA field, or two series-connected 1,250-ohm 120-mA fields. A single field winding of this last type

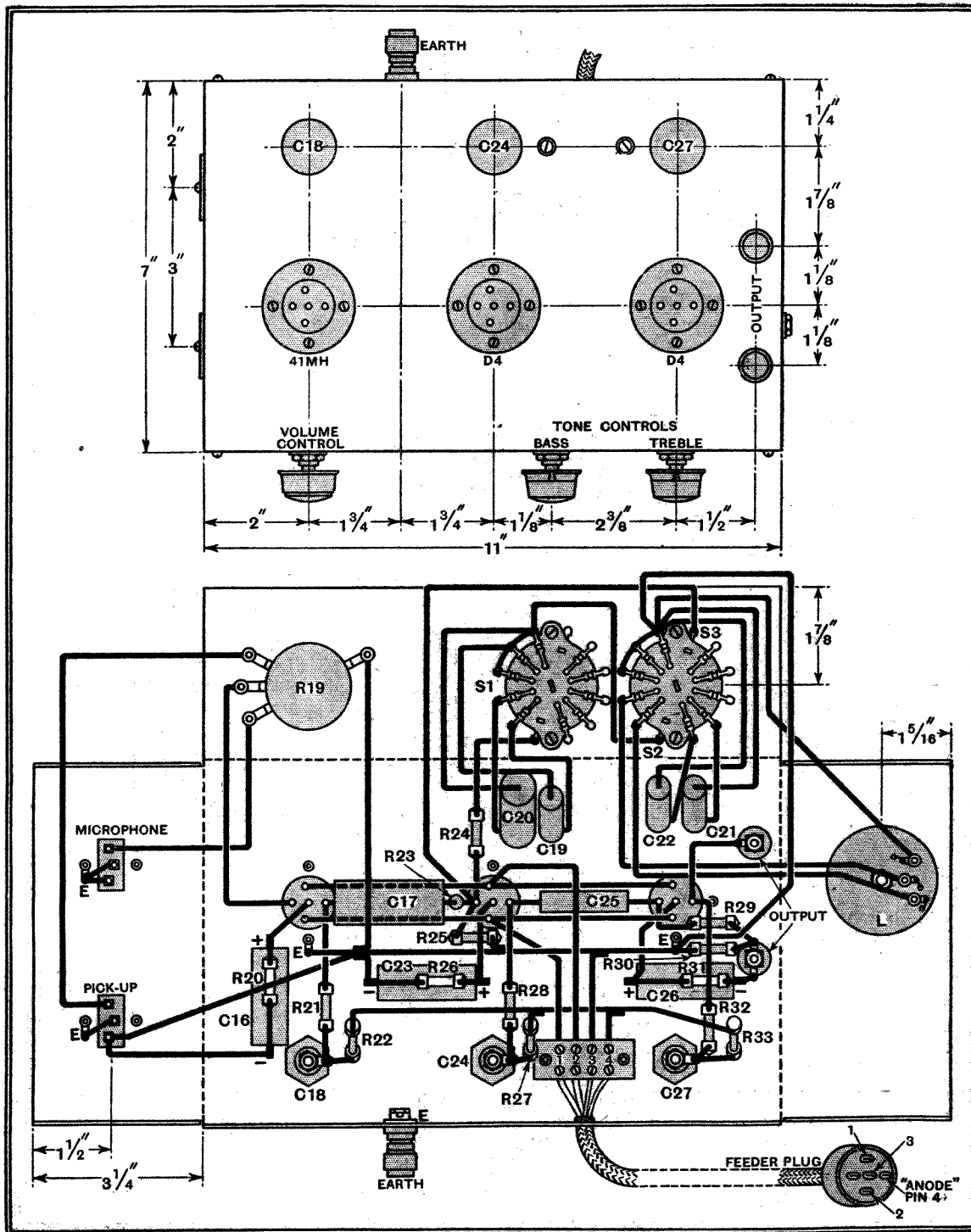
must be connected with a 1,250-ohm resistance of at least 20 watts rating, as shown at Fig. 5 (a), while a single 2,500-ohm 60-mA field should be connected as at (b) with a resistance of not less than 10 watts rating. As

VOLTAGES AND CURRENTS.				
Valve.		Anode Volts.	Cathode Volts.	Anode Current. (mA)
Output (1)	PP5/400	430	33.5	66.5
Output (2)	PP5/400	433	33	64
LF (1)	MHL4	130	3.2	4.15
LF (2)	MHL4	130	3.0	4.0
PC	D4	155	70.0	1.5
LF	D4	140	2.5	2.0
TC	41MH	170	1.8	1.3

With speaker field drawing 120 mA.



The Feeder-Unit.



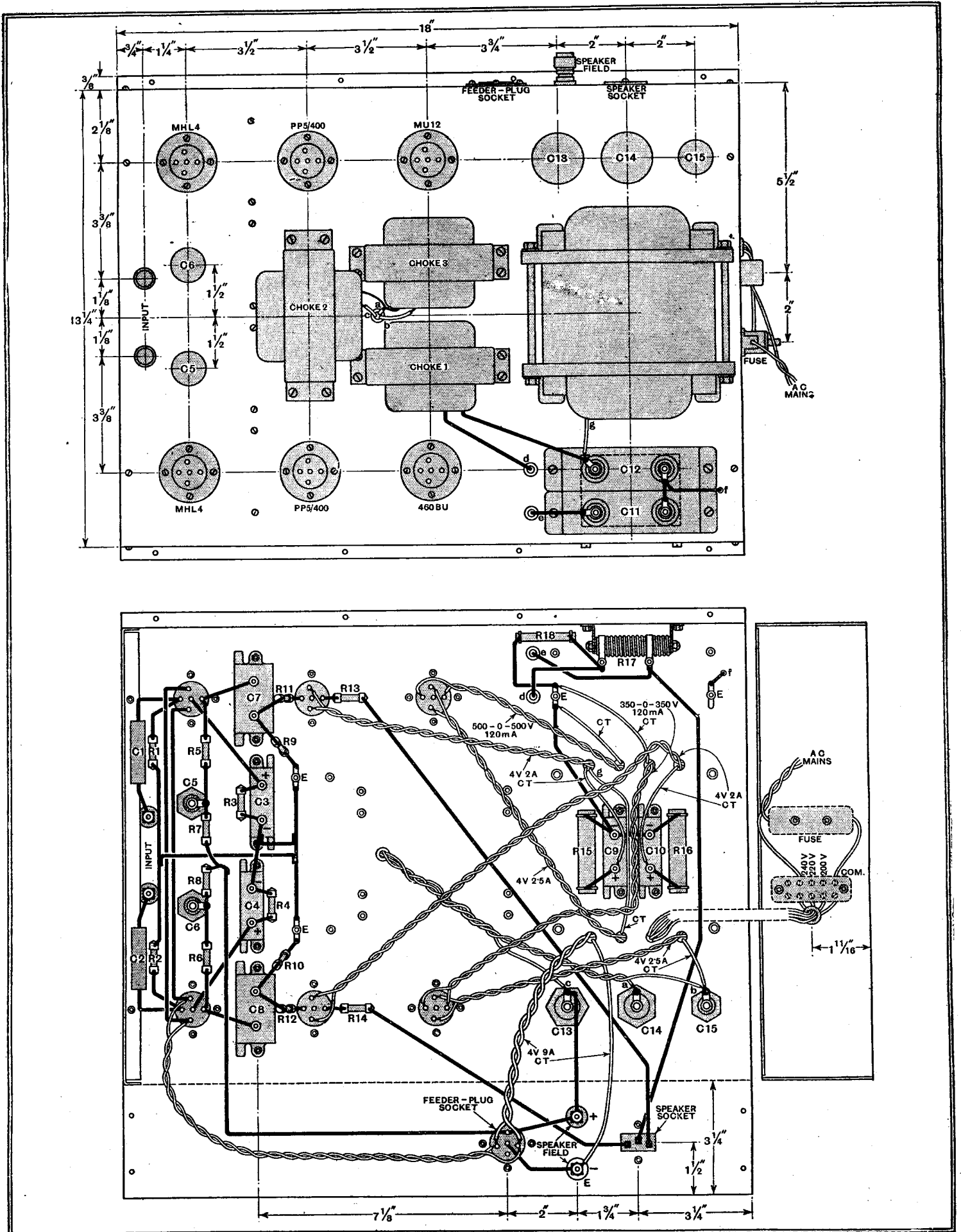
Full details are given in this drawing of the construction and wiring of the feeder-unit.

many as four fields of this rating can be energised by connecting them in series-parallel as in (c). It should be noted that 120 mA can only be drawn for field current when the amplifier is used with the feeder-unit. When current for working a receiver is taken from the equipment, it will usually be possible to draw only 60 mA for field windings. It will be noted that even when the feeder-unit only is used, the total current drawn from the rectifier exceeds 120 mA when this current is taken for the field supply. The overload is not great, however, and should not lead to a material reduction in the life of the rectifier.

The output stage requires a load impedance of 6,000 ohms obtained by means of a transformer connected as in Fig. 6. The ratio of the transformer can be calculated by dividing 6,000 by the speech-coil impedance and taking the square root of the result. The transformer should, of course, be of high quality with a good frequency response and capable of handling a power of 12 watts without introducing distortion. A primary inductance of about 40 H is adequate.

In cases where several loud speakers are used the speech coils can all be connected in parallel if they are all of the same type. The effective speech-coil impedance to be used in calculating the output transformer ratio is then the figure for one coil divided by the number of speakers. Where dissimilar loud speakers are used, however, each must be provided with its own transformer. The figure of load

# LAYOUT OF COMPONENTS AND WIRING CONNECTIONS



Practically the whole of the wiring is carried out on the underside of the baseboard.

**"Wireless World" PA Amplifier—**

impedance used in calculating the ratios should then be multiplied by the number of speakers.

Suppose, for instance, that two 15-ohm speakers are being used. The speech coils can be paralleled, and the combined impedance is 7.5 ohms, so that the transformer should have a ratio of  $\sqrt{6,000/7.5}$

be impracticable, however, on account of the leakage inductance, and a compromise of about 60 H will generally lead to the best results.

The placing of the output transformer is not important. In general, with a speaker having a speech-coil impedance up to about 15-20 ohms, it should be placed with the speaker and any extension leads run

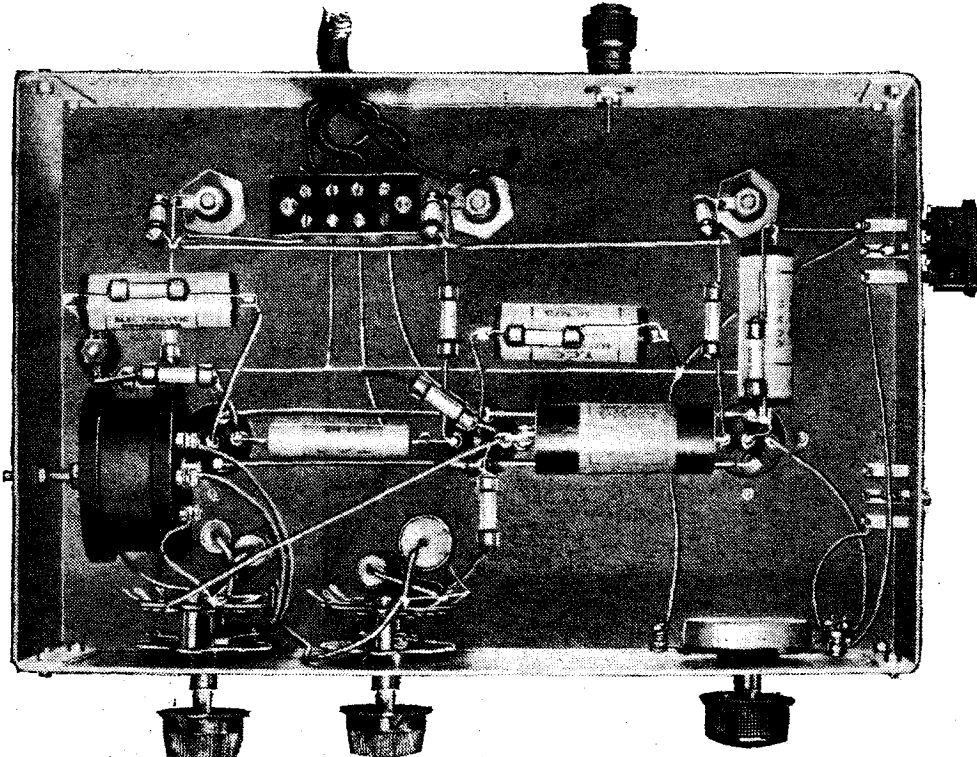
ing the comparatively small number of wireless sets in use in the country, Italy is now extraordinarily well served by broadcasting. Rome has three stations, Naples one, Bari two, Milan two, Turin two, and Genoa, Trieste, Florence and Bolzano one a-piece. The second Rome station will also be using a power of 120 kilowatts in the near future.

Another huge station due to be opened shortly is Marseilles-Provence, which will be rated at 120 kilowatts. It is sure to provide good reception in this country and its coming will be welcomed by those listeners who look to the Continent to provide a proportion of their alternative programmes.

I am glad to note the disappearance from the medium wave band, which may be temporary, though I fervently hope that it is permanent, of some of the small Belgian private stations which have been a distinct nuisance in the past on account of their wavelength-wandering habits. They can't have served any particularly good purpose even in their own country, for their output power was minute. They have certainly been nuisances so far as other countries were concerned owing to the heterodynes and the jamming for which they were responsible from time to time.

It is understood that Sweden is to erect a new 100-kilowatt transmitter at Malmö. Hitherto the southern part of Sweden has not been too well served and the new station should make all the difference. Swedish stations come in well in Great Britain, and the big Malmö transmitter should provide us with a good medium for the reception of the excellent programmes that Sweden's broadcasting authorities send out.

D. EXER.



The feeder unit seen from below.

$= 28.25-1$  instead of the 20-1 ratio which would be needed for a single speaker. If one speaker of 15 ohms is used with another of 5 ohms, then two transformers are needed. The 15-ohms speaker requires one having a ratio of  $\sqrt{12,000/15} = 28.25-1$ , while the 5-ohms one needs a ratio of  $\sqrt{12,000/5} = 49-1$ . The two transformer primaries should be connected in parallel, and, strictly speaking, each should have an inductance of twice the normal figure, or 80 H. This is likely to

in the transformer primary circuit. With a higher impedance speech coil, however, it is perfectly practicable to run the leads in the secondary circuit, provided that heavy conductors are used, and the transformer can then be mounted with the amplifier.

Separate full-size blue prints of the amplifier and the feeder unit are available from the Publishers, Dorset House, Stamford Street, London, S.E.1. Price 1s. 6d. each post free.

## DISTANT RECEPTION NOTES

**Y**ET another Bristol reader offers an explanation of the reason why at my station Lahti is almost unreceivable though Americans come in more than usually well. I expressed surprise some weeks ago that this should be so, mentioning that my house was at the bottom of a narrow Chiltern valley lying between ranges of hills running from south-east to north-west. The screening effect of the hills to the northward may be responsible for my failure to make much of Lahti; but if that is so why shouldn't the southerly ranges blanket me from American transmissions? This correspondent suggests that Lahti would be received by the ground wave, from which one set of hills would screen me effectively, but that U.S.A. transmissions would come in by the sky wave, to which the other hills would not act as a screen.

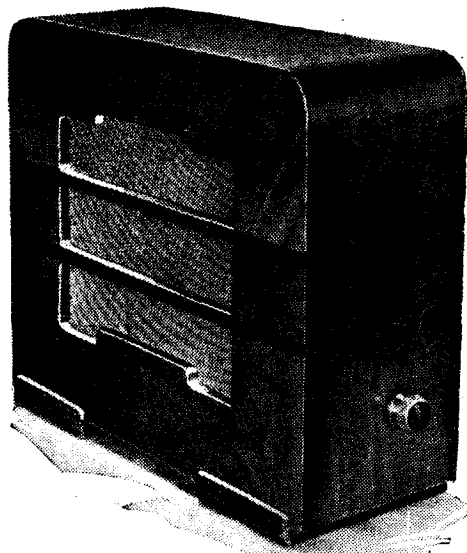
I don't think that this explanation fills the bill, for I can hardly believe that those who

receive Lahti in this country do so by means of the ground wave. Longwave reception, however, is rather a law unto itself, for we know that such transmissions are much less affected by conditions of daylight and darkness than those made on the medium waves. Still there undoubtedly is a longwave "sky" ray, otherwise the "Luxembourg effect" could not occur.

It will not be long now before Rome I goes up to 120 kilowatts. The new transmitter is nearing completion and should provide excellent reception throughout this country, for the present 50-kilowatt plant has for long been one of the easiest continental transmissions to tune in and one of the most strongly heard. Very soon now Bologna will have its new 50-kilowatt transmitter at work, and once this is in operation and Bolzano has increased its power (as it will any time now), the Italian broadcasting scheme will almost be complete. Consider-

## A New Wharfedale Speaker

**T**HE unit in this new extension loud speaker is of the latest Wharfedale "Bronze" type with aluminium alloy magnet. Special attention has been given to the requirements of the leading makes of set in designing the matching arrangements and



Wharfedale "Super Bronzian" extension loud speaker.

the speaker is available without transformer at 6os. for low impedance circuits and with universal transformer at 67s. 6d. for sets requiring high impedance output conditions.

Both models are equipped with the "Truqual" volume control which maintains constant impedance and avoids variation of high note response with different settings of the control.

# New DC Mains Output Triode

THE users of DC radio receivers and radiograms have always been at a disadvantage with their AC brethren by reason of the limitation imposed by the voltage of their supply mains. The nominal voltage of DC mains ranges between 200 and 250, according to localities, giving an average supply voltage of 225, and this is further reduced by the subtraction of the bias for the valves and HT smoothing.

To obtain the maximum power output from the receiver at this voltage a pentode output valve is usually used, owing to its sensitivity and to the low bias voltage required. At the same time, however, it is generally conceded that the pentode requires a great deal more care in the design of the associated circuit and components than is the case with the triode. In particular, the output transformer must be carefully chosen if the upper musical frequencies are to be reproduced naturally and the load impedance has a critical value for minimum distortion.

The substitution of a triode for the pentode, while reducing the sensitivity of the output stage, leads to more faithful response without critical adjustments, and the valve is more good-tempered under varying circuit conditions.

The conventional output triode for AC

# Output Triode

## THE MAZDA PP3521

corresponding modification in the characteristics is unavoidable. With the directly heated filament the lower bend of the grid-volts—anode-current curve is sharper owing to the fact that it obeys a "5/2 power" law. Indirect heating results in a longer tail to the curve which approximates more to a lower power law. The difference is slight but is nevertheless noticeable on comparison, and necessitates the use of a working point higher up the curve than would be the case in a directly heated output valve.

The Mazda PP3521, of which the characteristics are given in Fig. 1, has been designed on the lines mentioned above with particular regard to a high output at moderate anode voltages. The valve is illustrated in Fig. 2, and is seen to follow conventional power valve design with the exception of the indirectly heated cathode, which is of the "AC/DC" type operating at 35v. 0.2 ampere.

The maker's rating is as follows:—

Max. Anode Volts..	250
Mutual Conductance ..	9.0 mA/V*
Amplification Factor ..	6.0*
Anode AC Resistance ..	660 ohms*
Max. Dissipation..	15 watts
* At 100 volts anode and zero grid volts.	

The valve is fitted with a standard 7-pin base, customary in AC/DC valves, and the connections are:—

Pin 1	Blank	Pins 4 & 5	Heater
" 2	Grid	" 6	Cathode
" 3	Blank	" 7	Anode

For use as a single output valve, two sets of operating conditions are

given:—

Anode Volts ..	175	200
" Current (mA) ..	60	70
Grid Bias (volts) ..	22.25	25
Optimum Load (ohms) ..	2,800	2,000
Power Output (watts) ..	1.5	2.3
Input Volts (RMS) ..	15.8	17.5

The maximum anode dissipation is 15 watts, and it will be noted that the above figures are chosen to be slightly within this value. In order to avoid the possibility of exceeding the maximum wattage rating with different mains supplies it is advisable to arrange taps for the anode voltage as well as for the heaters.



Fig. 2.—The Mazda PP3521 output triode.

The resistance of the grid-cathode circuit should be kept low, and, including any stabilising resistance, should not be higher than 150,000 ohms. The valves should be individually self-biased with a resistance of 360 ohms by-passed with the usual condenser of approximately 50 mfd., but this value may be modified, depending on the degree of low-note reproduction required.

### Valves in Push-pull

Under push-pull conditions the output obtainable is greater than twice that of a single valve, owing to the higher degree of harmonic distortion permissible in the individual valves. It should not be forgotten, however, that strictly speaking the harmonic distortion only cancels out completely in the case of accurately matched valves. The degree of total harmonic present is governed by the degree of matching of the valves.

Referring to the curves of Fig. 3, which show the available power output, the anode load can be reduced to a value giving as much as 8 per cent. second harmonic with a corresponding increase in power output. For a single valve working at an anode voltage of 200 and a current of 70 mA, a load of 2,000 ohms is preferable, as variations between valves become more apparent at lower anode loads. With push-pull, an anode to anode load of 3,000 is recommended.

The curves of Fig. 4 show the output obtainable with push-pull operation with a quiescent feed current of 70 mA per valve, self-bias being employed.

Curve A represents the condition for an input equal to the quiescent bias (25 volts peak per valve). Due to the curvature in the characteristic, the anode current will increase when an input swing is applied to the valve, thus increasing the working bias.

Curve B illustrates the power output when the input swing has been readjusted to a value sufficient to swing to zero grid volts. The input swing required to give Curve B will depend upon the anode to anode load, as the anode current rise will increase as the anode to anode load is de-

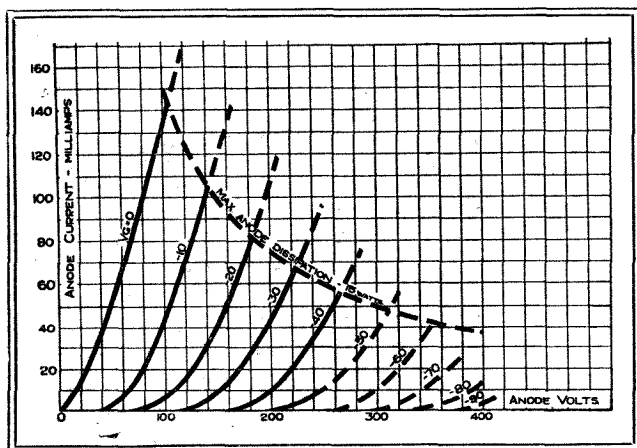


Fig. 1.—The anode-volts—anode-current characteristics of the PP3521 valve.

circuits employs a directly heated cathode, the bias being obtained from a resistance inserted in the lead to the centre-tap of the heating transformer. With a valve intended for use on DC, of course, this is not possible, and the advantages and stability of a self-bias circuit can only be obtained with an indirectly heated cathode. The alternative of separate battery bias need not be seriously considered, as the deterioration and frequent adjustment of such an arrangement detract from the smooth running of the all-mains set.

In changing the design of the output valve from direct to indirect heating, a

**New DC Mains Output Triode—**

creased. For an anode to anode load of 3,000 ohms the input swing had to be increased to 26.9 volts peak per valve.

Twice the power output given in Fig. 3 will be the power output that will be obtained on transient inputs for push-pull working, while Curves A and B of Fig 4 illustrate the power output that can be obtained on inputs of constant magnitude.

The distortion curves plotted on this sheet represent the total audio harmonic present in the output, and this only represents the con-

It will be observed that a greater anode efficiency, i.e., ratio of power output to power input, can be obtained by using lower anode loads and feed currents.

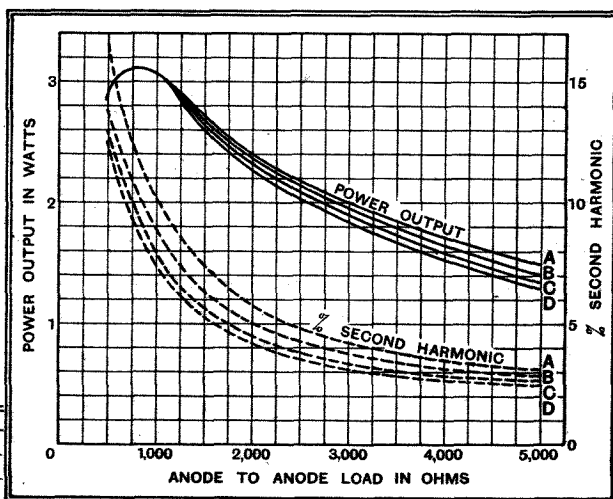


Fig. 3 (Above)—The variation of power output with load impedance for a single valve is shown here. Curves A, B, C and D are for anode currents of 60, 65, 70, and 75 mA. respectively.

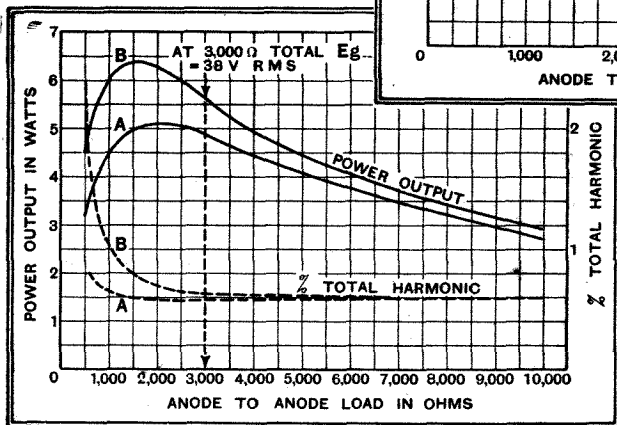


Fig. 4 (Left).—The performance obtainable when two valves are used in push-pull is illustrated by these curves.

dition with two practically matched valves. The distortion actually present in a given push-pull stage will depend entirely upon the degree of matching between individual valves, but in any combination the distortion present should be under five per cent. when the valves are used under the recommended conditions.

“Lower anode load” should not be confused with the so-called low-loading conditions, for which the valve is not designed. The values of load and feed current recommended have, however, been selected to take care of variations between valves, and to eliminate the necessity for accurate matching.

the other. With a superheterodyne, however, it is received without any interference whatever.

**The Model Station**

Unless any unforeseen snags crop up later, which seems unlikely, Lisburn's success will probably make it the model for the B.B.C. stations of the near future as the older Regionals and Nationals are rebuilt. Unfortunately, it will not be possible to build replicas of the Lisburn aerial everywhere. Brookman's Park, for instance, is no great distance from several aerodromes, and for that reason the Air Ministry will not allow a height greater than 200ft. for its masts. The Lisburn main aerial is 475ft. in height, and it has a sliding “top-mast” by means of which another 75ft. can be added. When the London Regional is rebuilt, as I foreshadowed a week or two ago in these notes, it may be necessary to find a new site for it if a mast of the Lisburn type is to be erected. But it will not be an easy matter to find a site where this can be done, since there are so many aerodromes around London and so many aerial routes into them.

**Safety First**

A SAD fatality recently occurred when a man, who was apparently adjusting a friend's wireless set, received an electric shock which caused his death. It was stated at the inquest that he was sitting with the set on his knees when he suddenly collapsed and died. The all-mains receiving set of good make and good design is a perfectly safe thing to use, but like most other mains appliances it does demand certain elementary precautions. No one who has not a considerable knowledge and experience of electricity should ever attempt to fiddle with the internal parts of a receiving set whilst it is connected to the mains. Some people are very much more susceptible to electric shock than others, and these should be particularly careful. I know many people who think nothing of a couple of hundred volts, but I am one of those unfortunates who can receive quite a nasty shock from a 60-volt battery, whilst touching the terminals of one of double that voltage leaves my fingers and forearms tingling for some little time afterwards.

# Random Radiations

**Wireless and the “National”**

FOR the control of the traffic in the Aintree neighbourhood on Grand National day the police made extensive use of short-wave wireless. Observers equipped with portable transmitting and receiving sets were stationed at key points along the various routes to the course, and were able to report just what the volume of traffic was at any given moment. Thanks to these reports it was possible to divert part of the stream to other routes when certain roads looked like becoming unduly congested. At some distance from the course itself the streams of cars were split up when necessary, with the result that hold-ups and delays were less frequent than they otherwise would have been. This system was an experiment, but on the whole it worked out very well. It certainly opens up big possibilities for the future, for, quite apart from race meetings and other such big assemblies, the traffic on our main roads is becoming increasingly heavy and more difficult to control without the aid of wireless. On a recent Sunday, for instance, the number of cars passing a point on the Portsmouth road was 3,600 an hour, or one a second.

By “DIALLIST”

**Lisburn's Success**

WHEN I wrote last week I had not received any reports of reception of Lisburn, but they have been coming in thick and fast since. There is no doubt that the anti-fading aerial is proving a magnificent success in the station's own area, or that Lisburn is covering not only Northern Ireland but a very considerable proportion of the rest of the country as well. Like myself, many people living in different places in England find that the new station comes in strongly and well at all times when it is working. It is, I see, officially stated to be operating with its full 100 kilowatts, though it was understood some time ago that it would open with about 70, keeping the remaining 30 in reserve. The station may prove somewhat disappointing to dwellers in England who try to receive it with straight sets of a not very selective kind, for it is sandwiched between Genoa and Bordeaux-Sud-Oeust, whilst Hilversum No. 2 is only two channels away on the one side and the Poste Parisien the same distance away on

**Kipling to be Broadcast**

DURING his lifetime Mr. Rudyard Kipling would never allow any part of his works to be broadcast. This was a great pity, for Kipling's stories and poems would have provided some magnificent material for readings in the past. We shall, though, be able to hear some of them in the future, for it was announced the other day that his executors had arranged with the B.B.C. that the latter might draw upon a considerable part of his works for broadcasting purposes. I very much hope that one of the earliest of his tales to be read before the microphone may be “Wireless,” which I mentioned some months ago in these notes. That story was written when wireless was in its very earliest days, long before the war, and still longer before the advent of broadcasting. Yet it shows such an amazing appreciation of the possibilities of wireless that it would make a wide appeal to-day. Kipling is one of the most graphic writers that ever lived, and for that reason alone his writings are admirably suited to broadcasting, which, until television comes, must make its appeal to the ear alone and not to the eye.



# CURRENT TOPICS

## EVENTS OF THE WEEK IN BRIEF REVIEW

### Amateurs' Trans-channel 5-Metre Link

FOLKESTONE radio amateurs have effected what is believed to be the first international two-way communication by non-professionals on 5 metres, their station, G2FA, having established regular contacts with the French stations, F8NN and F8WY, of Boulogne.

R7 signals have been received both ways. G2FA transmits regularly from 8 to 10 p.m. on Tuesday, Wednesday and Thursday on 56 megacycles. Between 11 a.m. and 1 p.m. on Sundays transmission is on 56 and 1.75 megacycles.

### "Radio Denmark"

TO assist identification Danish announcers have been instructed to precede remarks at the microphone with the words "Radio Denmark," instead of the familiar call: "Kobenhavn - Kalundborg og Danmarks Kortbolgesender."

### Norway's Broadcasting House

OSLO is to have a new Broadcasting House designed on modernistic lines to the plans of Mr. Niels Holter, the prize-winner in an architects' competition.

### Rome's New Aerial

THE Rome short-wave station has just been adorned with a new aerial which takes the form of a metallic sphere 10 metres in diameter on the summit of a 800ft. mast. The mast, incidentally, has been designed to resist a 90-mile gale. The previous mast was uprooted by a gale.

### Civilian Operators for Police Wireless

THE Chief Constable of Liverpool has asked the Watch Committee to authorise the appointment of three civilian wireless operators for duty in connection with the police wireless system that has been operative in the city for the past three years.

The idea behind this move is to replace the three police officers now engaged at the transmitting station, who, the Chief Constable considers, could be better employed on the police cars and motor cycles already fitted with radio apparatus. Further, the new men, being highly qualified technically, will be available to deal with maintenance and repairs.

### Switzerland's Radio Week

SWITZERLAND is to have a "radio week" in the autumn in order to popularise wireless among the mountain folk. This "great week of propaganda" will run from October 25th to the 31st.

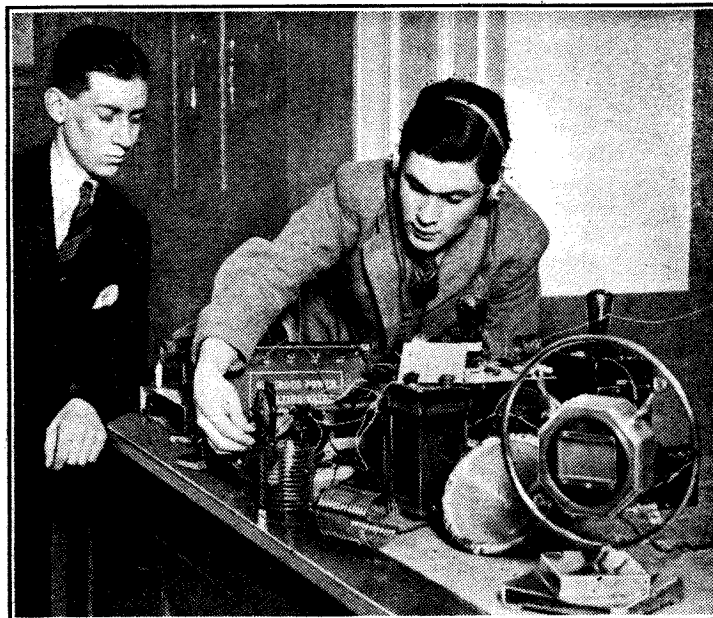
### Two-Channel Reproduction

SOME very entertaining experiments were included in a lecture-demonstration by Mr. P. G. A. H. Voigt to the R.S.G.B. at the Institution of Electrical Engineers on March 25th. Starting with a demonstration of a sound of complicated wave form emitted from an electric motor horn suspended in front of his loud speakers, the lecturer went on to some of the fundamental problems of sound reproduc-

ing the original with the reproduced version transmitted through a single channel and also through two microphones with independent amplifiers and loud speakers separated by the same distance as the microphones, viz., 5 feet. It is believed that this was the first demonstration of two-channel reproduction to an audience in this country.

### Kaiser as Radio Listener

THE ex-Kaiser Wilhelm II is reported to have become "a convert to radio." Until two months ago the ex-Kaiser is understood to have been strongly prejudiced against broadcast reception, but in order to follow the funeral ceremonies of the late King George V he ordered the installation of a receiver at Doorn.



FIRST PRIZE in the Hobbies Exhibition at Purley County School was won by this 40-metre short-wave transmitter constructed by the prefects.

tion, with particular reference to baffle and horn loaded diaphragms. During this period there was an interruption while Mr. Voigt retrieved a concertina which some facetious individual had purloined and was playing in a passage behind the Lecture Theatre. Subsequently it was revealed that both the motor horn and the concertina were loud speaker reproductions, and there was little doubt from the applause which followed the revelation that most of the audience had been well and truly deceived.

Later in the evening Brian Lawrence and his Lansdowne House Orchestra played in an adjoining room and members had an opportunity of compar-

So impressed was he at the beauty and dignity of the broadcast that, it is reported, his prejudice against broadcast reception has "completely disappeared."

### National Field Day

AMATEUR radio's most important outdoor event of the year—the annual National Field Day organised by the Radio Society of Great Britain—is this year to be held on June 6th and 7th. A score of portable stations will be operating in all parts of the British Isles. Additional points are obtainable if other portable stations are worked, in preference to fixed stations.

### Sir Joseph Petavel

THE death of Sir Joseph Petavel, K.B.E., D.Sc., F.R.S., on March 30th removed a figure renowned in the world of science, and one more or less intimately connected with the development of radio. As Director of the National Physical Laboratory since 1919, Sir Joseph was ultimately responsible for Government research in radio as in other directions. The late Director's signature was a familiar appendage on radio apparatus test reports issued by the Laboratory.

### Spain Calls British Listeners

TWO special short-wave broadcasts for British listeners will be given by the Madrid station, EAQ, on 30.43 metres on Saturday, April 25th, states the International Short-Wave Club. The two transmissions are as follow:—

- (I) 20.00 to 20.30 (G.M.T.).
- (II) Midnight to 00.30 (G.M.T.).

Reports will be welcomed by the broadcasting organisation, which will send special verification cards to all enclosing a stamp with their report.

### "Beam" Broadcasting

A BEAM aerial is to be a feature of France's newest Regional station, viz., Bordeaux-Cantenac, which is about to be erected at Cantenac in the Gironde Department. The new station, which is intended to replace the existing transmitter at Carrère, will be sixteen miles north-west of Bordeaux in the midst of the celebrated vineyards of Medoc and will have a power of 120 kilowatts.

The station, operated by cable from the studios in Bordeaux, will have a beam aerial with the object of projecting transmissions over land.

The use of a beam aerial raises the question whether such a station can, in the truest sense, be regarded as broadcasting. It also suggests lines on which a new European wavelength scheme might be entered upon under which, by the use of highly directive antenna, numbers of stations could employ the same wavelengths without conflicting with each other.

# Delayed Detector Operation

## METHODS OF OBTAINING QAVC

By J. H. REYNER, B.Sc., A.M.I.E.E.

**I**NTER-STATION noise suppression can be obtained in two distinct ways. The first is to operate the detector normally and to vary the amplification of some portion of the low-frequency chain in accordance with the signal received, so that until a certain limiting strength is obtained the amplification is negligible and the set remains quiet. Some of the considerations involved in this form of circuit and the disadvantages attached thereto were reviewed in a previous article.<sup>1</sup>

The second method is to suppress the operation of the detector itself until such a time as the signal strength has reached a satisfactory value. The simplest and most obvious way of achieving this is to place a negative bias on the signal diode. Any station of which the peak value does not exceed the negative bias is then not rectified, and consequently is not transmitted to the output valve.

This system, crude though it is, is a very simple arrangement which can be quite effective. It is used in some commercial receivers. The obvious disadvantage of the method arises with a station which does not exceed the negative bias by very much. In such circumstances the diode will function for weak modulation, but the stronger modulations will not be properly rectified, with consequent distortion. Theoretically, therefore, the system should only be used where all normal stations provide a really large voltage at the detector. Unfortunately, with such an arrangement the amplification of the noise is usually also fairly considerable so that the negative bias on the detector diode requires to be increased, which defeats the object in view.

What is required is some arrangement

<sup>1</sup> "Practical QAVC Circuits," September 27th, 1935.

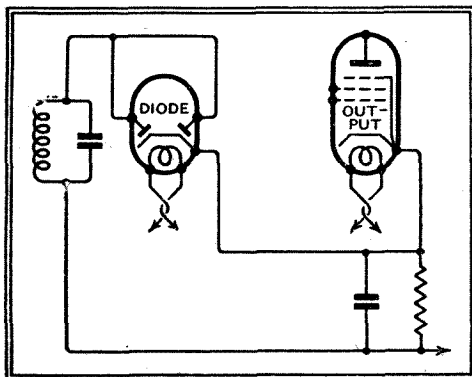


Fig. 1.—One method of obtaining muting consists simply of the application of a negative bias to the detector.

*INTER-STATION muting is undoubtedly a desirable fitting to highly sensitive broadcast receivers, but it is not one which it is always easy to include. In this article some of the chief methods and their characteristics are discussed in detail.*

whereby the detector diode can be given a large negative bias until the arrival of a satisfactory signal. Then provision must be made to reduce the detector bias swiftly to zero or some value approaching zero, so that the detector then functions in a normal manner. If this can be done the method has distinct advantages. In particular, since the amplification subsequent to the detector is not affected, signals which only just operate the "squench" are as faithfully handled as the stronger local signals.

One simple method is to use the change in the anode current of the various controlled valves to provide the necessary alteration in bias. The application of AVC bias to the valves preceding the detector causes the anode current of these valves to decrease. Hence, if this anode current is passed through a resistor in a suitable position it will develop a voltage which can start at a fairly large negative potential and decrease, on the arrival of a signal, to a sufficient extent to permit the detector to operate.

Such a simple system is shown in Fig. 2, in which a simple double-diode detector is used. One diode is employed for AVC and the other for signal rectification. The cathode of the diode is connected to the cathodes of all the HF and IF valves, which are not independently biased, and the total current of all these valves is then passed to earth through the resistance R. The AVC diode is tapped down across a portion of this resistance in such a way as to provide the required delay voltage, while the signal diode is connected to full negative so that it is considerably over-biased.

On arrival of a signal which operates the AVC, the anode current of all the controlled valves decreases. A relatively small change of grid bias on a vari-mu valve causes quite an appreciable change

in anode current, and as there are several valves all in parallel the change in voltage drop on the resistance R is sufficient to knock off most of the bias on the signal diode.

A trial of this arrangement in an actual receiver gave fair results. It was definitely better than a simple biased diode, and it introduces little or no additional complications. The diodes may, if desired, form

part of a DDT, in which case the grid of the triode section must be returned to a suitable tap on the cathode resistor.

The arrangement in Fig. 2, however, has a number of disadvantages, the principal one being that the cathode current of the preceding valves is not all controlled by the grid bias. The oscillator anode current, for example, remains tolerably constant, while the screen currents do not

vary to the same extent as the anode currents. Hence, the voltage across the resistance R does not fall completely to zero as it should do.

Secondly, if a DDT valve is used, the bias on this valve decreases to a small value when the signal arrives, which may result in some LF distortion, while the fact that all the HF cathodes are tied to the common bias resistance is liable to introduce some instability.

### Separate Control Valve

It is apparent, therefore, that the use of a separate valve for providing the necessary release is desirable, and it is relevant at this point to refer to the method successfully used in *The Wireless World* 1936 Monodial A.C. Super, which was described in the issues of July 26th and August 2nd, 1935. A circuit of this arrangement may be briefly described as follows.

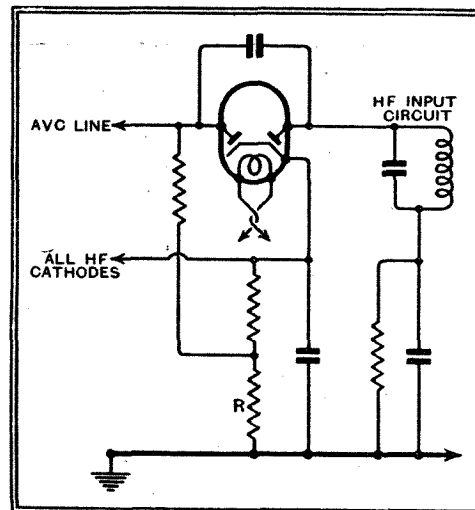


Fig. 2.—If the detector is biased from the AVC controlled valves the bias falls on tuning in a signal.

**Delayed Detector Operation—**

The secondary of the last IF transformer is fed to the signal diode with a load resistance at the low potential end returned to cathode in the usual way. The top of the load resistance, however, is connected to the anode of the muting valve, the cathode of which is taken to the slider of a potentiometer in the cathode of the DDT. The resistance of this cathode network is such as to develop 30 to 40 volts, the actual voltage being variable by adjustment of the slider. Under no-signal conditions the muting valve is so arranged to take anode current so that its anode-cathode resistance is small. Hence the point A is nearly at the same potential as the cathode of the muting valve, placing a large negative bias on the signal diode and rendering it inoperative as a rectifier.

On the arrival of a signal sufficient to develop a voltage on the AVC line, the grid of the muting valve runs negative, causing the anode-cathode resistance to rise to a high value and effectively disconnecting the point A so that the negative voltage on the signal diode is removed and the valve operates normally. AVC voltage in this particular circuit was provided from the preceding valve, which was a WD40 having its own diodes.

Given a suitable muting valve, the

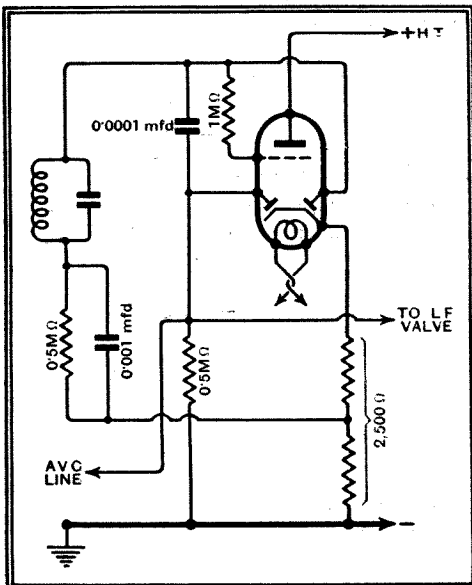


Fig. 4.—A circuit employing a duo-diode-triode which gives detection, AVC, and muting.

arrangement is highly effective, and it has the advantage that the control of the muting (*i.e.*, the adjustment of the negative bias on the signal diode when no signals

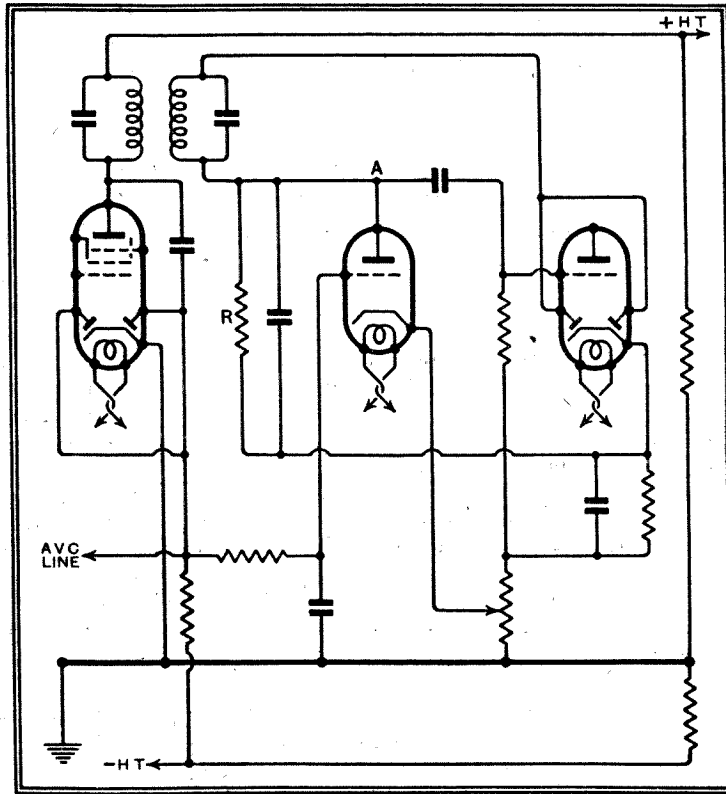


Fig. 3.—The method of QAVC used in the 1936 Monodial AC Super. A special valve is fitted for muting.

are being received) can be carried out independently of the delay on the AVC line (which, in the circuit in question, was obtained by connecting the cathode of the IF valve to a point a few volts up a network across the HT supply).

It is important that the muting valve should have a sharp cut-off and be free from "tail." The potential of the point A is determined by the potentiometer action of the resistance R and the muting valve in series, and if under working condition the valve still has a resistance of the order of a megohm or so, the signal diode is left with an appreciable fraction of the original negative voltage and thus does not release properly. Since this only involves a current of some 20 to 30 microamps through the valve, it is by no means an impossible condition, though the success obtained with the 1936 Monodial shows that the difficulty is not a serious one.

The modern receiver, however, which often has to work under conditions of serious interference, calls for requirements in the way of muting which are unusually severe. It is not sufficient to arrange for the set to be suppressed on signals below the ordinary AVC delay, for the interference itself may be capable of producing a greater voltage than this. What is really required is a release arrangement operated from the signal independently of the AVC, which should then come into action after the signal has been admitted and has exceeded the release voltage by a few volts. In other words, the delay on the AVC line should be reckoned over and above the signal voltage necessary to release the detector.

**Simple but Effective**

The circuit of Fig. 4 shows an attempt to obtain this condition. A double diode-triode is used for the sole purpose of detection and muting. The cathode of the valve contains a bias resistor of about 2,500 ohms, with which value, at normal HT voltages, the valve will pass about 4 milliamps, giving a total bias of 10 volts. The signal is applied to one of the diodes, the return being taken to a tap about one-fifth of the way down the cathode resistance and the grid of the triode section is connected to this diode through a decoupling resistance and condenser. Thus the valve has effectively 2 volts on the grid which will give the 4 milliamps mentioned with about 200 volts on the anode. The second diode is used as the signal diode and this is tied to the full negative potential so that it is normally inoperative.

On the arrival of a signal sufficient to

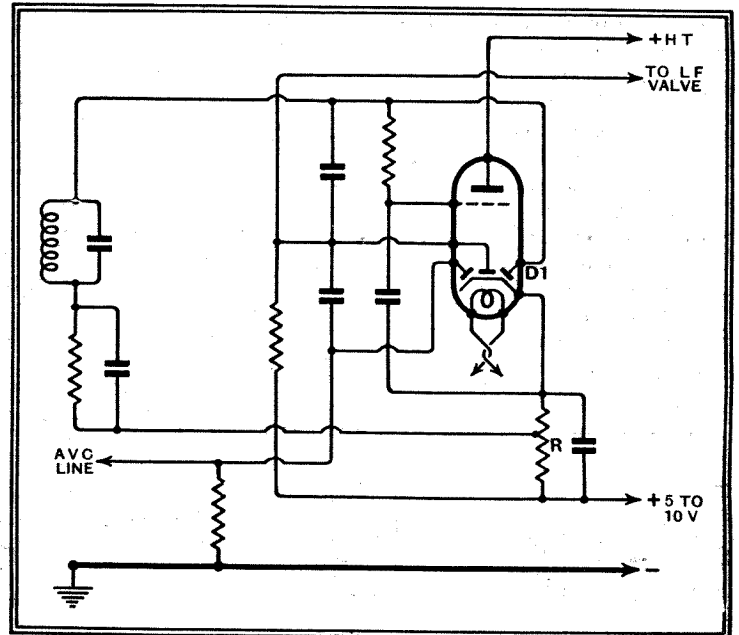


Fig. 5.—With the aid of a triple-diode-triode delayed AVC can be obtained.

overcome the 2 volts delay on the first diode, the voltage on the grid of the triode section will run rapidly negative, causing the anode current of the valve to be reduced practically to zero—an additional grid bias of 2 to 3 volts is quite sufficient

**Delayed Detector Operation—**

to do this—releasing the signal diode which therefore functions quite normally without distortion, provided that the rest of the constants have been satisfactorily arranged.

With this simple arrangement the AVC for the preceding valve is taken from the signal diode, so that there is no delay. Using a triple diode-triode, however, or separate diodes, it is possible to arrange delayed AVC as shown in Fig. 5. Here, the bottom of the cathode resistor for the DDT

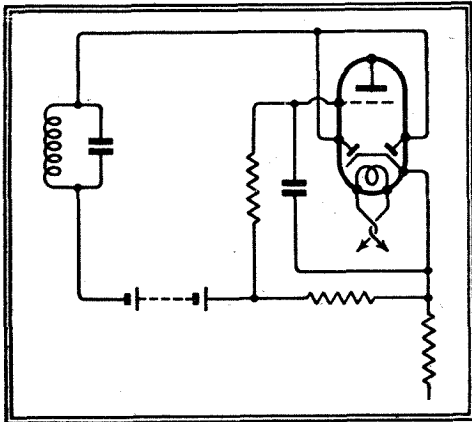


Fig. 6.—The use of a battery for delayed muting simplifies the circuit.

is taken to a suitable positive point on a potentiometer across the HT supply (or, if desired, to a suitable point on the bias resistor for the output valve). The signal diode is returned to this point, thereby being negatively biased in the same manner as before, while the AVC diode goes direct to earth, so that it has still a negative delay to overcome after the release voltage has operated.

This arrangement is simple and effective, its major disadvantage being that the delay on the release diode  $D_1$  cannot be

more than  $1\frac{1}{2}$  to 2 volts because this diode is tied directly to the grid of the triode section. Any increase in this delay, therefore, will make the grid negative and reduce the anode current, which defeats the operation of the circuit, since the object is to have an anode current which is normally reasonably large and which is immediately reduced to zero on the arrival of the signal.

Moreover, the reduction of the anode current of the valve flowing through R reduces the negative bias developed on the top portion of this resistance, and this to some extent offsets the negative voltage developed by the signal, so that the run-back tends to be limited. With a small release voltage this effect is negligible, but if any attempt is made to use a large delay here the two effects tend to counteract one another.

**Battery Bias**

The most satisfactory arrangement to overcome this difficulty is to use a battery for the negative delay on the release diode, as shown in Fig. 6. The current taken from this battery is, of course, negligible, since it is merely acting as a source of negative potential, while the grid can then be tied through the decoupling and diode resistances direct to the cathode of the valve. With this arrangement 9 volts delay, or even more, can be applied to the release diode, and such an arrangement is very effective under conditions of severe interference. The grid of the valve is not affected by the delay voltage and therefore runs negative on quite a small input signal and stays squelched so long as the signal persists.

It should perhaps be pointed out that the DDT used for this arrangement is relieved entirely from all functions of LF amplification. The triode section is used for the sole purpose of providing the

release of the signal diode and cannot be employed for any amplification. It is, however, possible to use it as a tuning indicator by including a meter in the anode circuit, and this is often a convenient arrangement with AC/DC sets where any voltage drop in the anode circuit of the ordinary valves is to be avoided.

In an attempt to overcome the need for the battery in the Fig. 6 circuit, various schemes have been tried, and for the sake of completeness an arrangement is shown in Fig. 7 using a double diode-triode and a separate diode, all for the purpose of providing quiet AVC. If the voltage developed at the signal diode is sufficient to feed direct into a high slope output pentode, then the extra complexity is not serious.

The same general principle is used. The signal diode is returned to the bottom of the cathode resistor of the DDT, this point being slightly positive to the earth line in order to provide additional delay for AVC purposes. The AVC diode is then returned direct to earth as already explained.

The release diode is now entirely separate and for convenience is fed from the anode of the preceding HF valve through a condenser in well-known fashion. The voltage across the diode resistance is applied through a decoupling circuit to the grid of the DDT triode, but the cathode of the diode is not returned to the cathode of the DDT, but to a point some volts positive in potential obtained from the potentiometer  $R_1, R_2$  from HT+. Thus, effectively, the anode of the diode is negative and the valve will not release the signal or AVC diodes until the signal strength has overcome the release voltage. It is found practicable with this arrangement to run up as high as 20 or 30 volts delay, and the results are particularly pleasing. The circuit is quite silent until a signal arrives, when it releases cleanly and sweetly with perfect quality.

**H.M.V. Demonstration Record**

THIS record has been produced with the object of providing a number of wave forms suitable for reproduction on an oscillograph. The record should be of particular interest to universities and schools, as the examples given are representative of many of the fundamental properties of sound. In all there are ten separate bands on the two sides of this 12-inch record, the catalogue number of which is DB4033.

Starting with simple illustrations of the relationship between wavelength and pitch and amplitude, the student is shown the mechanism of the production of beats between notes of slightly different frequencies, and then of the effect on wave form of the introduction of harmonics. Finally, there are examples of the quality of musical sounds, including the playing of an ascending scale passage on the mustel organ and of the same passage played on a grand piano.

The record concludes with a collection of examples of the characteristic wave forms of the vowel sounds of speech. A stroboscopic speed indicator is included, and the price of the record is 6s.

We are advised that the price of the Black Knob type K62, illustrated in the announcement of A. F. Bulgin and Co., Ltd., in the issue of April 3rd, should be 9d. and not 2d.

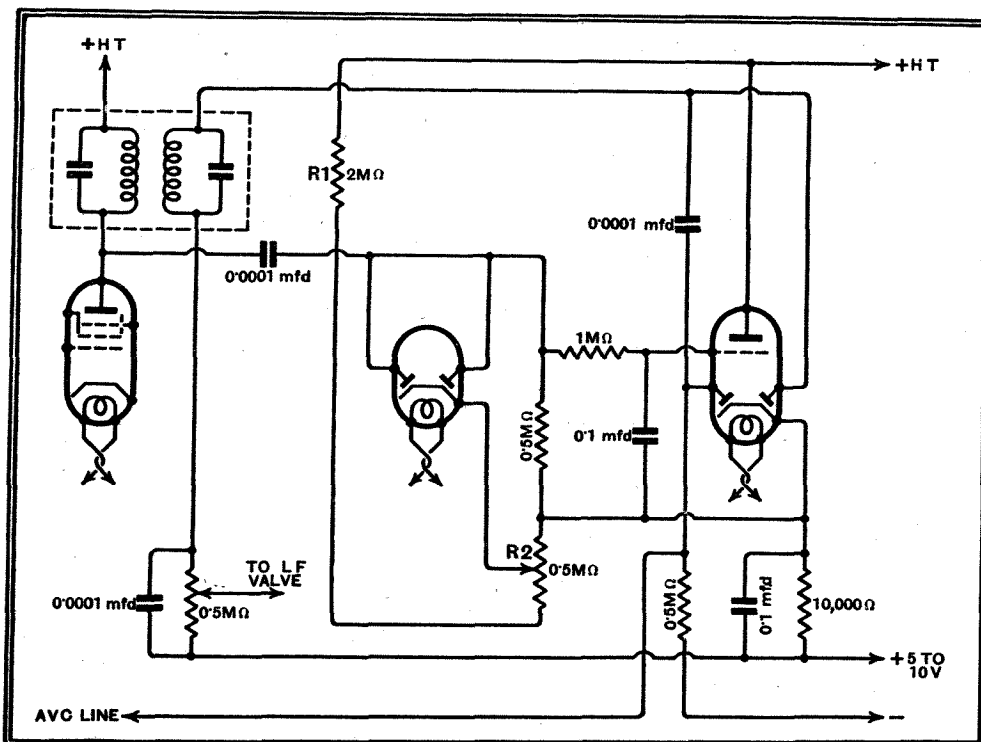


Fig. 7.—A completely mains-operated system giving delayed muting. A diode is needed in addition to a duo-diode-triode.

# Broadcast Brevities

By Our Special Correspondent

## The "West" Mystery

AT last I have discovered the reason for the continued delay over the new West Regional high power transmitter, which we have long understood the B.B.C. intends to build in Devon, so that the existing West transmitter at Washford Cross may become "Welsh Regional." Sites were surveyed months ago.

## Chief Engineer Explains

Sir Noel Ashbridge now tells me that the real reason for the delay is the difficulty of finding a wavelength.

"It depends," said the Chief Engineer, "on the wave we allocate to the North Scottish transmitter at Burghead. We don't at present know what that will be. We have a small transmitter testing up there, but the tests must be carried out over long periods if the results are to be worth while. We are not yet certain how far synchronisation will be possible."

From what I can gather, the Burghead situation may not be cleared up before the autumn, in which case the West Region may be kept waiting for several months yet.

## New Type B.B.C. Aerials?

Sir Noel is delighted with the performance of the anti-fade aerial in Northern Ireland, and future transmitters are almost certain to be fitted with a similar kind of radiator, though not necessarily of the same engineering design. The B.B.C. engineers believe they have found a less costly way of obtaining the same results.

## Sir Noel Ashbridge's Plans

The latest information on the new stations as given to me by the Chief Engineer is as follows: North Scottish, beginning its tests in the autumn, will have a power of 50 kilowatts. North East Regional will definitely operate on 100 kilowatts. London Regional is to be raised to 70 kilowatts forthwith, and will be re-equipped "some time in the next few years, the power being increased to 100 kW. or more if international agreements allow.

## North Wales Relay

The North and West Regionals have, of course, already been raised to 70 kilowatts; Scottish is to follow suit.

The North Wales Relay station is "going on well," and we may expect transmission this year. The projected Plymouth and Bournemouth transmitters

will probably be similar to the North Wales model at Bangor.

## Doings at Daventry

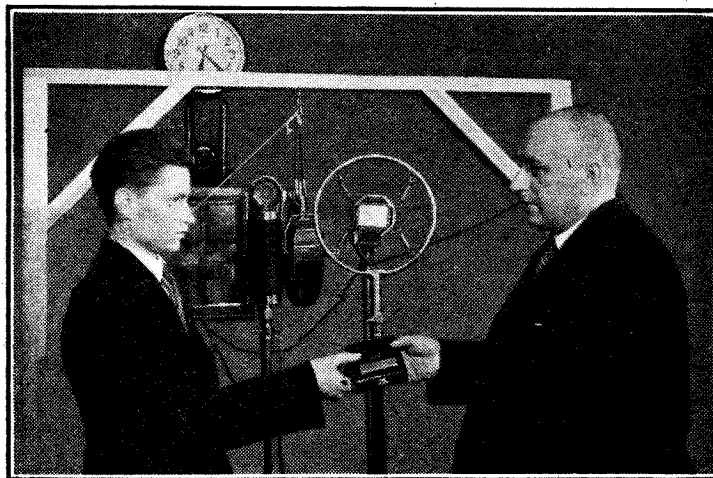
Big things are happening at the Empire station at Daventry. Yet another new transmitter—the third—is now on order, also to have a power of 40 kilowatts. Building is already in full blast at Daventry, and the reinforced service may be expected early next year.

The two existing transmitters may be rolled into one, so that there will be a total of four in operation.

## Awkward Questions

A number of parents, too, resent the notion of broadcast lessons, the feeling in many cases being that fees are paid for personal tuition—not for the reception of mass-education from a loud speaker. On the other hand, many parents have adopted the habit of listening to the broadcast lessons on their home sets, and are thus able to put awkward questions to the offspring on their return from school.

This is quite a fashionable game in the suburbs.



THE LUCKY HALF-MILLIONTH. A gold watch has been presented by the Polish broadcasting authorities to the 500,000th applicant for a wireless licence. In this picture Major Starznski, Director-General of the service, is seen handing the watch to the lucky listener, M. Dunowski, in the Warsaw studio.

## "Domination of Radio"

I AM not surprised that a percentage of the teaching profession is beginning to dread what the reporters call "the domination of radio." Naturally, schoolmasters and mistresses, or some of them, see a rival in the glib loud speaker, which bales out concentrated education while the teacher himself stands dumbly beside it, the only job left to him being to prevent little Johnny from sticking pen nibs in the speaker gap.

## The Teacher's Job

But is there no more to it than this? Those educationists who have mastered the real technique of broadcast teaching realise that the B.B.C. lessons can do no more than sow the seed. It is the teacher on the spot who waters the young plants, bends them to his will, and administers such salutary chastisement as, fortunately, the B.B.C. is unable to transmit from even the highest-powered of transmitters.

## Poor Blaris

JUST when the inhabitants of Blaris, Northern Ireland, were about to taste the wine of fame, the cup was dashed from their lips by Lisburn, the neighbouring township, whose name, rightly or wrongly, has been applied to the new Regional station.

This was rough luck for Blaris, considering that the mast-aerial actually sprouts from the Blaris municipal cabbage patch, and the seeds were sown for a deadly feud between the two communities.

## "Lisnagarvey"

At last a kind of crude justice has stepped in in the guise of the B.B.C. Engineering Department, which has decreed that the station shall henceforth carry the official designation "Lisnagarvey." Although their dearest hopes are unfulfilled, Blarisians will now die happily in the knowledge that the station will nevermore be known as Lisburn.

## Who Cares?

Not that the official name of the station matters much. It is never mentioned at the microphone; in fact, the only B.B.C. station known by the name of its locality is Droitwich. The others—Westerglen, Moorside Edge, etc.—might just as well be labelled Auchtermuchty or Sloowit for all that the public cares. All we want is good signal strength.

## Dropping Bricks

DURING impromptu debates B.B.C. officials in London listen apprehensively for dropping of bricks. At Birmingham they are more stoical; the official who organises "Midland Parliament" on Midland Regional tells me he never has any qualms—these impromptu discussions have been going on for some time, and no one has yet been indiscreet. Challenging, yes, but not indiscreet!

## The Useful "Ribbon"

The arrangements of "Midland Parliament" is interesting. Debaters sit around a square table, three on one side, two opposite, with a ribbon microphone in the centre. (This is where new double-sided microphone proves handy.) Speeches by the debaters are previously rehearsed, but after each speech three or four minutes is allowed for free discussion.

## Midland Auditions

WHAT the B.B.C. are up against at auditions is shown by a recent Midland talent-hunt. Officials visited Nottingham, Leicester, Coventry, Northampton, Derby, and Shrewsbury, hired rooms, and listened to all comers. They got between 20 and 30 "probables" out of 200 candidates. The probables are now being "re-auditioned" over the microphone at Birmingham.

At all events, this talent-search yielded one genuine "discovery," so they claim. This is a close-harmony act from Derby, the Four Rhythm Boys. They will broadcast on April 25th.

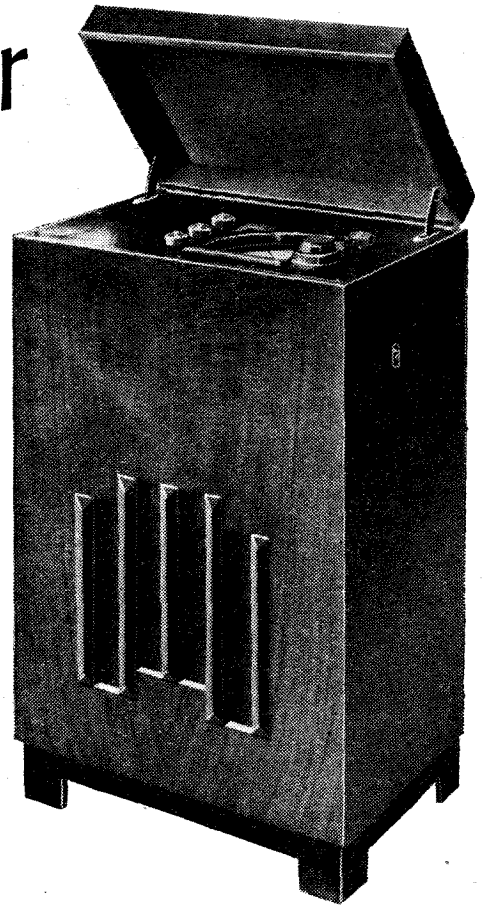
## Max Beerbohm Again

MAX BEERBOHM, the celebrated wit and caricaturist of Edwardian days, has promised to broadcast again on April 19. The subject will be "Speed," on which he feels strongly.

# Pye "Empire" Receiver

## AN ALL-WAVE SET WITH A COMPREHENSIVE SPECIFICATION

**FEATURES.** *Type.*—All-wave superheterodyne for AC mains. *Waveranges:*—(1) 13-33 metres. (2) 30-82 metres. (3) 198-560 metres. (4) 850-2,000 metres. *Circuit.*—Var.mu pentode HF amplifier—octode frequency-changer—two pentode IF amplifiers—double-diode AVC valve—pentode second detector and muting valve—triode LF amplifier—push-pull triode output valves. *Full-wave valve rectifier.* *Controls.*—(1) Tuning. (2) Volume. (3) Tone. (4) Variable selectivity. (5) Muting control. (6) Waverange. (7) On-off switch. *Price.*—28 guineas. *Makers.*—Pye Radio Ltd.



FROM the point of view of technical design, this is probably the most ambitious set which has so far been attempted by the Pye factory. It is the merit of the numerous devices giving refinement of performance, as much as the high magnification which has been provided, that will impress those who make a critical study of the specifications of the receivers they propose to buy. The push-pull triode output stage rated at 6 watts and the heavy-duty moving-coil loud speaker also give promise of satisfying volume and quality of reproduction.

Special attention has been given to the reception of the short waves, which are covered in two ranges. The quadrant-type tuning dial with a closely sub-divided degree scale at the longest arc gives facili-

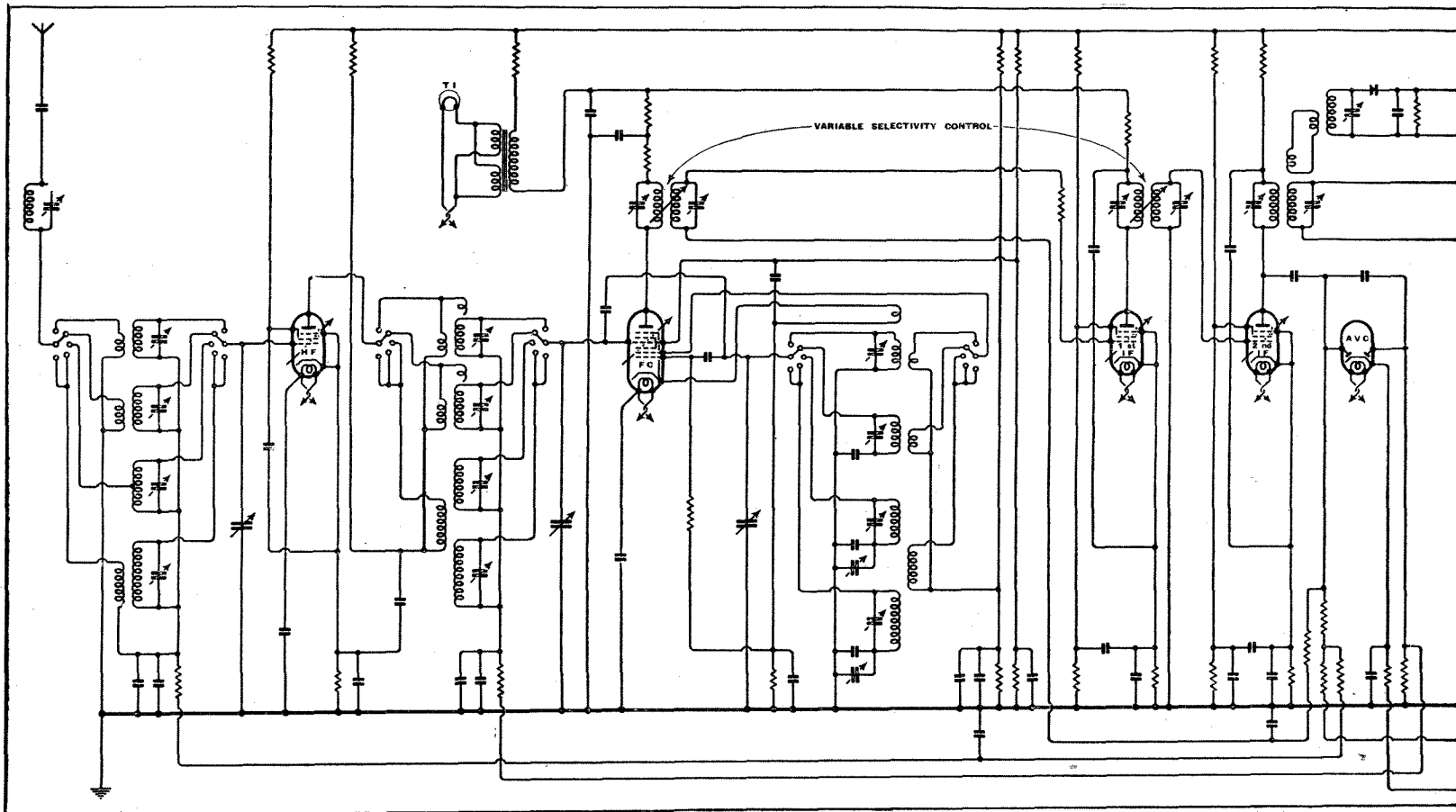
ties for accurately recording short-wave station settings. The accuracy of this scale is fully justified by the excellent mechanical qualities of the slow-motion drive, which is quite free from backlash. The drive has two speeds, and on the slow-speed knob there is a finger-tip button to facilitate rapid rotation when moving from one end of the tuning scale to the other. All the waverange scales are calibrated in kilocycles or megacycles as well as in metres. There are no station names, but a very comprehensive list of the world's short-wave broadcasting stations is included in the instruction booklet, and bands which are likely to be productive of interesting broadcast programmes are indicated by black lines on each scale.

The set is provided with variable selec-

tivity, inter-station noise suppression, and an AVC system of advanced design.

Including the rectifier, there are ten valves in the circuit, the first of which functions as a radio-frequency amplifier. A single tuned circuit precedes the amplifier on each of the four wavebands, and transformer coupling with a compensated

Notable features of the circuit include a separate AVC rectifier for the frequency-changer, variable selectivity and the use of a pentode as a suppressed diode rectifier in the second detector stage.

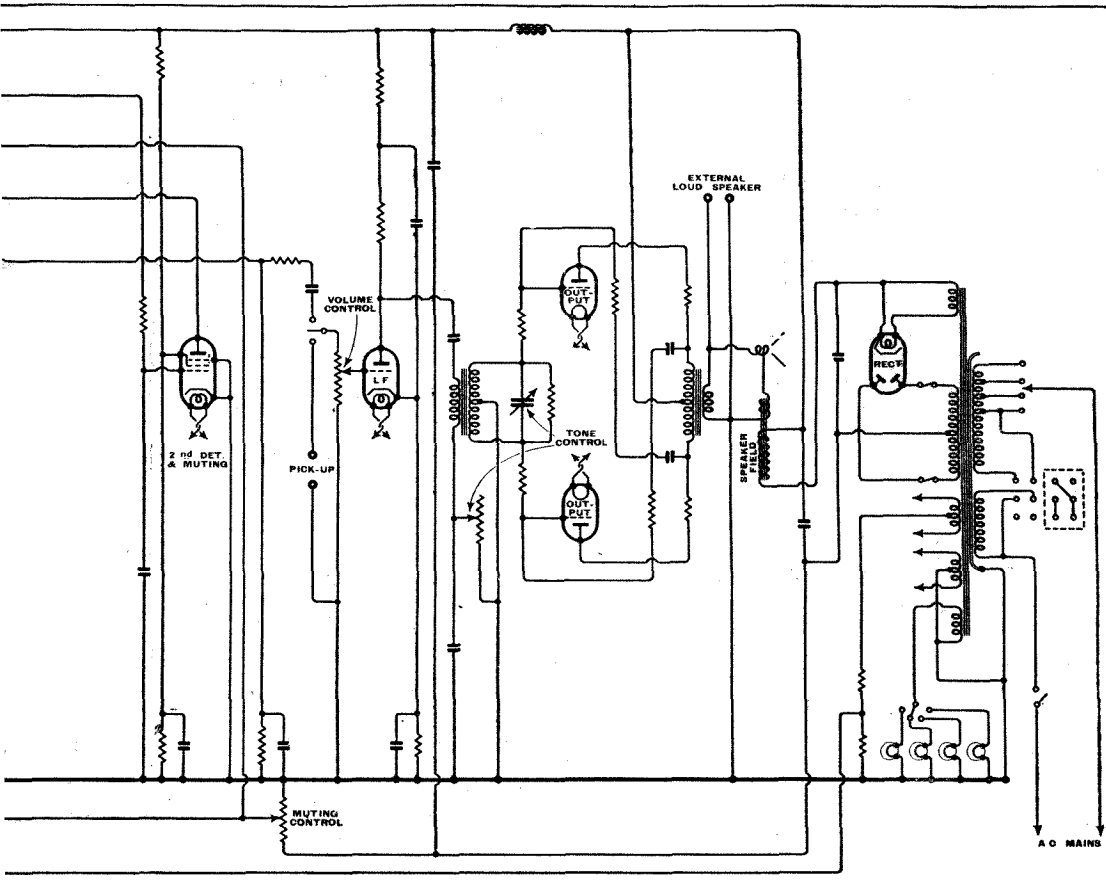
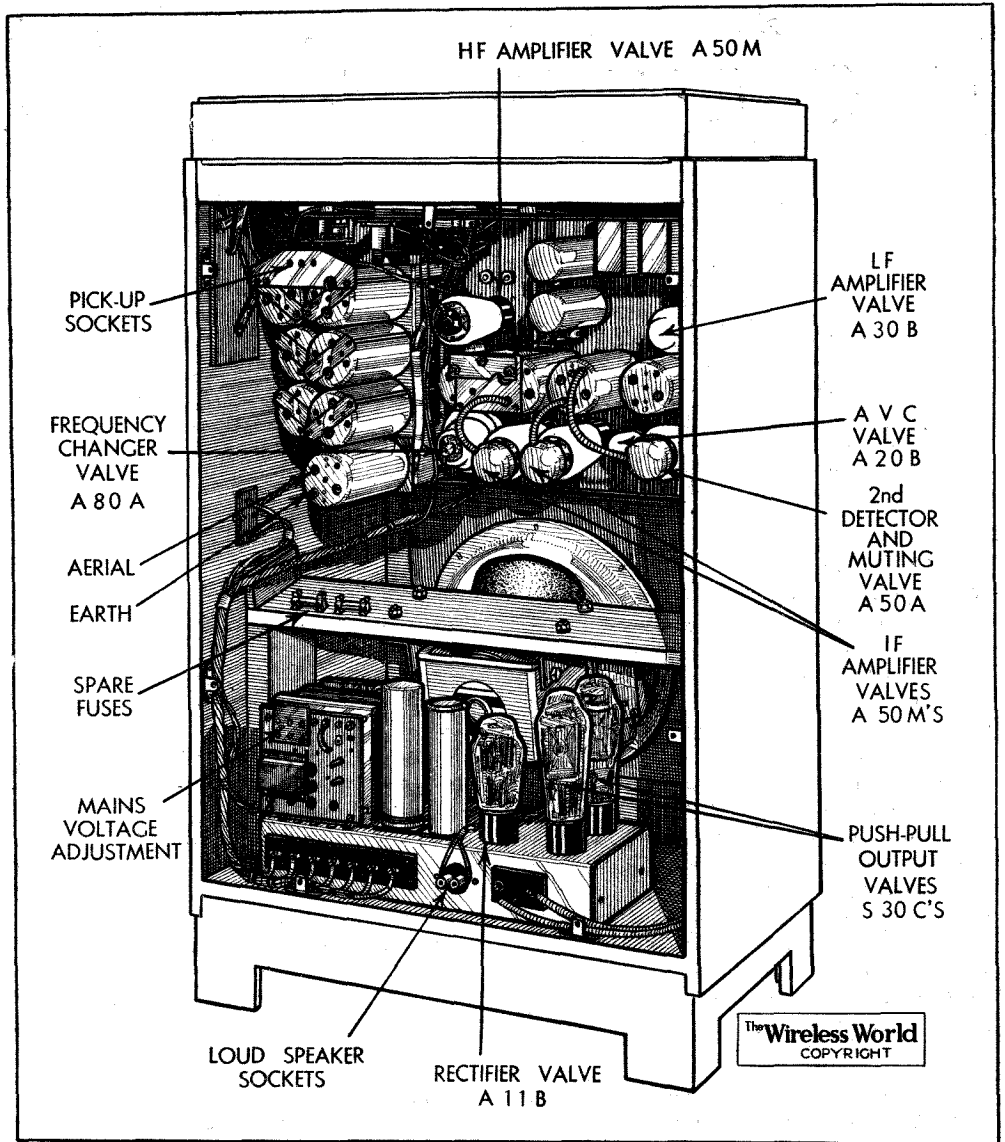


circuit to give uniformity of sensitivity throughout the range of the receiver is employed between the HF amplifier and the frequency-changer valve. The aerial lead includes a wave-trap tuned to the intermediate frequency of 465 kc/s. The frequency-changer is an octode, and on the ultra-short waveband additional coupling is provided by a coil in the cathode return lead.

**Variable IF Couplings**

Air-cored transformers with mechanically adjustable coupling between the windings are associated with the input and output circuits of the first IF amplifier. This valve is controlled from the AVC system, but the second IF amplifier operates at full magnification under all conditions. The visual tuning indicator is operated from the anode feed circuits of the frequency changer and first IF valves. It consists of a flash lamp bulb which is fed from the filament heater winding through two LF chokes. The anode current to the frequency-changer and first IF valves passes through a third winding on the same core as the pilot light chokes. As the DC current through this winding varies under the control of AVC, the degree of saturation of the iron core is changed and so determines the amount of AC passing through the pilot light bulb. The circuit is so arranged that when a station is correctly tuned the bulb gives a minimum illumination.

A separate double-diode valve is allotted to the AVC system. It takes its input from the primary of the last IF transformer, and one diode serves the frequency-changer only while the other supplies the



Some idea of the comprehensive nature of the specification is to be gained from this rear view of the Pye "Empire" receiver.

control bias to the HF amplifier and the first IF stage. The object of using a separate control for the frequency-changer is to prevent grid current in this valve from biasing back the remaining control valves which might result in a loss of sensitivity on some of the weaker transmissions received on the ultra-short waveband.

The functions of signal rectification and inter-station noise suppression are combined in the pentode valve which follows the AVC rectifier in the sequence shown in the circuit diagram. The output from the tuned secondary of the final IF transformer is applied to the anode of this valve, which rectifies as a diode. The action of the diode, however, can be suppressed by applying a negative bias to the control grid, and this is obtained from a potentiometer connected in the negative HT lead. This negative bias can be cancelled by a special rectifier circuit, including a Westector, which is fed through a linked coupling from the output IF transformer. The resonant circuit associated with the Westector is very sharply tuned and so avoids troubles due to side-band shriek.

A separate triode amplifier follows the

**Pye "Empire" Receiver—**

combined second detector and muting valve, and its output feeds the push-pull triode output valves through a parallel-fed transformer. An interesting tone control circuit is associated with this transformer. It consists of a variable condenser across the secondary winding and a variable resistance in series with the primary. These controls are ganged, the former controlling high-note response and the latter the bass. The mid-position of the control gives normal audio-frequency response. Rotation in a clockwise direction attenuates the high notes without affecting the low, and, conversely, rotation of the control in an anti-clockwise direction reduces the bass response while leaving the variable condenser across the transformer secondary at minimum.

In putting the receiver through its paces on the two short waveranges it was gratifying to note that in spite of a very creditable performance in the matter of range, background noise was much less troublesome than in many receivers of considerably lower sensitivity. The selectivity provided by the two tuned circuits which precede the frequency-changer was sufficient to eliminate second-channel interference and double-tuning points, and there were ample opportunities for appreciating the efficiency of the AVC system on these waveranges. A slight falling-off of efficiency was noticeable below 19 metres on the lowest waverange, but, even so, it was possible to tune in Bound Brook (W3XAL) on 16.87 metres.

**Low Background Noise**

On the medium and long waveranges the comparatively low level of background noise, even when the muting control was deliberately put out of action, was again a noteworthy feature of the performance. It is on these waveranges that the provision of variable selectivity is perhaps of greatest advantage, and there can be no doubt that those who have once used a set incorporating this feature will have little use for receivers in which a compromise between selectivity and quality of reproduction has had to be made. With variable selectivity it is possible to adjust the response exactly to the conditions required by each individual station, and in general it will be found possible to lean more towards a wide IF response and good quality than to knife-edge selectivity and consequent side-band cutting. As a matter of interest, however, the maximum selectivity was tested on the two Brookmans Park transmitters when using the set in Central London, and it was found possible to approach within one channel on either side of the normal settings of the stations concerned without picking up any interference from them. The set should always be tuned with the selectivity control in the high selectivity position in order to ensure accurate tuning to the station. In this connection it should be mentioned that while the tuning indicator was satisfactory for stations of medium strength, there was a tendency

for strong signals to extinguish the indicator light over rather too wide a band for really accurate adjustment.

The muting control worked smoothly, and the possibility of being able to adjust to any desired level the threshold at which stations were admitted is not the least attractive feature of this receiver.

The long-wave performance was excellent, and the Deutschlandsender was noticeably clearer of interference than in the majority of superheterodynes of similarly high performance. No trace of any self-generated whistles could be found on any of the four wavebands.

With the tone control in the mid position the balance between high and low note response is good and the increased baffle area provided by the console cabinet is undoubtedly responsible for the fact that the bass response appears to go down much lower than usual. The output stage is capable of delivering 6 watts to the loud speaker, so that there is no lack of volume at the command of the listener. At high volume levels, however, a certain harshness, apparently due to harmonic distortion, was noticeable. Rough measure-

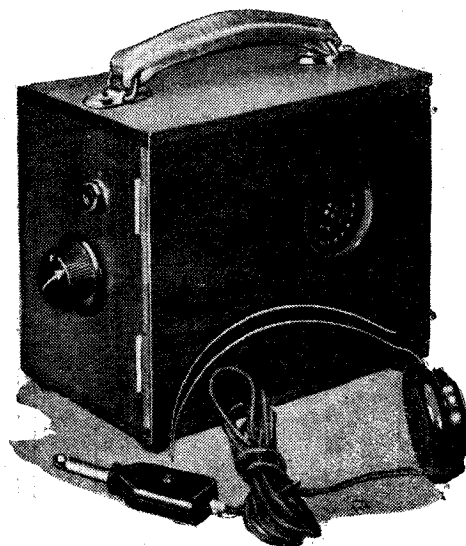
ments indicated, however, that trouble on this score is negligible up to powers which most people would agree are more than enough for the average living room.

The receiver is equipped for the addition of a gramophone pick-up, and a low-impedance external loud speaker may be fitted in parallel with or in place of the leads to the speech coil of the internal loud speaker which are plugged into sockets accessibly placed at the back of the lower of the two chassis units. The main receiver chassis is mounted at the top of the cabinet and is suspended on rubber. The lower chassis carries the push-pull output valves and the mains rectifier. The mains transformer, incidentally, is wound for 100/150-volt as well as 200/250-volt supplies and a neat reversible six-pin plug is used to adapt the transformer to either voltage range.

In conclusion, a word of praise is due to the instruction manual which includes, in addition to a comprehensive list of short-wave stations, a time zone map of the world and a reprint of the B.B.C. handbook on the Empire Broadcasting Service.

**In Next Week's Issue****Hearing Aid for the Deaf****Two Valve Microphone Amplifier Unit**

IN designing this deaf-aid unit it was borne in mind that considerable amplification may often be required to enable those whose hearing is very defective to derive benefit from apparatus of this nature. It was decided, therefore, to employ a two-valve amplifier and a microphone that combined high sensitivity with a good speech characteristic in order to ensure realistic reproduction.



Ease of operation, low upkeep cost, and, most important of all, small overall size, have all been taken into account; while only standard parts, easily procurable, are employed in its construction.

**LIST OF PARTS**

- 1 Transmitter Inset  
Siemens "Neophone" No. 13
- 1 Microphone transformer, ratio 30:1  
Savage "HB"
- 1 Valve holder, 4-pin  
Clix "Midget"
- 1 Valve holder, 4-pin  
W.B. Rigid Type
- 1 LF coupling unit Benjamin Transfeeda 8670
- 1 Electrolytic condenser, 2 mfd., 200 volts working  
T.C.C. "AT"
- 1 Electrolytic condenser, 50 mfd., 12 volts working  
T.C.C. "AT"
- 1 Volume control (wire wound), 50,000 ohms  
Claude Lyons "Clarostat"
- 1 Resistance, 3,000 ohms, ½ watt  
Bulgin HW7
- 1 3-spring automatic jack  
B.T.S.
- 1 Telephone plug  
B.T.S.
- 1 Telephone ear-piece, 2,000 ohms and head-band  
Scientific Supply Stores
- 1 HT battery, 45 volts  
Drydex X325B
- 1 LT battery, 2 volts 5 a.h.  
A.E.F. Type M7
- 2 Wander plugs and 2 spade ends  
Ealex
- Cabinet  
Peto-Scott
- Valves:  
1 XD Hivac, 1 LP2 Osram or Marconi.

**Heavier LT Current**

DUE to the use of illuminated dials and a higher average number of valves than formerly, the modern battery set often requires a somewhat greater LT current than can be effectively supplied by the small and popular "mass" type of accumulator. After reaching this conclusion, the makers of Exide batteries have decided to introduce a series of four new accumulator cells of the thin-plate type to be known by the trade name of "Hycap."



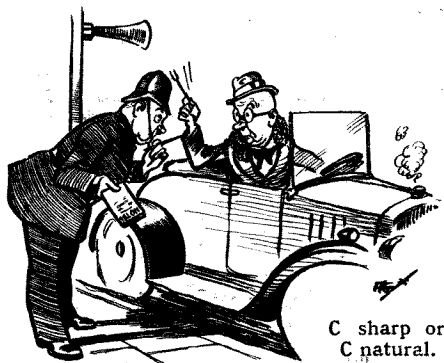
# UNBIASED

## The Radio "Cop"

THERE does not seem to be much liberty left on our roads nowadays, what with speed traps and Belisha Beacons, and if certain officials in Whitehall were permitted to have their way there would be still less. Indeed, unless those of us whose interests lie in radio as well as in the open road do not pull our socks up and do something about it we shall very likely find ourselves hoist with our own petard.

The reason for this is that certain experiments are, I understand, being conducted in the lonely fastnesses of the Welsh mountains with a novel form of wireless speed trap in which the errant motorist is caused to stand literally self-condemned.

In order to get this scheme working satisfactorily, each car or other motor vehicle would be compelled to carry on its side a small spot light, but, of course,



such a thing would not worry those in authority, who are generally only too delighted to add to our burdens. This lamp would have to be fixed at a certain height, the idea being for the beam to sweep across the lens of a special gadget fixed by the roadside at certain spots.

Behind the lens would be a row of small photo-cells, this lens being so arranged that the beam of light from a passing car would sweep across the cells one at a time. The front of the lens would, of course, be suitably hooded to prevent the entry of an undue amount of extraneous daylight.

As I have said, experiments are already being conducted with this arrangement. The cells are connected to a small ultra-short-wave transmitter, the signals of which are picked up by a wireless receiver farther up the road and converted into sound in the usual manner.

The greater the speed of the car the higher is the pitch of the note heard in the loud speaker up the road, and it is so arranged that thirty miles an hour sounds the note of middle C; if the listening constable hears any note higher than this he will, of course, at once stop the car as it comes up the road towards him.

Now this may be all very well for Welsh policemen, who have a natural gift for

determining the pitch of a musical note, but who is going to arbitrate in a dispute between a London policeman and Sir Landon Beechwood as to whether a given note is C sharp or C natural? Apart from

## By FREE GRID

this, there are innumerable snags in these proposed schemes, and I am hurrying off to the scene of action in order to investigate matters for myself.

### Electric Blanket Blues

AS the result of my detective work concerning the interference caused to broadcasting by an electric blanket, I have been inundated with complaints from all quarters accusing me of spoiling the programmes. It is quite obvious that there must be a great many of these devices at work, as the noise from my blanket cannot possibly be heard from Land's End to John o' Groats, since, in the interests of listeners, I have not used it recently.

In several cases, however, I have had letters written in a somewhat sarcastic vein informing me that I must have obtained my particular blanket from the British Museum, since the best makes are no longer fitted with thermostats. Any one of you, therefore, whose æsthetic feelings are offended at the thought of my turning blue with cold in my bed, has it in his power to cut short both his and my sufferings.

### Truth About Deaf Aids

IT is astonishing what a large number of instances of the strange workings of human nature you come across when connected in any way with wireless; only the other day, when engaged in conversation with a manufacturer of deaf-aid apparatus, a striking example of the sort of thing I mean was brought to my notice.

We had been talking in a general way about the benefits which science had bestowed upon the halt, the maimed and the blind, in the shape of appliances to lessen the effect of their infirmities.

I had been lamenting the fact that aids to eyesight in the form of good glasses had been with us for generations, whereas deaf-aids had only recently emerged from the Dark Ages. He pointed out, however, that until the coming of broadcasting com-

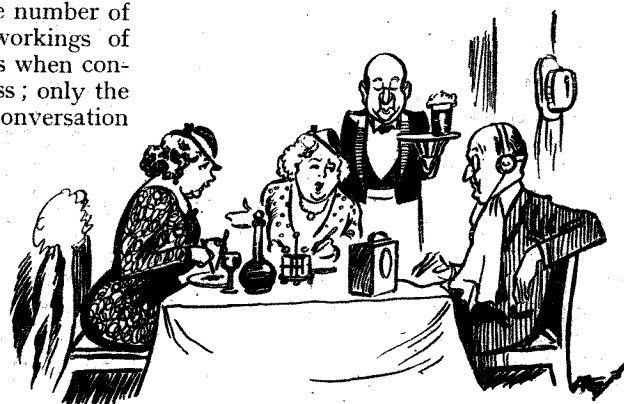
paratively little research had been devoted to the question of distortionless amplifiers and microphones; this is, of course, true, and a distinct feather in the cap of wireless.

As a result of the improvement in deaf-aids, to say nothing of their use by cinemas and other places of amusement, an enormous fillip had, so my manufacturing friend averred, been given to their sale. For some time past, however, he explained, the trade done in them had been beyond all expectations, even when all these new factors had been taken into consideration. This boom in sales had become so marked in extent that a well-known firm of American business-efficiency experts had been called in to trace the reason for this unwonted prosperity.

### Startling Statistics

After a great deal of investigation by many painstaking statisticians the astounding fact was discovered that over 90 per cent. of the sales were to married men. No reason, stated my friend, could be found to account for this, for it was rightly felt that most married men needed something to deaden, rather than to amplify, the torrent of sound to which they were accustomed. At last, however, the truth was revealed owing to the publication in the daily Press of the photograph of a well-known public man lunching with his wife and a friend at a West End restaurant.

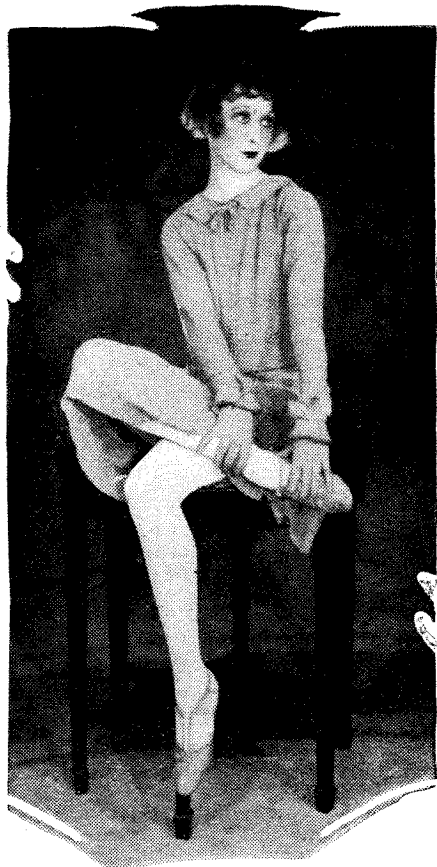
The manager of the deaf-aid firm who had made the apparatus wrote to the public man politely pointing out that the instrument was being used wrongly, as the microphone part of it was towards him instead of towards his friends, and he was therefore receiving very poor reception of their speech. His secretary replied, however, that it was evident that the manager was unaware that that was the very last



Lunching with wife and friend.

thing that his employer desired to do, and that he had, as a matter of fact, bought the instrument in order to hear *himself* speak when in the privacy of his domestic circle or when accompanying his wife and her friends to any social function.

# Listeners' Guide



**BINNIE HALE** plays the leading part in next week's broadcast version of "No, No, Nanette," which will be heard on Monday (Nat. 8.15) and Tuesday (Reg. 7.45). The "book" has been adapted by "Egg," otherwise, Henrik Ege.

outstanding event being a performance of "Parsifal" in the Queen's Hall at 7.30 (Nat.), when Sir Henry Wood will conduct the B.B.C. Symphony Orchestra, the Philharmonic Choir, and a choir of boys from the London College for Choristers.

This will be the first time that the B.B.C. has attempted to give "Parsifal" with a choral background, *i.e.*, with the Flower Maidens scene sung by Principals, Flower Maidens, Chorus, and full choral effects (with boys' voices) in the Grail scenes in Acts I and III.

The Archbishop of Canterbury will preach at a service relayed from St. Sepulchre, Holborn, on Good Friday morning.

As usual there will be a special Easter service broad-

**ALTHOUGH** the connection may not be obvious, everyone will rejoice that Easter week has been chosen to give the modern British composer a place in the ether. The number of new British works to be broadcast during the week beginning April 12th is indeed remarkable, commencing with the Sunday Orchestral Concert, in which Dr. Boult will conduct works by Dame Ethel Smythe ("The Cliffs of Cornwall"), Vaughan Williams ("The Running Set"), B. J. Dale ("An English Dance"), and works by Holst, Moeran and Bax (Reg., 9.20).

Then, on April 15th, the B.B.C. Orchestra, Section E, is to be conducted by the well-known woman musician, Iris Lemare. The programme will include a new Viola Concerto by Christian Darnton, a new orchestral suite by Elizabeth Maconchy, and "Passacaglia on a well-known Theme" by Gordon Jacobs. Miss Lemare, who specialises in the works of the younger British composers, is a daughter of the famous blind organist, Alfred Lemare.

There will be more English music on Thursday when Dr. Malcolm Sargent conducts the Elgar Serenade for Strings (Reg., 9.15).

## EASTER BROADCASTS

GOOD FRIDAY broadcasts are restrained in character, the

cast Nationally at 11 on Easter morning, this year from Liverpool Cathedral.

## "NO, NO, NANETTE"

**BINNIE HALE**, who played the leading part in the famous musical comedy, "No, No, Nanette," which ran in the West End for over two years, has been secured for the broadcast version, which we shall hear Nationally on Monday (8.15) and Regionally on Tuesday (7.45). For this production John Watt has also obtained Floy Penrhyn, character actor; Reginald Purdell, who sang in many of the "Songs from the Shows"; Eve Becke, back from pantomime; Patrick Waddington; Wyn Richmond, and Veronica Brady, who, incidentally, was in the first television revue, and sang the "Hallelujah" number in the stage version of "Hit the Deck."

"No, No, Nanette" is well suited to radio production, for the story is straightforward; it has, in fact, been necessary to omit only eight pages of the original. The book adaptation is by "Egg"—the pen-name of Henrik Ege.

## A THRILLER

GENUINE thrillers are all too rare in the broadcast programmes. A promising specimen in the National pro-

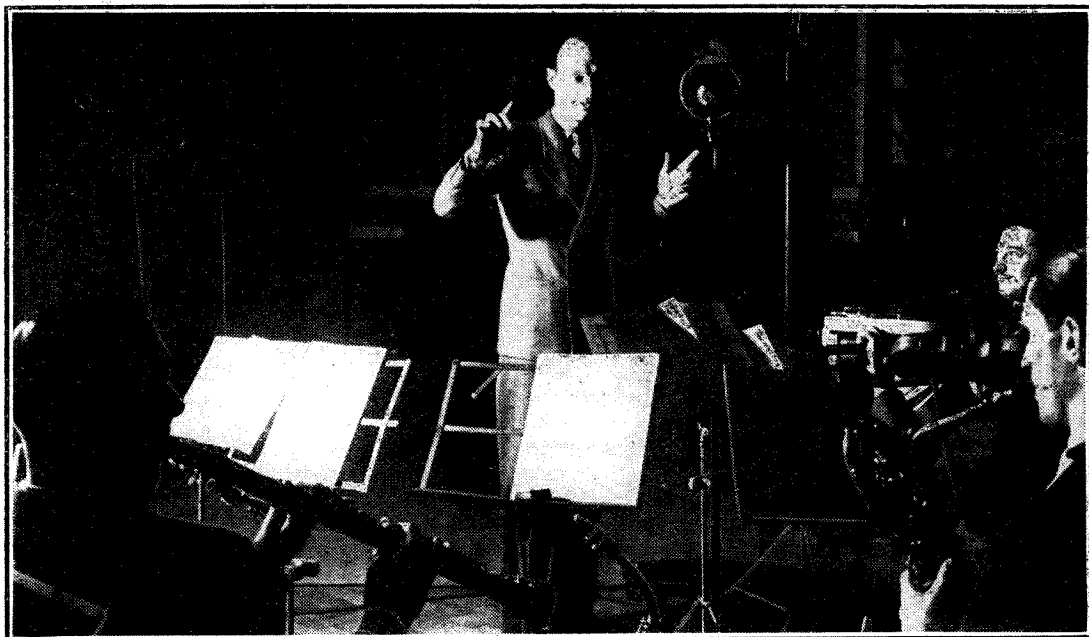
gramme to-morrow (10) is "The Power and the Glory," a hair-raiser by John Pudney, who, well known as a short-story writer and poet, is a producer in the Empire department of the B.B.C. The play, first broadcast in the Empire programme on February 1st last, concerns a young aviator on the eve of his departure on a record-breaking flight. Robert Speaight fills the rôle of the airman hero, and he will be supported by Philip Wade, Gladys Young, Gwendolen Evans and Leslie Perrins.

## SWING MUSIC

**GEORGE SCOTT-WOOD**, one of the few Englishmen who have made names for themselves on Broadway, is bringing the Six Swingers to the microphone at 6.30 to-morrow (Regional), when they take their place in the new dance band schedule. "Swing" music has sprung into great popularity, and to-morrow offers a good opportunity to hear this type of music at its best.

## SUNDAY SHAKESPEARE

THE Oxford University Dramatic Society is presenting next Sunday's Shakespeare programme with "King Richard II" (Nat., 5.30). David King-Wood, President of the Society, will play the



"THE ORIGIN OF MODERN DANCE MUSIC" is the title of a talk to be given by that brilliant modern composer, Constant Lambert, in the National programme at 8.30 on Wednesday next. Above is a famous exponent of modern dance music—Roy Fox—with members of his band in the H.M.V. studios.

# for the Week

## Outstanding Broadcasts at Home and Abroad

### HIGHLIGHTS OF THE WEEK

GOOD FRIDAY, APRIL 10th.  
Nat., 7.30, "Parsifal," from the Queen's Hall.

Reg., 8, B.B.C. Theatre Orchestra. 9.15, "Cello Recital by Raphael Lanes. 9.45, "The Sea," a Mosaic, with music by Purcell.

Abroad.

Radio-Paris, 8.45, Bach's "Passion" (St. John) by the National Orchestra, Raugel Choir and Soloists.

SATURDAY, APRIL 11th.

Nat., 7, Saturday Magazine. ¶Music Hall. 10.30, B.B.C. Orchestra.

Reg., 7.15, B.B.C. Scottish Orchestra. ¶Miller String Quartet. 10.30, Henry Hall's Hour.

Abroad.

Hilversum II, 7.43, Operetta: "The Bayadere" (Kalman).

SUNDAY, APRIL 12th.

Nat., Mantovani and his Tipica Orchestra. 5.30, "Richard II" (Shakespeare). 9, Leslie Jeffries and Orchestra, Grand Hotel, Eastbourne.

Reg., 6.15, Negro Spirituals relayed from Fisk Chapel, Nashville, Tennessee, U.S. 9.20, Sunday Orchestral Concert.

Abroad.

Paris P.T.T., 8.30, Operetta: "Monsieur Beaucaire" (Messager).

MONDAY, APRIL 13th.

Nat., 8.15, Binnie Hale in "No, No, Nanette." ¶World Affairs. ¶B.B.C. Orchestra.

Reg., 8.15, "Harry Hopeful's Day in the Dales"—a Derbyshire Itinerary. ¶B.B.C. Dance Band.

Abroad.

Berlin (Funkstunde), 7, Opera: "Aida" (Verdi).

TUESDAY, APRIL 14th.

Nat., Boyd Neel String Orchestra. 9, "Music from the Movies." ¶Walford Hyden's Magyar Orchestra.

Reg., 7.45, "No, No, Nanette." ¶"Port of Brixham" (Quayside Nights, 5).

Abroad.

Paris P.T.T., 8.30, Chabrier Festival, from the Conservatoire.

WEDNESDAY, APRIL 15th.

Nat., 7.30, Iris Lemare conducts B.B.C. Orchestra. ¶Constant Lambert on "The Origin of Modern Dance Music." ¶Variety. Reg., Al Collins and his Dance Band. 8.5, Chopin Recital (from Warsaw). ¶B.B.C. Orchestra.

Abroad.

Hamburg, 7.45, Operetta: "Die Fledermaus" (Johann Strauss).

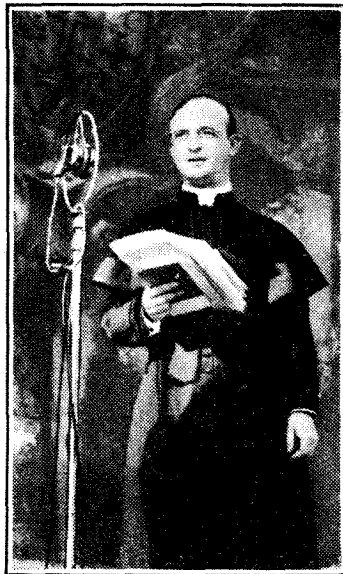
THURSDAY, APRIL 16th.

Nat., 8, "Eight Bells," produced by The Old Salt, Harry Pepper. ¶French Music by Laurence Turner String Quartet.

Reg., 8, Radio Play: "The Game," by Philip Wade. ¶Joe Loss and his Band.

Abroad.

Kalundborg, 8, Scandinavian Symphony Music.



**RELIGIOUS "O.B." CHIEF.** Dr. Geza Koudela, who has just been appointed commentator by the Hungarian Broadcasting Company. He will specialise in describing church processions and other religious ceremonies.

name part. As usual, some drastic cutting will be necessary, but this sub-editing is in the capable hands of Felix Felton, who has adapted the broadcasting version from the production at the New Theatre, Oxford.

### ALL ABOUT SHIPS

How ships are run and how shipping works is the theme of a new series of talks which opens at 10 on Tuesday next (Nat.), entitled "Sea Commentaries," the first dealing with the Merchant Marine and the speaker being Major-R. H. Thornton.

Men whose lives are spent in the industry are to contribute to the series, and they will touch upon ports, ship designing, manning and handling a ship, life on board, and running the ship. A highly topical series if only because the first voyage of the "Queen Mary" has stimulated the public imagination in all that pertains to the sea.

### LEIPZIG'S OPERATIC GALA

OPERA abroad is naturally somewhat curtailed this weekend, the majority of programmes being devoted to the religious festival. In fact, the only stations transmitting opera music on Sunday will be

the Deutschlandsender, offering Mozart's "Magic Flute" at 6.40, and Leipzig, which provides a gala programme of songs from favourite operas at 7 o'clock. The latter should be especially attractive, as the Leipzig Symphony Orchestra and Station Choir and the principals of the Berlin, Munich, Dresden and Weimar opera houses are taking part.

Strasbourg has a relay from the Paris Opéra at 8 p.m. on Monday.

### SWEDEN'S "CRACK" BAND

ONE of the finest military bands in Scandinavia is the Swedish Royal Guards Band, which is broadcasting a Wagner programme from all Swedish stations to-night at 9. The band last visited London in 1871 to participate in an international music competition, winning a special prize offered by Queen Victoria.

### UNKNOWN MUSIC

UNPUBLISHED musical works are often shunned on the erroneous supposition that if

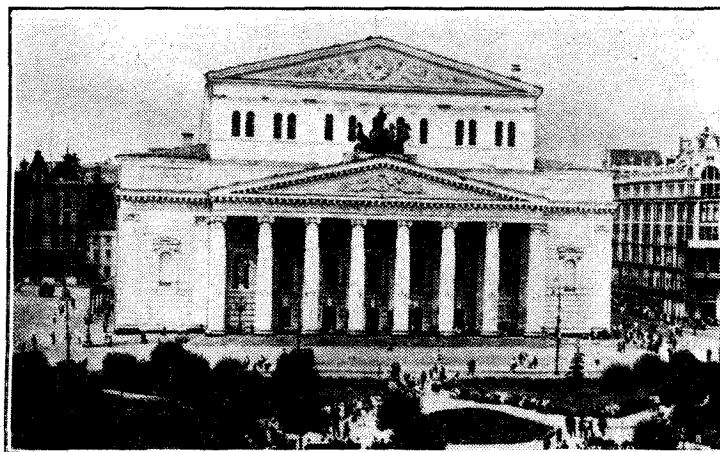
during the next seven days include Elizabethan music which Kalundborg is offering at 9.40 this evening (Friday); an Egon Petri pianoforte recital from Moscow at 6 on Sunday; and a recital by the Fehse Quartet from Deutschlandsender at 10 on Tuesday.

### OPERETTA

THREE operetta broadcasts for the coming week each deserve a star. At 8.30 on Sunday Paris P.T.T. should delight many listeners with Messager's "Monsieur Beaucaire," rendered by artists of the Opéra and Opéra-Comique; Hamburg broadcasts "Die Fledermaus," by Johann Strauss, at 7.45 on Wednesday, and Moscow gives the same composer's "Der lustige Krieg" at 6 on Thursday. The quality of the Moscow operatic transmissions grows more excellent every week.

### FRENCH "O.B.s"

THERE are two first-class "O.B.s" from France on Monday. At 11 a.m. listeners to



**OPERA FROM MOSCOW.** English commentaries are a feature of the weekly operatic broadcasts from the Moscow Opera House.

unworthy of publication they are unworthy of being listened to. It is often forgotten that many reasons may conspire to prevent publication of what might have turned out to be classics, and this may be revealed by the Leipzig station at 6 on Wednesday, when a lecture-recital is to be broadcast on "Unpublished Music of the Early 19th Century." There are to be violin, 'cello and pianoforte illustrations.

Other interesting recitals

Lille will hear the Dedication of the Memorial to Carrier Pigeons who played their part in the Great War. There will be chimes and an address by the Mayor of Verdun. At 1.30 p.m. there will be a relay from Strasbourg of the Feast of Jonquils from Gerardmer in the Vosges Mountains. Whether or not we understand French, we can absorb the atmosphere of the gay street processions with music by the municipal and military bands.

# British Broadcasting

## CONCLUSIONS DRAWN FROM A 2,000-MILE "RADIO TOUR"

# at a Glance

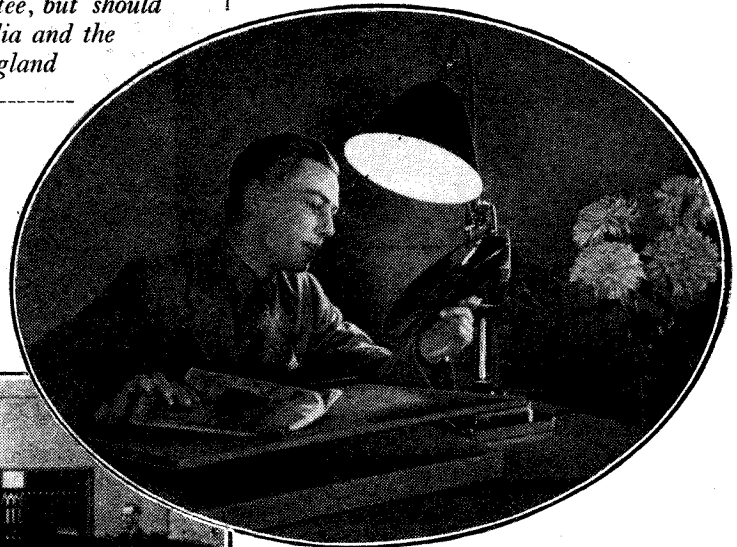
By LESLIE BAILY

**A**FTER my 2,000-mile "radio tour" of the British Isles I returned to London more optimistic than I expected about the future prospect of broadcasting in the provinces. Everywhere in the provincial studios I found a rising spirit of independent enterprise, no longer dampened by the former faint contempt, or even active opposition, from London headquarters. High B.B.C. officials at Head Office are more inclined than at any previous period to give the provinces their head, with more money, staff, and better modern equipment.

This augurs well for the future of provincial programmes—as far as they go. I shall suggest directions where they might go farther. Similarly, it may seem like flogging a galloping horse to criticise the B.B.C. Engineering Department at the present time, when they have no fewer than six new transmitters either in erection or on the drawing board, not to mention studio developments in almost every provincial centre, but the tremendous efforts now being made to improve the country's system of transmitters and studios only throw into bolder contrast those districts

*IN this pithy summary of his 2,000-mile "radio tour" of Britain on behalf of "The Wireless World" Mr. Baily offers some challenging opinions on the B.B.C.'s handling of the Regional situation. Personal contact with listeners and his own experiences with a portable receiver have led him to the conclusion that Regional extensions should not be confined to Wales and the North-East, as approved by the Ullswater Committee, but should embrace East Anglia and the South of England*

Raymond Burke giving a talk in his series on jazz music, with gramophone illustrations, before the Newcastle microphone. Below is the B.B.C. Northern Orchestra conducted by T. H. Norrison.



where the B.B.C. service falls far short of desirable standards.

The first is East Anglia. Over a wide area of Norfolk, Suffolk, Cambridgeshire and Huntingdonshire no Regional programme gives reliable fade-free reception. A relay transmitter here is long overdue.

The second is the South Coast, from the Isle of Wight round to Dover where,

similarly, the National is the only satisfactory B.B.C. programme. Since writing this, I have heard the news that the B.B.C. is exploring sites for a proposed new transmitter to serve the south coast.

The third is the West of England, where the present West Regional transmitter gives inadequate coverage and continues to annoy English listeners by its Welsh "interludes," talks and plays. The

B.B.C. certainly has promised a new Western transmitter (or transmitters) to remedy this, but time passes and so far no announcement even of the site(s) has been made.

The sooner this can be done the better, so as to complete the detachment of the West of England from Wales. This division is good policy, and I find it difficult to understand why it was for such a long time declared to be technically impossible.

I received a painful surprise in regard to the reception of Droitwich National in certain outlying parts of the country, not-

ably North Scotland and North-East England. Fading and its attendant distortion were worse than I had anticipated. In both the above areas high-power transmitters are being erected to relay Regional programmes, and local listeners are naturally asking why, while the B.B.C. are about it, they do not provide twin-programme stations here, as at Brookmans Park, Moorside Edge, etc.—and thus ensure good National, as well as Regional, reception. It would be interesting to have the B.B.C.'s answer to this question, but my own impression is that the B.B.C. is tending towards a policy of dependence on Droitwich for National coverage (admitting that in this world a perfect service in all areas is impossible), and that, far from there being any chance of new National relays (even synchronised), the existing "little Nationals" may be abandoned and their waves appropriated for the improvement of Regional coverage throughout the country.

There is something to be said for this if the various Regional programmes—Lon-

**British Broadcasting at a Glance—**

don, West, Welsh, North, Midland, Scottish and North Irish—are to be more *alternative* to one another, and to the National, than hitherto, but I can see little or no value in building new and powerful Regional transmitters, at the sacrifice of "little Nationals," if the new Regionals are to do little more than pump out the same programme.

I was much struck by the demand in recent *Wireless World* articles by Capt. P. P. Eckersley and Mr. Marsland Gander—and the same demand in letters from

folly to force an all-round increase of locally produced programmes; in several Regions the material is just not there. It would lead only to a drop in quality. All the Regional programmes are capable of expansion, some more than others, but certainly none up to 100 per cent. with the possible exception, if only it had the staff and the money, of the North Region.

An interesting suggestion has been made that the North Region should broadcast a 100 per cent. Northern programme, and a new Southern Region should put up a 100 per cent. Southern output, thus providing two main provincial programmes *always* contrasting not only with each other but also with National. The Southern Region would include the present Midland and West Regions. The Scottish, North Irish and Welsh Regions

field could conveniently serve both Lincolnshire and South Yorkshire, and would meet the objection of Sheffield broadcasters about travelling to Leeds.

I was impressed by the weight of Nottingham's demand for local studios, but reception of Midland Regional is so poor in this part of the Midlands that it seems pointless to improve facilities for producing local programmes so long as those programmes cannot be easily received. A better Midland signal for North Nottinghamshire is a crying necessity.

I come, therefore, to the conclusion that the B.B.C. could further cultivate its provincial programmes with good results, but that it should *not* say, "We will increase local programmes in each Region" by a standard 20, 30, or any other percentage. The natural resources must be examined in each case, the first thing to avoid being an extension of quantity at the cost of quality.

There appears already to be an unfortunate tendency to standardise the Regions. Each Regional centre has five studios, although the size of the Regions and their potential programme-productivity vary considerably. The reintroduction of Regional orchestras is welcome, but these orchestras are so standardised that it is difficult to tell one from another on the air. The amount of programmes turned out by each Region is more or less standardised. I hope this tendency will be resisted: let each Region express its individuality, producing as much local programme material as is consistent with quality.

Mr. Baily's "radio tour" was described in the following issues:—

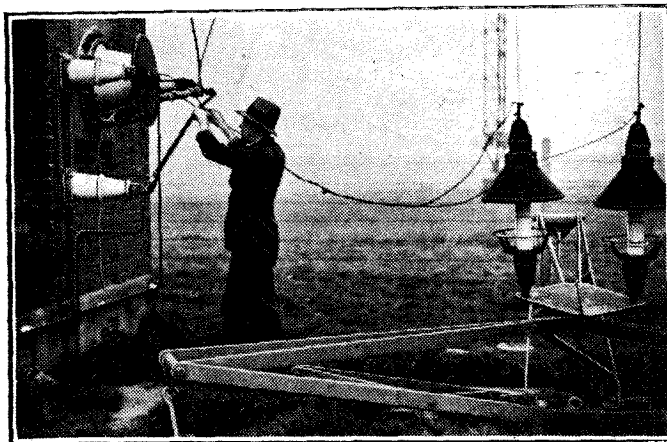
- I. Through the Midlands—October 25th, 1935.
- II. Along the South Coast—November 1st, 1935.
- III. The New West Region—November 8th, 1935.
- IV. Across Wales—November 15th, 1935.
- V. Over to Northern Ireland—November 29th, 1935.
- VI. From Glasgow to Burghead—December 13th, 1935.
- VII. Burghead to Aberdeen—December 27th, 1935.
- VIII. Falkirk and Edinburgh—January 10th, 1936.
- IX. Over the Border to Newcastle—January 24th, 1936.
- X. North Regional Headquarters—January 31st, 1936.
- XI. Moorside Edge and Leeds—February 14th, 1936.
- XII. East Anglia and Brookmans Park—March 13th, 1936.

**THE RADIO INDUSTRY**

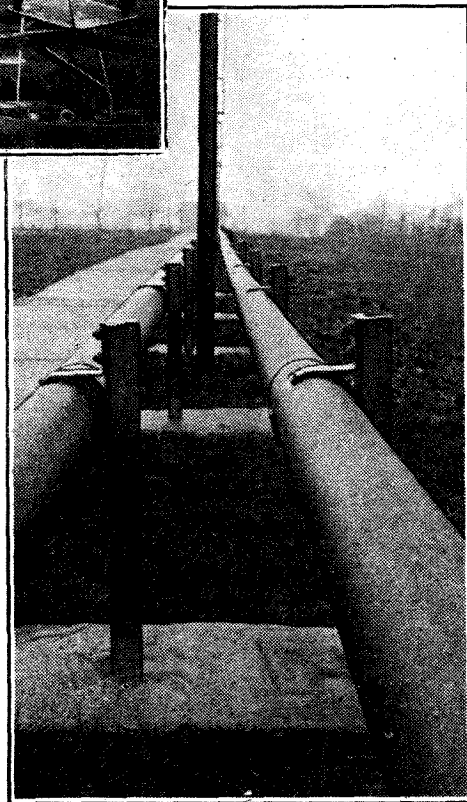
WITH reference to a note on the public performance of gramophone records in our recent "PA" Number, we are asked by the Synchronophone Co., Mead Works, Hertford, to publish the following statement.

Monthly supplements of first-class dance, organ, and instrumental records are issued by this company for free public performance, provided the user already holds the appropriate licence from the Performing Right Society.

F. W. Lechner & Co., Ltd., have been appointed agents for the Singen Aluminium Works, which produce aluminium foil in thicknesses of from 0.005 mm. upwards for paper and electrolytic condensers.



Unearthing the aerial at North Regional, Moorside Edge. Note the massive insulator construction.



The new concentric aerial feeders at the London Regional transmitter. They have been installed beneath the original open-wire feeder supported on poles.

readers—for a greater measure of contrast between the Regional programmes, and after visiting all the provincial studios and studying the local sources of programme-material my conclusion is that, taking the country by and large, *it is possible* to increase the quantity of provincial programme-production without lowering quality. In other words, to make each Region depend more on its own resources, so that there would be less common relaying of one programme. But this presumes that London would be prepared to give the provinces sufficient money to develop their untapped resources.

**Better Provincial Studios**

It is a good sign that thousands of pounds are being spent, as I have described in my articles, in modernising provincial studios, and increasing their number, and their staffs. This cannot be too highly praised, for it should have two immediate results: the exploitation of programme ideas hitherto neglected, and the improvement of quality. There is no reason why "provincial" should be synonymous with "mediocre"; when this was so in the past it was due largely to under-rehearsal, which in turn could be blamed on insufficient staff and inadequate studio accommodation. Even now, despite extensions, the Regional centres at Manchester and Birmingham, particularly, appear barely adequate to cope with modern transmissions and rehearsals.

I have read suggestions of letting each of the seven Regions produce a "100 per cent. local" programme. It would be

would remain as now. The idea is worth serious attention.

North, recently increased by the addition of Lincolnshire, is by far the most impressive Region, but staff and studios are inadequate to cover this vast area. The Manchester staff dissipates too much energy in excursions to the sub-studios at Leeds and Newcastle, where resident staffs are urgently needed. Leeds Broadcasting House, moreover, was clumsily designed with one huge and one tiny studio, and needs at least one more medium-sized studio; and a studio centre at Lincoln is needed. Alternatively, studios at Shef-

# Letters to the Editor

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

## The Magnavox "Duode"

WE agree with Mr. Fairhurst that greater realism can be obtained by using a number of speakers, because the source of sound is thereby increased in area. The proposal is not a practical one for most users, and there is no noticeable improvement except in a very large room with a much greater increase in the area than that given merely by using two speakers instead of one.

Now that it is possible to obtain in the duode a single speaker covering the whole frequency band with almost negligible variation from a straight line, we suggest that the use of speakers with different characteristics in combination is obsolete. The objective is the same, but a single unit is preferable because it avoids the troubles experienced with the combination in connection with the overlap, not to mention the difficulty over impedance matching.

For those who can afford it a bank of similar speakers, each with a range of 30 to 15,000 cycles, can therefore be recommended.

The figures given by Mr. Fairhurst for the combination are, he says, approximate, from which we assume that no accurate measurements were taken.

The difference in realism between a combination with a doubtful range of 50 to 8,000 cycles and a single unit which really does extend from 30 to 15,000 or 16,000 cycles has to be heard to be believed.

BENJAMIN ELECTRIC, LTD.

BURGESS DEMPSTER, Chief Engineer.  
London, N.17.

AS designer and patentee of the new features embodied in the Magnavox "Duode" speaker, I am naturally interested in the views expressed by correspondents with regard to high-quality reproduction. Points raised by Mr. Fairhurst, for instance, are particularly interesting. He questions whether one speaker to reproduce the whole frequency range is ideal, and suggests that a combination of speakers is better. Actually, the use of more than one speaker, fed in the usual way from a single receiver, is fundamentally wrong. A source of sound as transmitted is that existing at the microphone at a single and definite point removed from the point, or points, where the sound originates.

If this alone is considered, it should be clear that the final link, the loud speaker, should recreate sound waves in every way similar to those picked up by the first link, the microphone. If this final operation of reproduction is performed simultaneously at more than one point, the reproduced sound cannot be but seriously modified, as the sound waves from one source interfere with those from the other, causing partial cancellation at certain frequencies and reinforcement at others, according to the effective physical separation of the speakers.

If a single loud speaker, with a single diaphragm, can be made to reproduce the whole audible range, the necessity to use more than one unit no longer exists, and the whole problem is simplified. The "Duode" fills this requirement, and much has been written about the unusually good frequency response, as shown by the N.P.L. and *The Wireless World* curves, but I consider that the degree of damping and better

loading made possible by the new construction are equally important. Even when dealing with a restricted frequency response, the advantage shown is very marked, particularly on transients.

I need hardly add that my observations on the use of more than one speaker refer only to standard single-channel reproduction, and not to stereophonic sound, which is quite impossible under existing broadcasting conditions.

Sussex. A. CECIL BARKER.

## U.S.A. 5-metre Reception

WITH reference to the letter from Mr. J. Watts, of Bournemouth, claiming reception of a U.S.A. station on five metres, I think it is most probable that the station Mr. Watts heard is W8XWJ, owned by the *Detroit News*. This station is one of several high-frequency stations, working on 31,000 kc/s (approximately), and, I believe, used for experimental television transmissions. I heard this station on March 7th at 16.45 G.M.T. at R6-QSAS. I have written to the station, and if I receive a reply I will forward any particulars they may send. If W8XWJ was the station heard, then Mr. Watt's receiver could not be working in the 56 Mc. band. My own receiver is an O-V-1.

Weymouth.

R. SWANN.

WITH reference to Mr. J. Watts's letter regarding reception of a 5-metre American station, might I suggest that he heard the harmonic on 6.96 metres of W8XK operating on 13.92 metres?

I have heard this myself, but at such a strength that identification from the call-sign given was easy.

Mr. Watts says that the letters "WJ" formed part of the call-sign, but as mistakes are so easily made when receiving call-signs from a fairly weak telephony station, the letter "J" may have been "K."

JAMES S. K. STEPHENS, R.S.G.B.

WITH reference to the letter from Mr. Watts published in your issue of March 27th, I am wondering if Mr. Watts checked the frequency or wavelength of the "5-metre" U.S.A. 'phone station he received on March 4th. It occurs to me that the station he received was probably W8XWJ working on about 30,500 kc. or 9.8 m.), as this station has been well heard on several occasions, and I think it unlikely that Mr. Watts heard its second harmonic. His remarks on the above would be interesting.

It may also interest you to know that when G2MV and myself were in three-way contact with CN.8MQ recently on ten metres, I asked "G2MV" if he had heard U.S.A. on five metres, and he replied, via CN.8MQ, that he had not, so that it appears, to date, no signals from U.S.A. have been heard this side of the pond on five!

The period February 28th to March 17th gave amazingly good conditions for East and West working on ten metres. U.S.A. signals were heard up to as late as 21.45 (about three hours after dark), and contact was made with several West Coast U.S.A. stations. On March 1st I made contact with J3FK in Japan, but this was spoilt by the sudden disappearance of his signals. How-

ever, I had a good contact with him again on March 10th at 09.00, this being the first between Britain and Japan. On March 1st ten-metre W.B.E. and W.A.C. on telephony was completed, when 'phone was put over to VU2AU in India.

Since March 17th the only reliable signals heard on ten metres have been from South Africa and Central and South America, and occasionally Russian. The South African route is particularly reliable, signals from ZS.1H in Capetown being heard daily any time from 07.30 to 18.30.

I should be interested to hear if any of your readers have heard a strange atmospheric "hissing" which occurs occasionally on or around ten metres. It generally only lasts for a minute or so, and cannot be attributed to any form of man-made static. It was last heard to-day at 17.45, gradually building up to an R8 level and then fading away again within a minute or so.

D. W. HEIGHTMAN (G6DH).

Clacton.

[A number of other letters have been received from readers on this subject.—Ed.]

## Television and Interference

MR. M. G. SCROGGIE'S letter on "Television and Motor Car Interference" in your issue of March 27th was to some extent answered by Sir Noel Ashbridge in his lecture to the Television Society on March 25th. Sir Noel said that, contrary to expectations, high definition pictures were very little damaged by this class of interference. He also said that he understood from America that the situation had largely taken care of itself in New York because the majority of cars were now fitted with radio and, consequently, with adequate suppressors.\* Sound reception on the ultra-short waves would, of course, be severely interfered with unless adequate means of cutting out the spark signals could be taken. In the quiet country district in which I live I can hear cars at least a quarter of a mile away, and the ignition interference covers the whole band from four to eight metres.

By the way, in connection with your reference to the Baird television signals, your readers may be interested to know that a new transmitter will be in use from the beginning of April with considerably increased power. Hayes has been sending out television signals recently, which have been well received here at Pirbright. I understand that Scopony, Limited, will shortly be sending out signals of low power from their station on the high ground to the north of Kensington High Street on 6.39 metres sound and 6.12 metres vision. The B.B.C.'s test signals (sound) are still being sent out from the roof of Broadcasting House.

E. H. ROBINSON.

Woking, Surrey.

[\* Clifford N. Anderson, in a paper on "Radio Communication in Mobile Services" in the March issue of the Proceedings of the Institute of Radio Engineers (America), in reference to telephony with automobiles, writes: "Spark-plug resistors for suppressing ignition noise have generally been discarded. Instead various other expedients are used. . . ."—Ed.]

# Readers' Problems

## Screened Microphone Leads

A READER who has tried the effect of connecting a microphone to a DC amplifier is not altogether satisfied with the results. Quality and volume are reasonably satisfactory, but there is an annoying background of high-pitched hum. Screened leads have been fitted, but this alteration appears to make matters worse rather than better.

We advise, in the first place, that the screening of the leads and apparatus associated with the microphone should be very thoroughly done on the lines indicated in Fig. 1. Again, it must be remembered that all DC sets and amplifiers present special problems of their own, and it is not always desirable to earth the screening directly in the normal manner. Perhaps this last trouble may be responsible for our correspondent's trouble.

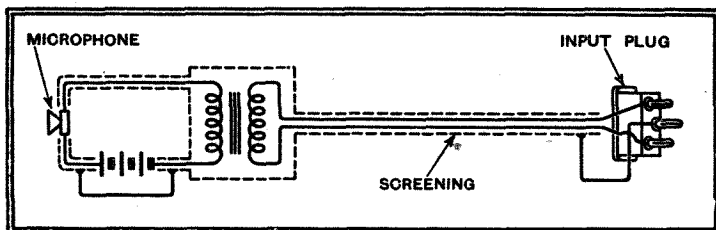


Fig. 1.—Complete screening may be desirable for the connection of a microphone working with a DC mains amplifier.

Generally speaking, it is best to earth the screening to the mains through a condenser of about 0.01 mfd., and for this purpose an extra pin is shown on the connecting plug in the diagram.

Our correspondent will glean some useful hints on the use of DC amplifiers from an article that appeared in our issue of January 24th.

## 1936 Monodial

CONSTRUCTORS of the 1936 Monodial AC Super should know that since the original description of the set slight changes have been made in the IF transformers employed. In consequence of these changes, the selectivity control now works in the opposite direction to that described in the constructional article. No difficulty should be met with, however, if the terminals are connected up according to their lettering.

## A Resistance Test

IN almost every case the DC resistance of all the signal-frequency coils in a receiver should be the same; any appreciable discrepancy must be taken as an indication of high-resistance connections, short-circuited turns, defective switches, etc. But when making such tests the oscillator windings of a superhet must not be considered as signal-frequency coils.

This is in answer to a querist who, with the help of the "ohms" scale of a reliable multi-range meter, has found a discrepancy of more than 50 per cent. between the medium-wave sections of the two signal-frequency coils of his superheterodyne.

## Omitting the Rectifier

WE are asked by the owner of a universal AC/DC set, in which the rectifier has failed, to say whether it would be permissible to omit the rectifier entirely, as the receiver is to be used exclusively on DC. The heater element will, of course, be replaced by a resistance of the same value,

and the cathode-anode sockets of the valve-holder will be short-circuited.

Provided the set is always to be used on DC the rectifier performs no essential function, and so may be omitted. It must be remembered, however, that there is always the possibility of a reversal of mains voltage, in which case the electrolytic condensers normally fitted may be destroyed. In cases of uncertainty they should be replaced (except in bias circuits) by paper condensers or by double-polarised electrolytics.

## Making Variable-Selectivity Transformers

A READER who proposes to wind his own variable-selectivity IF transformer asks our opinion on the suitability of variable capacity coupling between the circuits.

In a variable-selectivity IF amplifier, the primary requirement is that tuning shall be disturbed as little as possible by variable coupling. From this point of view the capacity method is not satisfactory, and magnetic coupling (by physical movement of the coils) is much better. Even so, special precautions should be taken to ensure that stray capacity coupling be avoided, and, with this aim, adjacent ends of primary and secondary coils should be connected with their low-potential ends adjacent. It is equally necessary to take care that the wiring is so disposed that stray inter-circuit capacity coupling be reduced to a minimum.

## All to the Good

A CORRESPONDENT, who proposes to add another stage of amplification to his receiver in order to make it suitable for working with a microphone, finds that it will be necessary to provide an independent source of anode-current supply for the extra valve. This he can do easily enough with the help of components already in his

## The Wireless World

### INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

possession, but he apparently regards this as a make-shift arrangement and one that is likely to impair performance.

We would assure him that, so far as performance and freedom from trouble are concerned, there is every advantage in using a separate source of anode voltage. The possibility of inter-stage reaction which often gives trouble when adding an extra valve should be entirely avoided by doing so. Except for the saving of cost and bulk, there is nothing in favour of a common source of supply.

## Out-of-Phase Speakers

AFTER reading an article in our recent Public Address Number, a correspondent has come to the conclusion that his failure to obtain satisfactory results from a pair of loud speakers used in the same room may possibly be due to incorrect phasing. He sends a sketch of his output circuit and asks how a definite test may be made as to whether the connections are correct.

It is quite possible that phasing difficulties may arise when two speakers are used in the manner described. If, at a given point within the area covered by the two instruments, a wave of compression produced by one speaker coincides with a wave of rarefaction by the other, the two will cancel

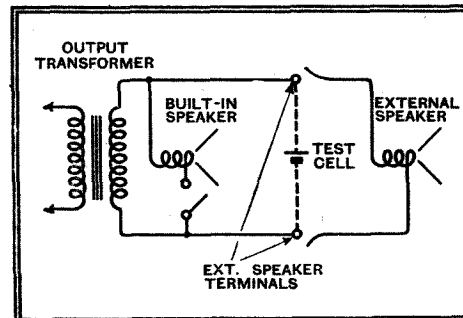


Fig. 2.—Loud speakers "in step"; method of testing connections for correct phasing.

out to a greater or lesser extent. The matter is really quite simple; the two diaphragms should be moving "in step" (i.e., either inwards or outwards) at the same time.

A simple way of determining whether this is, in fact, taking place is to make a test with a dry-cell connected in the manner shown in Fig. 2. With the built-in speaker in circuit, connect the test cell momentarily across the external speaker terminals (and thus cross the speech coil) and observe carefully whether the diaphragm moves inwards or outwards. Then connect the external speaker and again complete the test-cell circuit with the same polarity as before. If the extension-speaker diaphragm behaves in the same way as that of the built-in instrument, all is well. If it does not, a simple reversal of its leads will put matters right.

# Recent Inventions

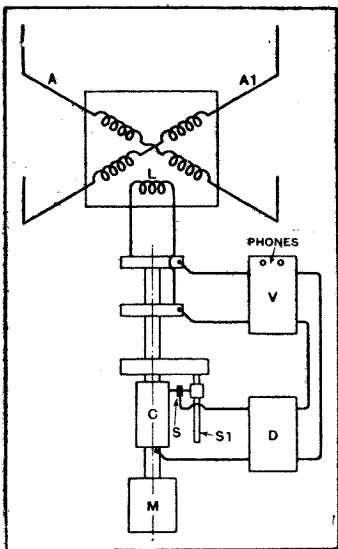
The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each

**Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section**

## DIRECTION FINDING

IF "fading" is in evidence, it is difficult to judge the critical point of minimum signal-strength in direction-finding. It is not enough to take readings of equal strength on each side of the supposed minimum, and to assume that the correct bearing lies midway between the two, because fading may occur during the process of taking these readings.

Instead of a pair of headphones, a stylus can be used to mark the incidence of the critical minimum point on a cylindrical sheet of paper, and a comparison of a series of such markings will then show by their coincidence the true critical points, and allow any accidental "minima" caused by fading to be distinguished and ignored.



Schematic diagram of the DF recorder.

As shown in the figure the radiogoniometer coil L of a pair of directional aeriels A, A1 is driven by a motor M. The pick-up voltages, after being amplified at V and rectified at D, are applied to operate a stylus S, which records their varying strength on a sheet of chemically prepared paper mounted on a cylinder C. The stylus is carried on a screw-shaft S1, which traverses it along the recording cylinder.

R. H. L. Bevan, C. Crampton and S. E. Trigle. Application date July 24th, 1934. No. 441770.

## STABILISING HF OSCILLATIONS

THE frequency of an oscillating valve, used, say, in a superhet set, is stabilised against slow changes of frequency due to varying temperature, by making use of the fact that the permeability of the powdered-iron core, say, of a coupling-transformer, automatically alters with its temperature. The permeability will increase or

diminish according as the co-efficient of expansion of the "binder" or insulating mixture is greater or less than that of the magnetic particles. The frequency generated by the valve can in the same way be safeguarded against fluctuations in the supply voltage.

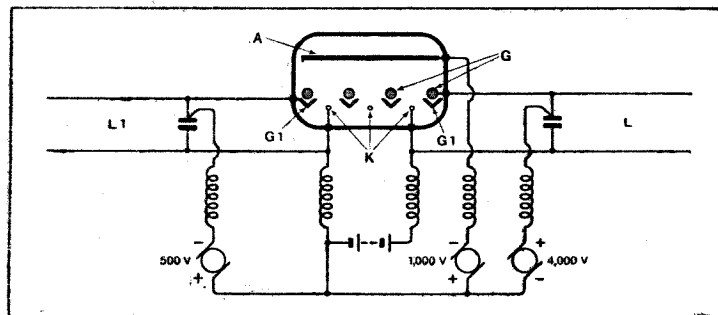
Alternatively the core of a coupling transformer may be made in two parts, which are bonded together (except for an intervening air-gap) by a thermal strip which varies the width of the gap as the temperature alters. This regulates the magnetic reluctance of the coupling or supply transformer and so keeps the generated frequency constant.

W. J. Polydoroff and Aladdin Industries, Ltd. Application date 27th October, 1934. No. 440877.

## SHORT-WAVE GENERATORS

A LIMITING factor in the generation of very high frequencies is the time taken by the electrons to traverse the inter-electrode distance between the filament and the anode inside the valve. One way out of this difficulty, used in the Barkhausen-Kurz type of generator, is to increase the acceleration of the electrons by using a higher grid voltage, or to insert a special spacecharge grid between the positive grid and the cathode. But then care must be taken to avoid losses due to direct absorption of the electrons.

According to the invention, the auxiliary space-charge grid G1 is formed of trough-shaped members which are interposed between the cathode wires K and the ordinary grid G. The grid G1 is given, say, a negative charge of 500 volts, and the grid G a positive voltage of 4,000, whilst the anode A carries a negative bias of 1,000 volts relative to the cathode.



Circuit of the short-wave generator.

The electrons, under the influence of the various static fields of force, stream from the cathode wires K, through the gaps between the grid members G1, and past the openings between the grid wires G, into the space between the latter and the anode A. Here they are suddenly "braked" by the strong negative field and are thrown in the reverse direc-

tion against the wires of the grid G where they induce high-frequency currents in the Lecher-wire circuit L. This in turn sets up corresponding currents in the circuit L1 by capacity coupling. The shape of the space-grid members G1 protects the grid wires G during the upward flow of the electron stream, but not during the downward or "reverse" flow.

I. Hausser. Convention date (Germany) July 17th, 1933. No. 441341.

## TUNING INDICATORS

IN order to be able to display a large number of station-names on a dial of comparatively small dimensions, the names are printed on a spiral strip of stiff paper or celluloid, which is then threaded over a spindle, so that the printed names form a kind of screw-thread which can be collapsed concertina-wise.

The tuning-control gradually unrolls the strip, and, owing to the springy nature of the material, each name springs out in succession to one side, where it comes under the light from a lamp.

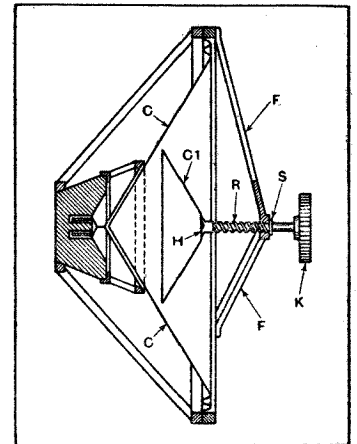
J. A. Wiegand and P. R. Weenink. Convention date (Holland) May 8th, 1934. No. 440607.

## SCANNING DISCS

WHEN using a rotating disc or mirror drum for scanning, the lines traced out on the screen are slightly curved instead of being straight. In consequence, they tend to crowd together at one end, whilst they open out and leave gaps between them at the other end of the screen. This defect becomes particularly noticeable when "interleaved" scanning is employed.

In order to overcome it, the slots on the scanning disc are made wedge-shaped, so that when they are used in conjunction with a fixed aperture, the effective size of the slot through which the ray of light passes is gradually increased from the beginning to the end of each scanning line. This

small cone is carried by a screwed rod R, mounted on a cross-frame, so that its distance inside the larger cone can be adjusted by means of a knob K. A stop S, on the rod R, prevents the inner cone from making contact with the surface of the outer one. A small hole H, at the apex of the



Constructional details of the loud speaker.

inner cone, allows some of the sound to emerge at that point.

R. R. Glen. Application date July 4th, 1934. No. 441061.

## VOLUME CONTROL

FOR some purposes it is desirable to control the volume of a wireless receiver according to the degree of modulation, instead of according to variations in the amplitude of the incoming signal. This is accomplished by using as rectifier one or more saturated valves, arranged so as to produce an output current which is a logarithmic function of the input voltage.

Alternatively, the incoming signal may be used to modulate the intensity of a source of light which, in turn, varies the emission from a photo-electric cell. The number of electrons liberated in the cell is a logarithmic function of the light intensity, and so serves the same purpose.

H. O. Roosenstein and W. Runge (Assignors to Telefunken Ges. fur drahtlose Telegraphie m.b.h.). No. 2014509 (U.S.A.).

## BACK-COUPLED CATHODE-RAY TUBE

IF a fluctuating voltage is applied to the control grid of a cathode ray tube, as used say for recording the sound track on a cinema film, and a telephone is inserted in the anode circuit of the tube, the sound impulses are found to be present in amplified form. This fact is utilised to introduce reaction between the control grid and anode circuits, so as to increase the intensity of the light effect produced on the fluorescent screen. The anode variations may be fed back to the grid through the medium of an auxiliary valve amplifier, or an extra electrode may be inserted in the cathode ray tube for the purpose.

F. W. Hehlgans (Assignor to General Electric Co., U.S.A.). No. 2004790. (U.S.A.)

## LOUD SPEAKERS

IN order to improve the tone response of a loud speaker, a small inverted cone C1 is placed inside the ordinary cone-diaphragm C. The



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

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## EDITORIAL COMMENT

### Price of Valves

#### Effect on Radio Development

SINCE the beginning of broad-  
casting, and for a long time  
before, the valve has always been  
the heart of the wireless receiver.  
Unless the efficiency and reliability of  
the valve are maintained at a high  
standard every user as well as the  
whole industry which has been built  
up on wireless, would suffer since the  
performance and life of receivers can  
never be better than that of the valves  
used in them.

For these reasons there is much to  
be said for the policy of the valve  
manufacturers in maintaining the prices  
of valves at a fairly high level, even  
during a period when set manufac-  
turers have been reducing their prices  
to levels which have often brought  
them dangerously near financial dis-  
aster as well as impairing the efficiency  
of the sets themselves.

But we are compelled to ask whether,  
without jeopardising the quality of  
valves, it is not possible for manu-  
facturers to take a long view of the  
present position and consider a sub-  
stantial reduction in prices which, we  
believe, would in the end result in an  
all-round benefit. However dependable  
in the matter of performance and life  
valves may be, the average user of a  
receiver still continues to look upon  
them as those components of a wireless  
receiver which he must expect to have  
to replace from time to time throughout  
the life of the set. He knows, too, that  
valves are expensive things and that  
the more valves there are in his set  
the higher will be the cost of upkeep.  
It may be asked how it is that  
manufacturers' sets can be so cheap  
when the valves they have to supply  
with them are so costly. The answer  
is, of course, that when set manufac-  
turers place orders for valves in huge

quantities the price paid is very differ-  
ent from what would be paid for an  
individual valve over the counter.

So long as this is a determining  
factor in the choice of the set, so long  
will the public hesitate to buy any set  
using a number of valves if a smaller  
set with, say, three or four valves  
could be made to do.

When television sets are on the  
market the very large number of valves  
in use will probably discourage the  
public from buying, in view of the re-  
placement cost of valves, even more than  
the initial cost of the sets themselves.

In America valve prices are very  
much lower than they are here and  
this we believe to be one of the prin-  
cipal factors which have contributed to  
the popularity there of the set of many  
valves. Where the designer is limited  
to the smallest possible number of  
valves, his receiver can never be any-  
thing but a compromise and must fall  
far short of what could be done if he  
had a freer hand. It is here that  
American designers have opportunities  
denied to those in this country, and it  
seems to us that the whole question of  
how far we can hope to progress in  
receiver design in the future is de-  
pendent upon the attitude of those  
who control the prices of our valve  
supplies.

#### Quality Must Stand

Let it be clearly understood, we do  
not want to see a price competition  
between valve manufacturers which  
would result in a cheapening of the  
product to a point where reliability  
would suffer, but we believe that if  
valve manufacturers collectively will  
look ahead to the possibilities which  
would result from an all-round re-  
duction of prices and the elimination of  
the growing competition of valves of  
foreign make, they could satisfy them-  
selves that there is much to be said  
in favour of such a policy.

# Hearing Aid for the Deaf

## TWO-VALVE MICROPHONE AMPLIFIER UNIT

By T. S. LITTLER, M.Sc., Ph.D.

*THE small portable hearing-aid described in this article embodies a carbon microphone combining high sensitivity with a good frequency response while the amplification afforded by its two valves is such that it will prove of considerable help even in cases of serious deafness.*



A GOOD deal of attention has been given in the Press in recent years to the discussion of hearing aids for the deaf, and a number of articles have appeared in this journal and elsewhere on the fundamental principles of hearing and measurement of hearing.<sup>1</sup> Briefly, the basic principle in an electrical hearing aid is that some form of

contrast to the more common type of conduction along the ear passage known as air conduction.

Apparatus and technique have been developed in recent years in the Department of Education of the Deaf at Manchester University, whereby the effective amplification of hearing aids may be measured throughout the audible frequency range as well as the effectiveness of the aids for producing intelligible speech. The writer has described the method elsewhere,<sup>2</sup> and it is hoped to give accounts in this journal of designs of other hearing aids that have been found of great help to a large number of deaf patients if the present article proves of interest.

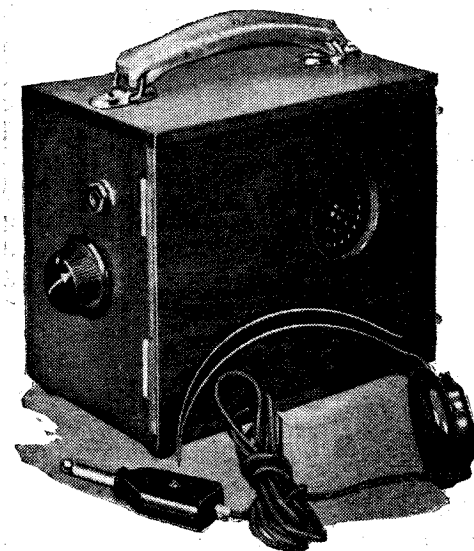
The hearing-aid described in the present article makes use of the Siemens Neophone, a carbon granule microphone combining a fairly high sensitivity with quite

cation a hearing-aid can be made which is of considerable help to a large number of seriously deaf subjects. The latter form of the hearing-aid is the one described here. Modifications of the design are possible, but this particular model has been chosen because it provides a hearing-aid which is quite portable, while at the same time the miniature batteries are not so extremely small as to give a great deal of trouble. Standard types of miniature batteries are used, but, if desired, it is possible to use smaller types, when the aid can then be made of smaller dimensions. In this case, however, it will be necessary to renew the batteries considerably more frequently than if the standard batteries are used.

### Two-valve Circuit

The circuit of the hearing-aid is given in Fig. 1. It consists of a two-valve amplifier with parafeed coupling between the

two stages. The first valve used is a Hivac Midget Type XD, in the anode of which is connected the tapped resistance of the parafeed unit, the tapping HT2 being used for anode decoupling through the electrolytic condenser C1. For the second stage an LP2 valve has been used as being an extremely efficient small-power valve combining high sensitivity with very small power consumption. A mid-



microphone is, in effect, substituted for the subject's ear, the acoustic energy being thereby transformed to electric form and amplified, and the amplified energy is then allowed to operate a telephone receiver applied to the ear. In some forms this receiver has a stiff vibratory element which is allowed to press on the mastoid process or some bone of the head. This is known as bone conduction in con-

a good frequency response. When used in conjunction with a single valve amplifier the sensitivity of the microphone is sufficient to help some moderately deaf people, and with two stages of amplifi-

get valve can be used in this stage if desired, but, of course, the effective amplification will be less. Automatic bias of about  $1\frac{1}{2}$  volts is used on the second valve, R1 being the bias resistance shunted by an electrolytic low voltage

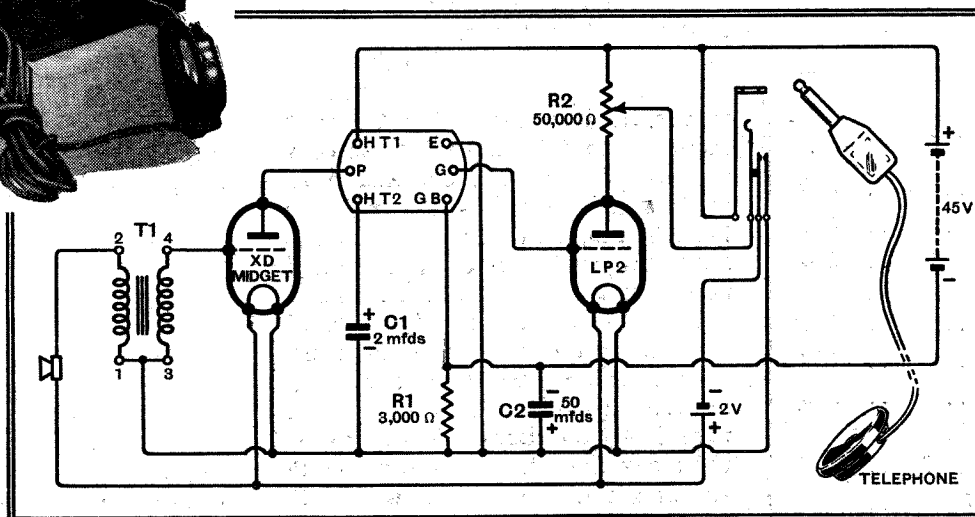


Fig. 1.—Theoretical circuit diagram of the small portable hearing aid.

<sup>1</sup> "Deaf Aids," *The Wireless World*, August 9th and October 11th, 1935.

<sup>2</sup> *Journal of Scientific Instruments*, April, 1936.

**Hearing Aid for the Deaf—**

condenser, C2, of 50 microfarads. For the first valve the fall of potential along the filament is used to maintain negative bias on its grid, the grid return of the microphone transformer T1 being connected to the negative end of the filament.

crystal element. When moving-iron types of receivers are used it will generally be found that since quite appreciable DC current flows through the receiver in the maximum sensitivity position, the polarity of the leads is quite important for the most sensitive operation of the amplifier.

each constructor, and many variations are, of course, possible.

A diagram of the layout is given in Fig. 2, which shows the position of assembly of the components. The door of the case must have a hole cut in the position shown to expose the microphone, which is held

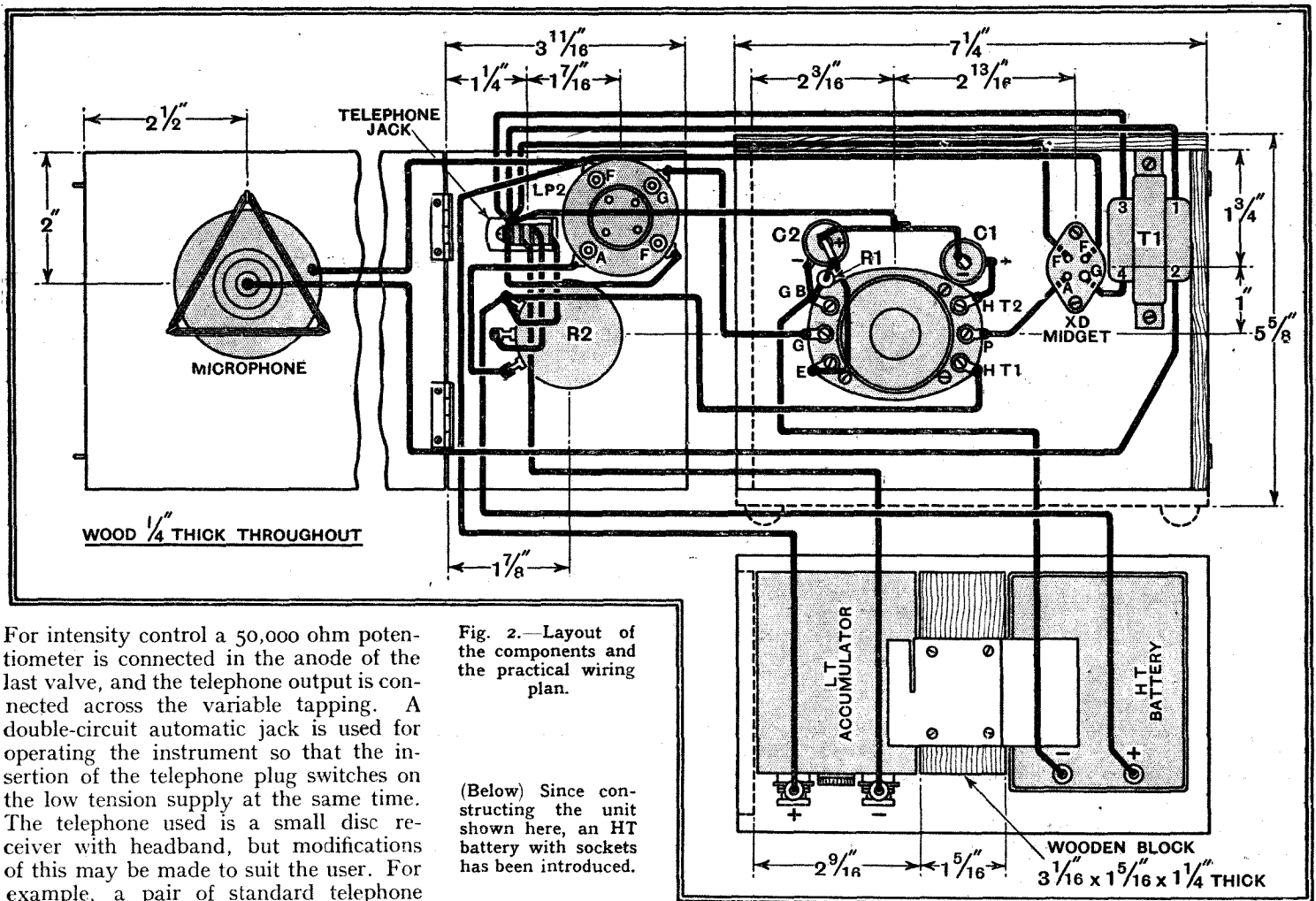


Fig. 2.—Layout of the components and the practical wiring plan.

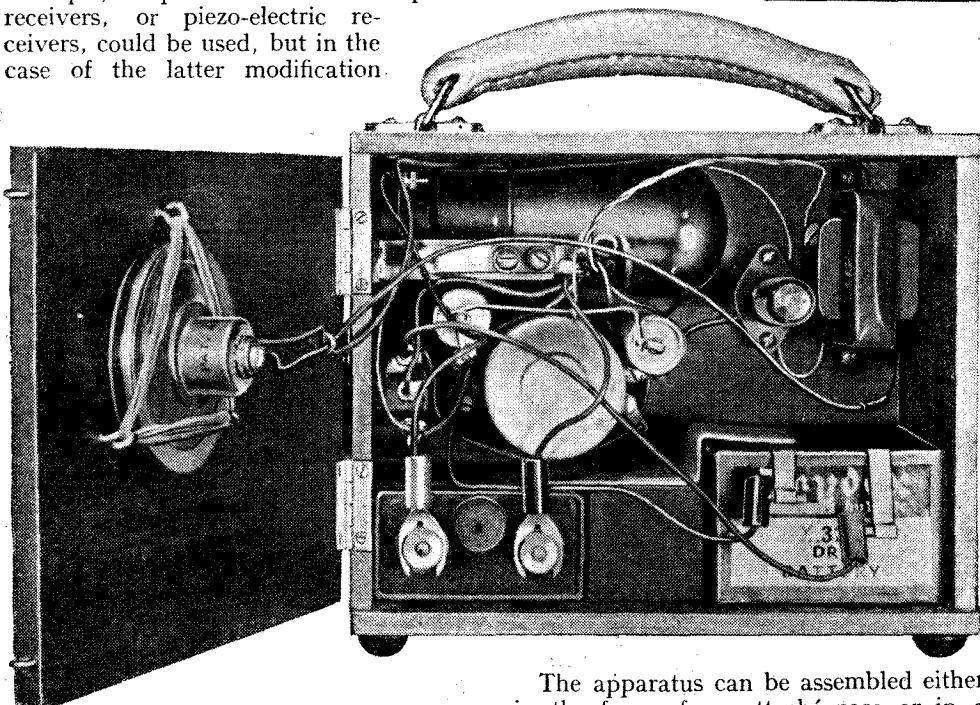
(Below) Since constructing the unit shown here, an HT battery with sockets has been introduced.

For intensity control a 50,000 ohm potentiometer is connected in the anode of the last valve, and the telephone output is connected across the variable tapping. A double-circuit automatic jack is used for operating the instrument so that the insertion of the telephone plug switches on the low tension supply at the same time. The telephone used is a small disc receiver with headband, but modifications of this may be made to suit the user. For example, a pair of standard telephone receivers, or piezo-electric receivers, could be used, but in the case of the latter modification.

suspended to three small hooks by means of a triangular piece of rubber cord or string. It is an advantage to remove the top of the cabinet during the assembly. The parafeed unit, bias resistance, electrolytic condensers and microphone transformer are mounted on the back of the cabinet with the midget valve holder in between the microphone transformer and the parafeed unit. On the side of the cabinet to which the door hinges are attached, are mounted the standard valve holder, the valve control and the telephone jack.

**Wiring**

The wiring up of the circuit, which can now be done, requires little comment. It is sufficient to point out that care should be taken to ensure that the polarity of the electrolytic condensers' connections are correct. When all the connections have been made flexible leads should be connected for the battery supplies, spade terminals being used for the LT accumulator and plugs for the HT battery. A wooden block with a sheet of metal serving as a clip can be used to keep the

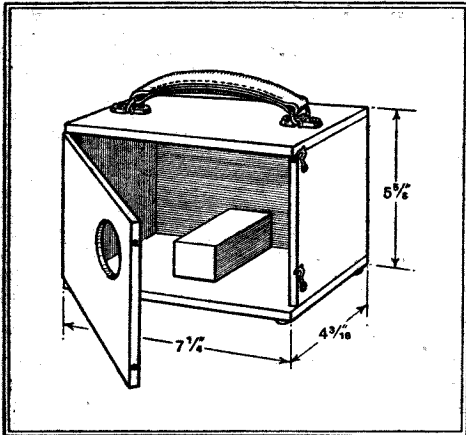


care must be taken to insert a condenser in one of the output connections to prevent a DC voltage being applied across the

The apparatus can be assembled either in the form of an attaché case or in a small box; the latter style of assembly is described here as the type of attaché case would probably differ with the feelings of

**Hearing Aid for the Deaf—**

batteries in position. If alternative sizes of batteries are used the size of this block must be altered accordingly. When all the connections are completed the cabinet can be screwed together and hook fasteners placed upon the door. When



The dimensions given here for the cabinet are outside measurements. The wood is  $\frac{1}{4}$  in. thick throughout.

connecting the telephone to the telephone plug care should be taken that the positive lead of the telephone is connected to the plug contact that makes connection to the HT side of the automatic jack. In most telephone receivers this polarity is indicated, but if difficulty is experienced a test should be made to determine the most efficient connection.

After the instrument has been completely assembled it may be tested by inserting the telephone plug. If it is correctly assembled and if all the components are in order the telephone should howl when it is allowed to face the microphone and is within two feet of it. The howling produced is due to the acoustic

feed back and always occurs in a hearing-aid when the effective amplification is above a certain value. In general, the pitch of the howl is somewhere near the frequency at which there is maximum effective amplification, and it is the same effect as the howling that occurs in public address systems. It will sometimes be found that when a hearing-aid is used at its full sensitivity howling will occur when the receiver is lifted from the ear of the user. To prevent this it is a good plan to place the thumb over the telephone opening when the receiver is taken from the head of the user.

A list of components is given for the convenience of those who desire to construct their own hearing aid. The author has supplied a design to Messrs. Griffin and Tatlock, Ltd., who will make up the complete instrument.

**LIST OF PARTS**

- 1 Transmitter Inset**  
Siemens "Neophone" No. 13  
(Obtainable from Peto-Scott).
- 1 Microphone transformer, ratio 30:1, T1**  
Savage "HB"  
Clix "Midget"
- 1 Valve holder, 4-pin**  
W.B. Rigid Type
- 1 LF coupling unit Benjamin Transfeeda 8670**
- 1 Electrolytic condenser, 2 mfd., 200 volts working C1**  
T.C.C. "AT"
- 1 Electrolytic condenser, 50 mfd., 12 volts working C2**  
T.C.C. "AT"
- 1 Volume control (wire wound), 50,000 ohms R2**  
Claude Lyons "Clarostat"
- 1 Resistance, 3,000 ohms,  $\frac{1}{2}$  watt, R1**  
Bulgin HW7
- 1 3-spring automatic jack**  
B.T.S.
- 1 Telephone plug**  
B.T.S.
- 1 Telephone ear-piece, 2,000 ohms and head-band**  
Scientific Supply Stores
- 1 HT battery, 45 volts**  
Drydex X325B
- 1 LT battery, 2 volts 5 a.h.**  
A.E.F. Type M7
- 2 Wander plugs and 2 spade ends**  
Eelex
- Cabinet**  
Peto-Scott
- Valves:**  
1 XD Hivac, 1 LP2 Osram or Marconi.

flexible coupling and two bevel gears, with a reduction of about 1 to 2.25, and at normal turntable speed gives approximately 90 threads to the inch on the record. This results in a playing time of a shade over two minutes.

For recording broadcast matter practically no additional apparatus, other than the recording unit, is required, for the cutting head is of the high-resistance type and can be connected across the primary winding of the output transformer with a four-mfd. condenser connected in one of the leads.

Where terminals or sockets are provided for an extension loud speaker the method of connection will be simplified, though if this be intended for a low-impedance model it will be necessary to employ a suitable step-up ratio transformer.

Both methods have been tried with various types of commercial receivers, and very good recordings obtained. We found that surface noise, or needle scratch, was a little more noticeable than with professionally made records, but if the receiver is fitted with a tone control much of this can be removed without spoiling the reproduction. The hardness of the record's surface after baking is largely responsible for the needle scratch, but it is not excessive.

A few failures were experienced at first, due to a variety of causes in no way associated with the apparatus, but in connection with the method of using it. Having available a 4-watt amplifier some of the records were cut with too deep modulation, others had not been sufficiently well brushed, but on rectifying these defects, and after a little experiment with different volume levels, it was found possible to produce a very good record indeed. So early failures must not be allowed to give rise to a false impression, and a few experiments will soon reveal where the defects lie.

The most surprising part about this unit is its price, for complete it costs only £3 17s. 6d. Yet the workmanship throughout is of a very high standard. Double-

## Permarec Home Recorder

**T**HE Permarec home recording unit is designed for easy attachment to an existing gramophone, and it can be used either with an electric model or one fitted with a good spring motor, as it requires very little more power to operate than would be absorbed, for example, in playing a 12-inch record.

One reason why it can be used with quite ordinary apparatus is that discs of 7-inch diameter only are employed, but another, and equally important, factor is that the recording blanks have a very soft surface and so do not impose a heavy drag on the cutter.

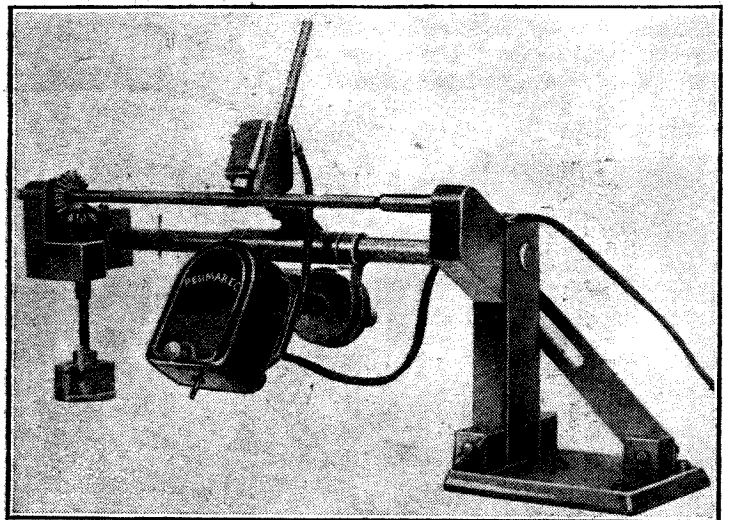
The recording unit is intended to be used with any standard wireless receiver.

The recording blanks have an aluminium base and, as mentioned already, are coated with a plastic material which would wear very rapidly if reproduction were attempted immediately after recording. In order to make the record durable the surface is hardened by baking in a warm oven, which process takes about three hours. After this the surface becomes glass-hard and ordinary steel needles can be used for playing back.

Prior to the baking process the discs must be carefully brushed with a soft camel-hair brush to remove any particles of the surface

**A Soundly Designed  
Inexpensive Unit,  
Easy to Install and  
Simple to Operate**

**Permarec home recording unit made by Musikon, Ltd.**



material that may have been left in the grooves by the cutter, though the major portion of this comes off as a fine thread and winds itself round the centre boss. Unless the brushing is carefully done these particles will be baked hard in the grooves, and when the record is played back will make their presence known by a series of sharp explosive sounds.

The traversing mechanism is driven from the spindle of the gramophone motor by a

sidéd recording blanks cost 1s. 6d. each.

The only criticism we have to make is that the operating instructions could, with advantage, be expanded, for while the unit is simplicity itself to install, there are many little details we have included in this report that were only discovered by experiment.

The makers, Musikon, Ltd., are to be congratulated in evolving an inexpensive and most satisfactory home recorder.

H. B. D.

# CURRENT TOPICS

## Aircraft Watch Keeping

THE maintenance of a continuous listening watch by aircraft operators during flight is strongly recommended in an Air Ministry notice, which states that important radio messages have been missed on occasions owing to the radio watch being interrupted.

It is recommended that should a radio watch be interrupted by atmospheric storms the appropriate radio station should be notified.

## Amateurs to the Rescue

DURING the recent disastrous floods in the north-east of the United States, amateur transmitters provided the sole means of communication during long periods in many centres. In Pittsburg and several other towns where the electricity supply failed amateurs employed battery-driven transmitters to maintain contact with the outside world. Others operated under instructions from the militia during the martial law period.

## Scholastic Amateurs

AT a certain Warwick school there are two amateur transmitters. One is a master and the other a boy pupil at the school, and both manage to transmit without serious mutual interference. There is no truth in the allegation that when the master wants the ether to himself he gives the boy a hundred lines to keep him occupied!

## Have You Heard Jerusalem?

THE Palestine broadcasting service is now in full swing, the Jerusalem station having been officially inaugurated on March 30th by Lieut.-Gen. Sir A. Wauchope, the High Commissioner. Five-hour programmes are broadcast in English, Arabic and Hebrew.

Jerusalem transmits on 449.1 metres, and thus clashes with North Regional. No interference, however, has been reported.

## Television Lecture

THIS year's Faraday lecture of the Institution of Electrical Engineers will be given by Dr. E. Mallett on the subject of "Television—An Outline," at a meeting for members and associates only which will be held at headquarters on May 7th following the annual general meeting at 6.30.

## EVENTS OF THE WEEK IN BRIEF REVIEW

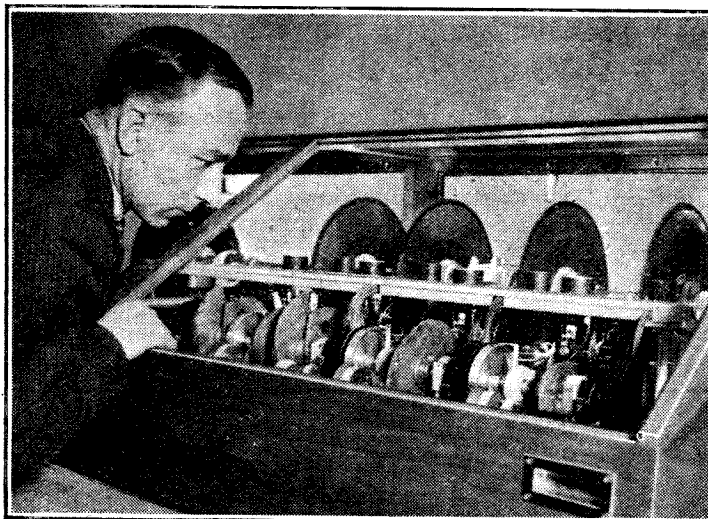
### Addis Ababa Still Calling

BRITISH short-wave listeners have been able to put their sets to grimly practical use during the last three weeks in picking up war news from Addis Ababa. It was on Sunday, March 29th, that Station ETA, Addis Ababa, opened its weekly news bulletins in English on 25.09 metres, requesting that British listeners should forward their reports *via The Wireless World*. Since then a large number of "Q.S.L.'s" have reached the offices of this journal and have been forwarded to the Operator-in-Charge. The addresses of the senders reveal that short-wave reception is popular all over the Kingdom from Cornwall to Northumberland, and a notable feature of the reports is the obvious clarity with which the station is being picked up.

every Sunday at the same hour. The call sign is "Utvarp Reykjavik," pronounced "Ottvarp Raykyaveek," or sometimes in English: "The Icelandic Short-wave Broadcaster." The wavelength is 24.52 metres.

### Wireless Link

OUR Special Correspondent, discussing in "Broadcast Brevities" the question of the possibility of a wireless link between Broadcasting House and Brookman's Park in our issue of April 3rd, was unnecessarily sceptical about the suggestion put forward, not as a fact, but rather as a possibility, in one of the best-informed of the lay papers. Sir Noel Ashbridge has denied that such a link is contemplated, but he would not, we think, quarrel with the idea on any technical grounds.



"TIME, PLEASE." An interesting exhibit in the Post Office "village" at the Ideal Home Exhibition, Olympia, is the telephone clock, with the four records made by Miss Ethel Caine, "the girl with the golden voice."

The station is situated eight miles outside Addis Ababa at a height of 8,000ft., which may account for its excellent radiation with a power of only  $3\frac{1}{2}$  kilowatts.

The English bulletin is broadcast every Sunday evening at 21.30 to 21.50 (G.M.T.) on 25.09 metres (11,955 kc/s.) with the call-sign ETA.

### Short Waves from Iceland

ICELAND opens a regular service of short-wave broadcasts on April 23rd at 18.40 (G.M.T.), and programmes will be broadcast from Reykjavik

## Demand and Supply

THAT lonely women feel their position most keenly after 10 in the evening is the theory of the Directors of the Radio Cité station, Paris, which has inaugurated a "Lover's Hour." An artificial *amoureux* takes his place before the microphone and broadcasts "sweet nothings" on 280.9 metres.

A similar "quarter-of-an-hour" has been inaugurated by Budapest for the benefit of "anonymous and invisible lady listeners." This feature includes a Wireless Serenade, and for the sum of 15 frs. a woman listener can choose a musical selection addressed to herself.

## N.P.L. Standard Frequency Transmissions

IN view of the incidence of Easter, the usual monthly emission from the National Physical Laboratory of a modulation frequency of 1,000 cycles per second will be postponed for a week from April 14th to April 21st. The time, 10.40 (G.M.T.), will be 11.40 Summer Time.

## "Fair Practice" in American Radio

"FAIR practice standards" set by the American Radio Trade Federation Trade Commission may shortly hold sway in the U.S. radio trade, the aim being to eliminate questionable claims for radio sets such as "Hong Kong Any Night" or "Tune in Anywhere Anytime."

The American R.M.A. asks for exact definitions to be applied to different types of radio sets, and also demands a code of rules covering advertising claims, brands, trade marks, etc.

For example, it asks that "standard broadcast" should apply only to sets that cover continuous spectrum frequencies from 540 to at least 1,600 kc/s. "All-wave," it is contended, should cover the spectrum from 540 to 18,000 kc/s (16.65 metres), thus embracing not only the conventional North American broadcasting band, but the major international and other short-wave programmes services.

Claims for reception of foreign, police, aviation, and amateur stations must be held within definite scientific bounds so that purchasers may not be misled into believing they can tune these stations at any time at will.

## French War on Static

RELENTLESS warfare is still being waged in France on all forms of interference with broadcast reception. Every month a *communiqué* is published showing the rate of progress.

During last month there were 6,277 investigations—269 more than in February—and as a result 11,542 offending pieces of apparatus were traced and their owners called upon to fulfil their legal obligations. At the same time nineteen refractory "second offenders" were prosecuted.

# Amplification on Ultra-Short Wavelengths

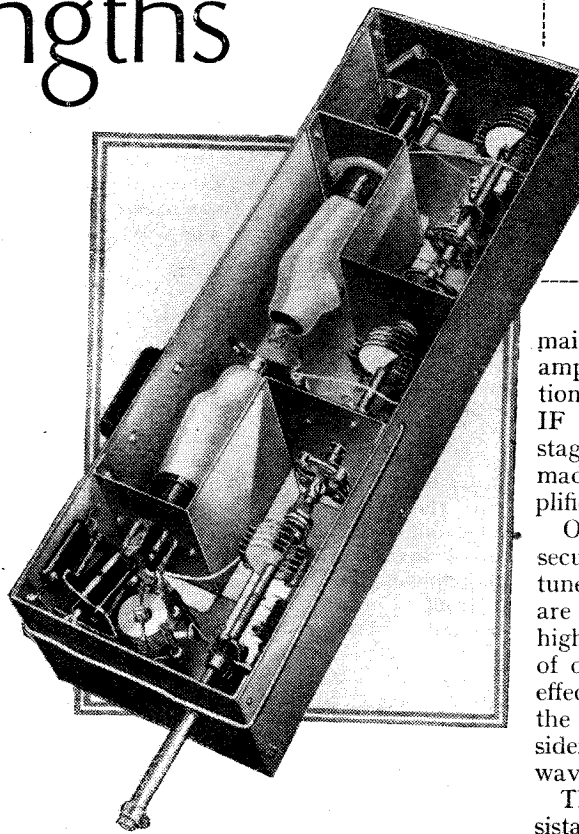
By W. T. COCKING

**ALTHOUGH** the superheterodyne is probably the most satisfactory type of receiver for the ultra-short wavebands, its use does not necessarily make HF amplification unimportant. The performance of a superheterodyne can be considerably improved by the use of a single stage of amplification at signal frequency, and in this article details are given of an arrangement which experiment has shown to be highly satisfactory.

**T**HE problems underlying the design of a frequency-changer for an ultra-short wave superheterodyne were discussed in a recent issue of *The Wireless World*,<sup>1</sup> and it was shown that an entirely satisfactory performance can be secured by using a triode-hexode valve in a suitably designed circuit. It is, of course, perfectly possible to build a superheterodyne in which the frequency-changer is the first valve in the set, and for many purposes this arrangement is very satisfactory. It is not entirely so, however, when a high degree of sensitivity is needed, for, apart from the signal-noise ratio, it becomes difficult to obtain adequate IF amplification with stability.

<sup>1</sup> *The Wireless World*, March 27th, 1936.

## The Use of an HF Stage in a Superheterodyne



mains, for the post-frequency-changer amplification is really excessive. The solution, of course, is the use of only two IF stages with a signal-frequency HF stage, provided that such a stage can be made to give a reasonable degree of amplification.

On broadcast wavelengths it is easy to secure a high gain from such a stage, for tuned circuits of high dynamic resistance are readily constructed and valves have a high input impedance, while the frequency of operation is low enough for feed-back effects through the grid-anode capacity of the valve to be small. None of these considerations applies on the ultra-short waveband, however.

The attainment of a high dynamic resistance for the tuned circuits is naturally the first consideration, for with a given valve the stage gain is proportioned to this, provided that external damping is negligible. This means not only that the efficiency of the coils must be as high as possible but that their inductance must be high also, and this naturally demands that every effort be made for the reduction of stray circuit capacities to a minimum. If

The intermediate frequency chosen for receivers of this type is of the order of 5 Mc/s, and two stages giving a gain of 50 per stage are inadequate unless a fairly high degree of LF amplification is used. Three stages, however, are very difficult to stabilise when giving this degree of amplification, and even when stability has been achieved the problem of noise re-

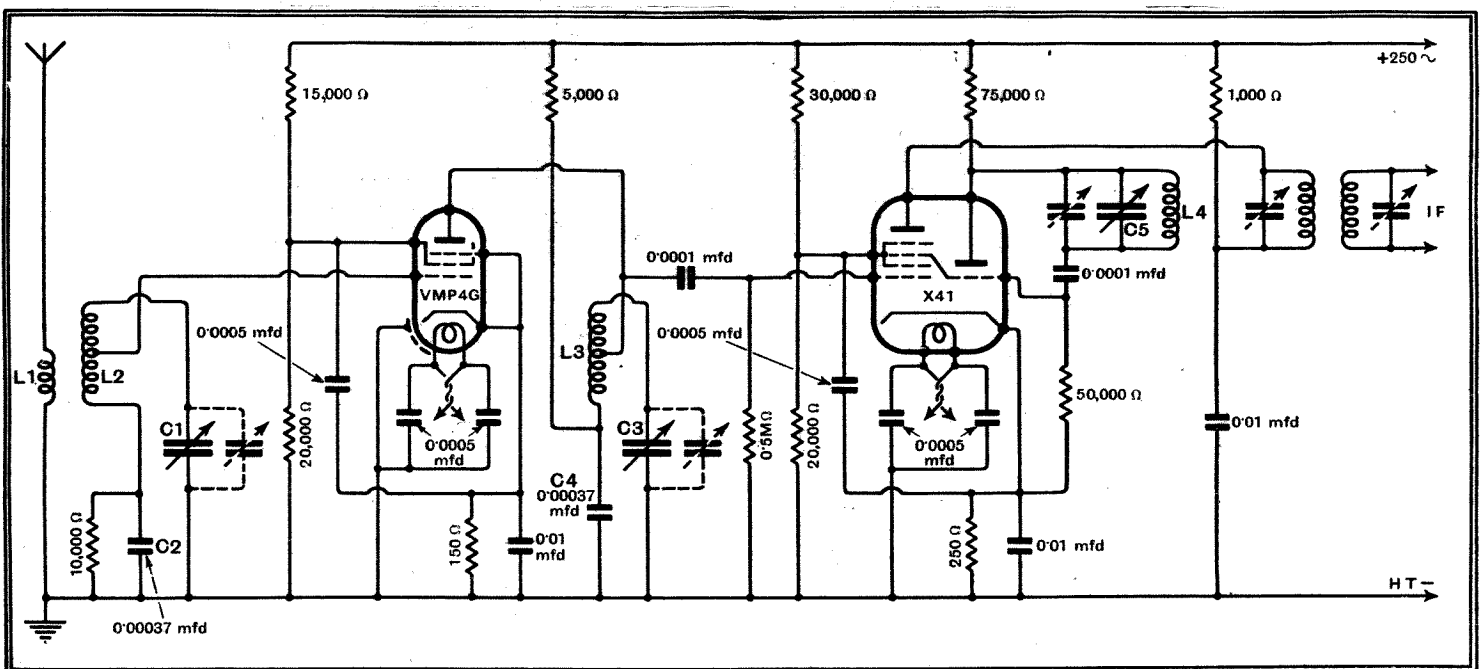


Fig. 1.—The circuit diagram of the HF and frequency-changer stages of an ultra-short wave superheterodyne. Ordinary valves can be used with good results.

**Amplification on Ultra-Short Wavelengths—** the capacity of a tuned circuit can be halved, the inductance can be doubled, and this doubles the dynamic resistance and the stage gain—always provided that the external damping is negligible.

#### Advantages of Low Gain

In practice, however, valves have a fairly low input resistance on these wavelengths; it may be as low as 5,000-20,000 ohms. When it is remembered that the dynamic resistance of the tuned circuit may be no greater, the difficulties in the way of obtaining high amplification will be realised. Now, because of the high operating frequency, feed-back effects are much more serious than on the medium waveband, and for a given amplification it is more difficult to achieve stability. In fact, it would be impossible to stabilise a stage if it gave the amplification we are accustomed to on broadcast wavelengths. The low gain of an ultra-short wave amplifier is consequently not an unmixed evil, for if it were possible to obtain high amplification we could not use it without resorting to neutralised circuits.

Practical experiment shows that it is readily possible to build a single-stage amplifier which will give a worth-while degree of amplification without leading to any difficulty from instability. Measurement at the frequencies involved is difficult, and results are consequently unreliable, but the writer estimates that at 7 metres a gain of about ten times is obtained from a stage feeding a frequency-changer.

The circuit diagram of the arrangement which the writer has found the most suc-

cessful is shown in Fig. 1, and a photograph showing the construction, which is just as important as the circuit, in Fig. 2. Short leads are essential, and the arrangement adopted permits this to be readily achieved. In particular, the horizontal mounting of the valves enables very short leads to be obtained in the coupling, for the top-cap of the HF valve is the anode, whereas the top-cap of the frequency-changer is the grid.

of 370 mmfds. capacity, are inserted in the signal-frequency circuits. The advantage of this arrangement is that the trimming is carried out on the comparatively flatly tuned signal-frequency circuits instead of the very sharp oscillator circuit, and the ease of adjustment is much greater.

In the case of the signal-frequency circuits, the stray capacities are best roughly equalised by the adjustment of the tapping points on the coils. It has been found that with 40 mmfds. tuning condensers L2 and L3 should be about  $0.45 \mu\text{H}$ , and coils consisting of seven turns of No. 14 wire spaced eight turns per inch with a diameter of  $\frac{3}{4}$  in. are entirely suitable; L2 should be tapped at  $4\frac{1}{2}$  turns from the earth end, and L3 at  $3\frac{1}{2}$  turns. The oscillator coil L4 must be about  $0.5 \mu\text{H}$ , and eight turns are satisfactory. Such coils are naturally self-supporting, and slight alterations to the inductance values are readily made by compressing or stretching the coil as required.

Additional capacity is needed in the oscillator circuit, and this must be about 4 mmfds., and is provided by a parallel trimmer across C5. The exact equalisation of the capacities in the two signal-frequency circuits is effected by means of very small trimming condensers.

Practical tests with this unit and a two-stage IF amplifier have been very satisfactory. No difficulty whatever from instability or modulation hum has been found, and the HF stage definitely amplifies to a degree adequate to justify its existence. The use of two signal-frequency tuned circuits, moreover, greatly reduces the chance of second-channel in-

terference. Experiments with this apparatus have shown the use of an HF stage to be well worth while when high sensitivity is needed on wavelengths of the order of 7 metres, and that ordinary valves can be used.

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## Wireless Technique in Medicine

*Kathodenstrahl-Oszillographie in Biologie und Medizin*, by Wolfgang Holzer. 1936. Published by Wilhelm Maudrich. Vienna. 155 pp. + x, illustrated.

AT the beginning of this book the author aptly sets the celebrated dictum of Maxwell, that the most important step in the progress of any science is when measurements begin to be made. In his introduction he states that his object is to do for biology and medicine what Watson Watt and his colleagues of the Radio Research Station have done for wireless in their well-known volume, "The Cathode-Ray Oscillograph in Radio Research."

The book is divided into five sections. Section A, after an introductory discussion, deals with cathode-ray tubes, a detailed description being given of the high-power metal tube developed by Knoll and the author at the Berlin (Charlottenburg) College of Engineering; while another chapter is devoted to "Braun tubes," a term which the author limits to sealed-off glass tubes such as those developed by von Ardenne. Section B deals with auxiliary apparatus and measuring technique. Here, a very long chapter devoted to the increase of sensitivity by means of amplifiers is followed by a short chapter on the decrease of sensitivity by voltage dividers, and by another short chapter on the conversion of non-electrical quantities (changes in pressure, brightness

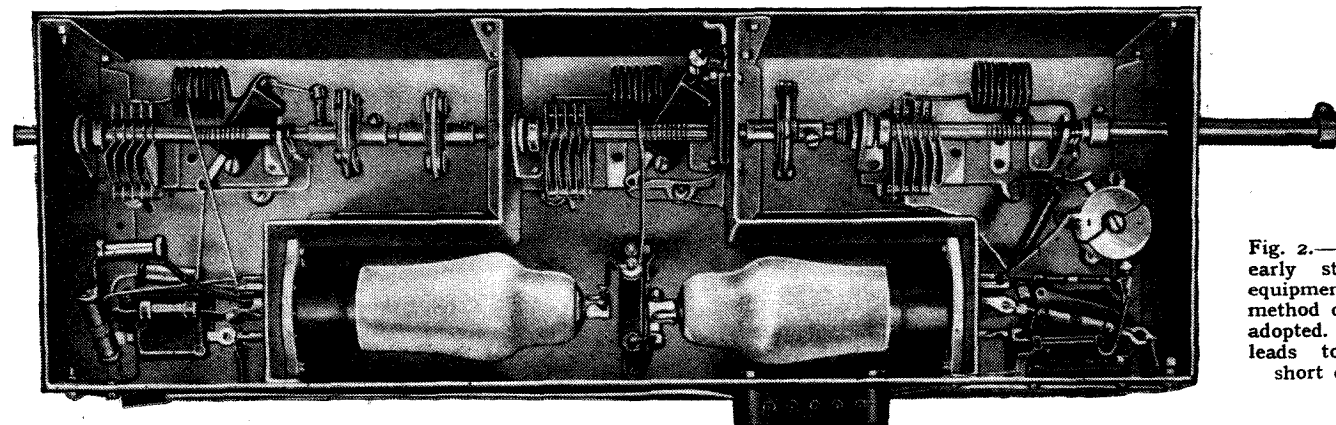


Fig. 2.—A view of the early stages of the equipment showing the method of construction adopted. It is one which leads to particularly short connections.

of light, etc.) into potential variations suitable for the oscillograph. The section ends with a chapter on time bases and one on photographic recording methods.

Section C, the really specialised portion of the whole, deals with some examples of the medical and biological applications. Separate chapters describe and illustrate the recording of action potentials of muscles, the making of electrocardiograms, the recording of nerve action potentials, and the recording of heart and pulse sounds, etc. Section D, on the comparative advantages of the cathode-ray oscillograph and of alternative apparatus such as the string galvanometer, makes out an overwhelming case for the former, even as regards cost. The final section, E, gives a bibliography of some 200 items selected from the whole field covered by the volume.

H. D.

#### Coil-winding Data

Ganged tuning is used, and for ease of adjustment the oscillator operates at a lower frequency than the signal. This means that the padding condensers C2, C4,

terference. Experiments with this apparatus have shown the use of an HF stage to be well worth while when high sensitivity is needed on wavelengths of the order of 7 metres, and that ordinary valves can be used.

The gain of the stage undoubtedly varies with wavelength, and is highest around 8.5 metres, the maximum wavelength of the set. It falls off appreciably at lower wavelengths, but is still appreciable at about 6.25 metres. At still lower wavelengths in the neighbourhood of 5 metres, which is below the tuning range of this gear, it is doubtful whether much amplification would be secured. At such wavelengths the input resistance of ordi-



# Judging By Ear

## Critical Estimation of Receiver Performance Without the Aid of Measuring Instruments

*ABOUT a year ago, a contributor described methods of locating faults without any measuring instruments whatever. Without suggesting that there are any real substitutes for scientific methods, the present article describes how, by critical observation and deduction, the capabilities of a receiver may also be estimated by ear with more than the usual accuracy.*

**H**OW, failing the possession of a few hundred pounds' worth of laboratory apparatus, are we to decide whether a receiver suffering from no very obvious defect is really in first-class order in all respects? And, having done so, can we determine whether the limitations imposed by its original design can be tolerated?

There are, unfortunately, no completely satisfying answers to such questions. But, by putting prejudice aside and cultivating our critical faculties, it is possible to form a useful opinion by carrying out the aural tests to be described in this article.

Starting in the usual—and apparently illogical—manner, at the output end of the set it is necessary to determine whether volume is sufficient when receiving the local station. Failing any standard of comparison, it is none too easy to do so by direct means. But if the output and rectifying valves have lost emission (a primary cause of poor volume) it is probable that other valves are in the same case; in a "straight" receiver difficulty in provoking self-oscillation at all wavelengths by operation of the reaction condenser is a proof that this is so. In a superhet failure of the oscillator to do its job over part (usually the upper part) of one or both wavebands conveys similar information.

### The Signal-frequency Circuits

Partial failure of an HF or IF valve is not at all easy to detect without making measurements either of the valve itself or of the overall sensitivity of the set. It may, however, be suspected as a possible cause in a case where the sensitivity of a set turns out to be disappointing. There are usually no other symptoms of a worn-out valve in this position in the set. A check can be made, as in all cases where a valve is suspected, by replacing the doubtful valve temporarily with one known to be sound.

However expensive and multi-valve the set may be, whatever may be its prowess in receiving distant stations, there is no

getting away from the fact that for much of its time it will be used for listening to the local station. The most important test of all must, therefore, be to make sure that the reproduction of the local station programme is good enough, for if it is not, no amount of other virtues in the set will compensate for this one failing. But before settling down to study the fidelity of the reproduction it is quite essential, if we are to be fair to the set, to make absolutely certain that tuning and other adjustments are set to the best possible advantage.

If the set is of the "straight" three-valve type, consisting of HF stage, detector, and output valve, it must be remembered that quality can very easily be spoiled by overloading the detector. A set of this type usually has, in effect, two volume controls; one is a means of adjusting reaction, while the other usually varies the bias on the variable-mu HF stage. For the local station the reaction must be turned back as far as it will go, and the bias control must be turned up *only just enough* to give the required volume. Turning it up too far may not cause the signals to become too loud, but may very easily cause overloading, and consequent distortion, at the detector.

In a straight set the tuning will probably be rather flat with the controls set as just suggested, so that the exact position of the tuning-dial will be of little consequence from the point of view of quality. In a superheterodyne, on the other hand, tuning will be very much sharper, and to obtain a true impression of the reproduction given by the set it will be necessary to adjust the dial to a setting *exactly* in the centre of the small range over which the signal is heard. If tuning is slightly

offset from this point reproduction will be shrill; the point of exact tune is that where shrillness is most completely absent.

If the set is a fairly modern one, fitted with AVC, the manual volume control should be set to give reproduction at a level safely short of that at which there becomes evident distortion due to overloading the output valve. In the case of an older superhet, with a manual volume control operating on stages preceding the detector, the precaution against detector overload mentioned in connection with the straight set must again receive attention. In either type of set the "tone-control," if one is fitted, should be turned to "maximum brilliance."

### Standards of Quality

In listening to the set, now adjusted for the maximum fidelity of which it is normally capable, to decide whether the quality of reproduction is up to the standard we require, it is not enough to absorb just a general impression. In any set of reasonably up-to-date design there will be practically no distortion in the strictest and most literal sense. That is, the loud speaker should not noticeably emit any sounds not present in the original performance before the microphone. But many sounds, clearly enough audible to anyone present in the studio may fail to reach the listener, while others, present but not obtrusive in the original performance, may be magnified far beyond their true proportion.

Faults of this kind do not always strike the uncritical listener at once, but unless the ear becomes atrophied, they are apt to attract continually increasing attention as time goes on. In such a test as this it is therefore well to listen for them deliberately. First, the bass.

There is no reason (save, perhaps, lack of power) why the bass should not be present in any fairly modern set with a moving-coil speaker. Often, indeed, there is too much). Attentive listening will show whether the bass is true bass, enabling drums of different pitch to be really distinguished, or whether it is a resonance that turns every low note, no matter what its true pitch may be, into a thud that owes its character to the loud speaker instead of to the instrument in the studio.

It is only fair to add that one must



**Judging by Ear—**

not be too critical in this direction. If, on attentive listening, the bass reproduction seems to be, if not the truth, at least an acceptable substitute for it, the set has passed its test.

**Tests for High-note Response**

Now let us transfer our attention to the high notes, the point being to see whether they are present in sufficient quantity. In listening to speech the sibilants should be clean and crisp; "such" should not be rendered as "shush." A more stringent test, passed by many straight sets but by a minority only of superheterodynes, is to tune in a powerful foreign station (accurate tuning; no reaction) and see whether speech in an unfamiliar language can be followed. The language chosen should be one of which we know a little, but in which we are not completely at home. If listening gives the impression that it would not be difficult to write down, as from dictation, every word spoken, even though the meaning may be quite obscure, then the set is giving really first-class reproduction. But if only a word here and there can be caught, and the rest seems unintelligible jabber, we may at once be sure that the reproduction of high notes leaves much to be desired. That speech in English should be entirely intelligible is no test at all; one unconsciously guesses a half-heard word.

This test depends on the fact that the consonants, upon which speech relies for its intelligibility, consist very largely of sounds of high frequency, and can only be correctly reproduced by a set that has a good response to high notes. Music, except for those who are very familiar with instruments of an orchestra, shows up a defect of high notes much less readily, and so is much less suitable as a test.

It is only fair to say that there are few sets that would emerge as perfect from a really stringent application of the test just described, and to add that any set giving such unusually good reproduction as that suggested would inevitably be of very poor selectivity compared with the average superheterodyne. Each owner of a set must decide for himself whether the degree of intelligibility achieved by the set he is testing is high enough for his requirements. On the whole, it will be found that straight sets give better quality of reproduction than superheterodynes, for the latter are practically always designed to give the rather high selectivity that the public has come to associate with the name "superhet."

In many sharply tuned sets a very considerable increase indeed in the high-note response can be had by slight mistuning. If the set under examination seems to require it, this expedient can be tried while receiving the local station. If we are willing to accept the small extra trouble of having to find the exact tuning point that gives the best overall balance on the local station every time it is tuned in, the selectivity so useful for our long-

range reception may be found compatible with very acceptable reproduction of every-day programmes.

Having formed our opinions of the set in the matter of quality of reproduction, we have to extend our tests to its other qualities. Is it sensitive enough? In many cases this can be settled in a few seconds by finding a setting of the tuning dial at which no station is heard. If, with the volume control at maximum, there is heard a greater amount of background noise than would be tolerated when listening to a programme, the set will bring in any station which, *at the place where it is being tested*, is louder than the background noise. One would never use greater sensitivity than this. Alternatively, one may seek for a station which, with careful tuning, can barely be persuaded to give a full-strength signal in the speaker. If the background noise accompanying such a station is only trifling, it is probable that a more sensitive set would bring in more stations of programme value.

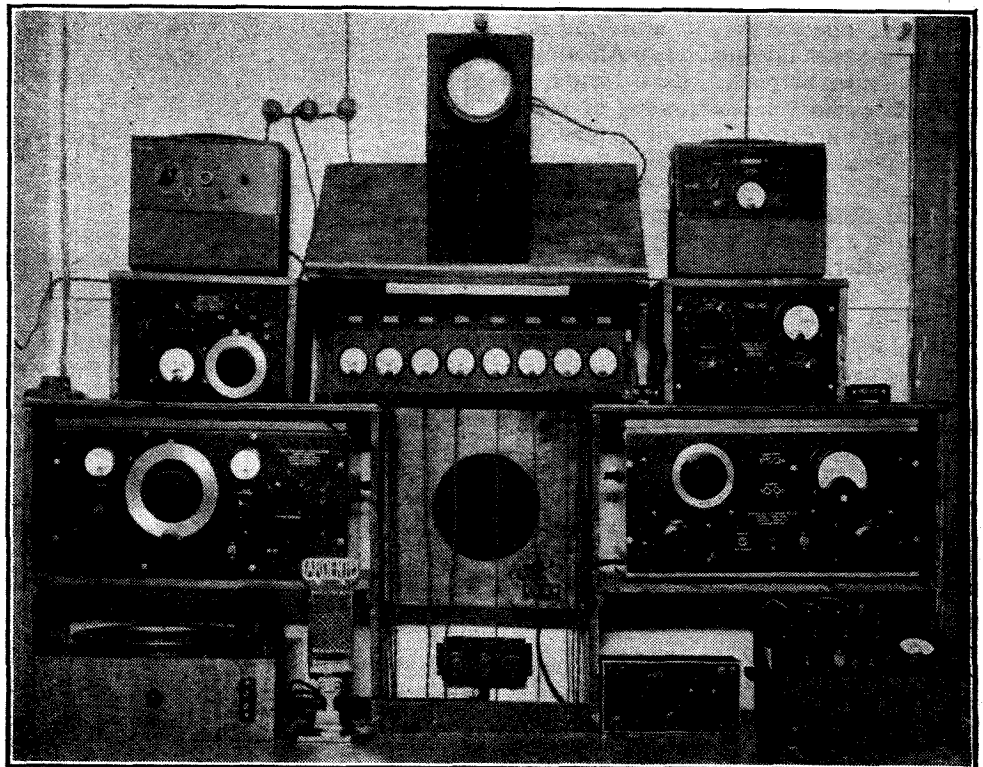
But there still remains the probability that the set under test may provide a sufficiently satisfying supply of foreign programmes; no one but the prospective purchaser can decide *that* point.

In the question of selectivity it is even more difficult to set up any standard. A straight set must be expected to tune rather flatly unless reaction is applied; with its aid, it is reasonable to expect that the louder of a pair of stations on adjacent channels should, in most cases, be receivable clear of its neighbour. But the

skill with which the user handles the controls is really a much larger factor in selectivity than the design of the set (but the number of tuned circuits counts).

In a superheterodyne the selectivity is "built in," and does not depend in any way on the user's skill in tuning. Unlike the straight set, the selectivity is the same (or nearly so) over the whole of both wavebands. In any part of Southern England a very good idea of selectivity can be had by attempting to tune in the Deutschlandsender at a time when both Droitwich and Radio Paris are transmitting. If the set gives really high quality, the German station will not be found at all. At the other extreme, ultra-high selectivity will enable this station to be heard with only the slightest occasional side-band splash from its two powerful neighbours, but a set that tunes in so restricted a frequency-band as this must necessarily be deficient in high notes. Most superhets offer a compromise between these two extremes; Deutschlandsender is heard with the accompaniment of a good deal of side-band splash, but when tuned to that station the programmes from Radio Paris and Droitwich are not heard in intelligible form. Such a set combines acceptable, but by no means irreproachable, quality, with a selectivity sufficient to provide a very wide choice indeed of interference-free foreign stations.

In this direction, as in others, the tester is the only possible judge as to whether the compromise offered by the set is a satisfactory one from his own point of view.

**INVESTIGATING DEAF-AID PROBLEMS**

Some of the test gear used in the production of Ardente amplifying and deaf-aid equipment. Among the units shown is a beat frequency oscillator, a peak sound indicator, cathode-ray oscillograph and a noise level indicator.

# UNBIASED

By

## FREE GRID

### Photo-electric Clock

PEOPLE are getting so lazy nowadays that they can't even be bothered to read their newspapers properly. It is this modern attitude of mind which accounts for so much of the litigation which chokes our courts. If people only bothered to read properly the various contracts they sign, our judges, and more especially those of the Divorce Division, would have far less to do, for fully 90 per cent. of the contracts would never be signed once their signatories had fully grasped what they were contracting to perform.

These melancholy reflections on the frailties of human nature are prompted by the number of letters I have received concerning the new sun-driven clock which I mentioned the other week. I distinctly stated then that this absurdly complicated



Think I am the inventor.

“wireless” sundial, with its prodigious battery of photo-cells and other impedimenta, had been invented by an American, yet a number of readers have written to me in sarcastic vein demanding to know what keeps the clock going during the sun's nocturnal absences. It is quite evident that they think that I am the inventor of the wretched thing, and they have therefore given only a slipshod reading to my notes on the matter.

I have no notion, of course, of the manner in which the inventor keeps the works of his clock on the move during the sun's temporary absences, but, naturally, I presume that he has engirdled the earth with prodigious batteries of photo-cells on the reasonable assumption that, as the song says, “Somewhere the sun is shining” no matter what the hour or the time of the year. By means of simple wireless transmitters these photo-cells could then pass on the necessary impulses of energy to his clock, no matter where it was situated.

While I can, perhaps, stretch a point and forgive the ignorance of the majority of my readers, who cannot be expected to know any better, I do not think I can extend my clemency to a particular individual—a scion of the great motoring industry—who seems extraordinarily ignorant of the elementary principles of

the mechanics upon which his own trade is founded. Judging from his letter to me, he seems to be unaware that the ordinary car engine has to be fitted with a device to tide it over the periods during which the spirit that moves it is out of action.

I refer, of course, to the ordinary fly-wheel with which every form of reciprocating engine must of necessity be fitted. Instead of applying this delightfully simple mechanical principle to the problem in hand, he must needs go into details of an elaborate and quite unnecessarily complicated invention of his own. I would gladly publish his screed, together with his name and address, for everybody to read, but, fortunately for him, beneath a rugged exterior I have a tender heart and should not like to feel that any action of mine contributed toward his having to hang his head in shame before the scornful glances of his fellow roadhogs.

### I Visit the Palace

CONSIDERING the fact that television transmissions are supposed to start some time during the summer, it is extraordinary how little the B.B.C. let us know about it. A definite hush-hush policy seems to have been adopted, just as though Broadcasting House were half ashamed of it; not that there is anything to be astonished at, even if they do feel a sense of guilt after promising us transmissions for months past.

In order to satisfy my curiosity I took the opportunity the other day of paying a visit to the Alexandra Palace to see exactly what is happening, and was astounded at what I saw. There was chaos everywhere, and it certainly looks as though things will never be ready. It is, of course, against the B.B.C.'s rules to permit people to wander into any of their premises, but, provided you arrive there in an imposing equipage with a sufficiently glossy silk hat and an adequate pomposity of manner, you can get away with anything.

The reason for the delay is, I discovered, a highly interesting one. It appears that, although the palace is situated on a high hill, or a lofty eminence as an official to whom I spoke insisted on calling it, it is feared that the range of the transmitter will not be as great as was at first thought. The radiation limits of ultra-short waves for a reliable service are not much greater than those of light waves, and consequently they do not get far over the normal curvature of the earth. Obviously this difficulty could be overcome by putting the transmitter suf-

ficiently high up, and it was at first suggested, so I learned, that a sort of imitation Eiffel Tower should be built with both studios and transmitter at the top.

However, expense ruled out this project, but as a result of the development of the co-axial cable a startling suggestion was put forward by a hanger-on of the engineering staff who is renowned for his ingenuity. His idea was to put the transmitting apparatus into a large captive balloon anchored at a height of several thousand feet above the palace studios.

Had it not been for the development of this special cable it would have been impossible to separate studios and transmitter by so many thousand feet and, of course, it would have been inconvenient to have the studios in the balloon, since it would have meant constantly winding it down in order to permit artistes to enter and leave; apart from this, many of them would have probably been air-sick due to the swaying of the balloon in the wind, and the B.B.C. ground staff would probably have objected to this.

One fatal objection to the scheme has been raised, however, and, unless it is overcome, the transmitting apparatus may have to be housed inside the Palace after all. The objection has been raised by an



Providing you arrive in an imposing equipage.

eminent psychologist whom the B.B.C. consulted. He fears that the small boys of the neighbourhood will arm themselves with air rifles and indulge in the sport\* of bringing down the balloon. It is all very well to say that the police will look into the affair and that, after it has been done once or twice, sufficiently severe punishment will act as a deterrent. It must be remembered that every time the balloon was shot down it would mean the loss of some of the engineering staff up aloft, and the insurance companies who handle their life policies would undoubtedly object even if the engineers themselves were as willin' as Barkis.

By Our  
Special  
Correspondent

# BROADCAST BREVITIES

## Recording in Public

ONE of the things that cheer the B.B.C. Recording Unit on their adventurous expeditions is the wholehearted support which they receive from the public. Mere mention of the fact that the queer-looking green van, with its coils of cable and collection of microphones, is "something to do with broadcasting" always elicits the greatest enthusiasm; indeed, the man in the street is usually so interested that he is inclined to trip over the wires in his eagerness to see the works.

## Helping the "Flying Squad"

I remember a year ago a ceremony at the Guildhall, London, when the "Flying Squad" was arranging microphones in the courtyard in order to report the arrival of Australian blue-jackets. Some difficulty was encountered in finding a suitable suspension point for one of the "mikes," which was intended to pick up the first strains of the approaching band.

Immediately one of the bystanders volunteered to hold the microphone, such was his enthusiasm for the "cause." If his offer had been accepted he might have stood there for hours, for the procession was late.

## Underground

This same keenness has been met with during the recording of sound vignettes on the London Underground for Felix Felton's feature programme on May 8th. The "tube" staff were given an opportunity to make the organisation speak for itself, and were only too willing to go out of their way to help the producers to give a true picture.

## "Tube" Questions Answered

Of course there were peculiar problems in taking "sound photographs" of the Underground Railways. The recording van had to stay above ground, while long stretches of cable were fed down shafts to the platforms a hundred or more feet below ground level.

There are many questions that passengers put to themselves when rushing through the tunnels. How is the signalling system operated? What happens when all the lights go out? How do you get out of the Underground when shut in after

the last train has gone? Where does the conditioned air come from?

These are some of the questions which will be answered on May 8th, besides many others.

## Talent-Spotting

PEOPLE who think it must be grand to be a "talent spotter" for the B.B.C. might change their minds after a chat with Mr. F. Boulton, who has just toured 120 towns and villages and seen (and heard) about 1,500 artists of all descriptions, from the ages of 6 to 60.

He visited every kind of Theatre and Hall—Royal, Masonic, Floral and all the other varieties—and the net result seems to have something akin to a sick headache. One

## No Originality

The outstanding revelation of the tour, it appears, was the lack of originality on the part of the artistes. Even highly paid comedians used gags as old as the Ark. Young artistes made the mistake of copying older and well-known people instead of trying to kindle a spark of originality. Very few seem to have tried to do something which would make people stop talking when their broadcasts began.

## Spa Logic

FRENCH logic has come to the fore in a demand from the Mayors of Auvergne and Bourbonnais—both places noted for their spa treatments—that the district should provide a site

which Barbara gives her millionaire father an impression of her Salvation Army activities. It was decided that the best course would be to have the brass section of Oslo Philharmonic Orchestra playing in the open, so the players took up a stance in a small courtyard next to the broadcasting headquarters.

## Misplaced Generosity

Now this same courtyard backed on to the Hotel Continental, and as soon as the music began to go round and round and the engineers started recording, unexpected sounds were registered on the discs. There were the squeaks of opening windows, and a few seconds later the jingle of a stream of coppers. . . .

## "Queen Mary's" Maiden Voyage

THE B.B.C. Variety Director, wishing to celebrate the "Queen Mary's" maiden voyage with a musical work, has commissioned George Posford to write a symphonic rhapsody in the modern idiom. This special work, entitled "Transatlantic Rhapsody," will be played in London by Geraldo and his Orchestra in the programme "Romance and Rhythm," during the time of the voyage.

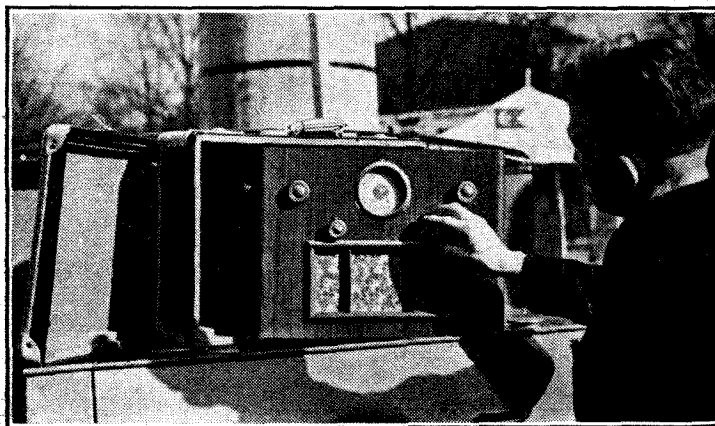
The occasion will be important for Mr. Posford, and should help to place the seal on his success with "Good-Night, Vienna," and "Invitation to the Waltz."

## Descriptive

The "Rhapsody" is descriptive, first portraying the departure and the colossal activity at the docks and then forming a kaleidoscope of cheering crowds, bands playing and sirens of tugs, as the giant liner leaves the quay. The second theme is the open sea—a romantic theme on the grand scale, depicting the achievement which the "Queen Mary" represents in British shipbuilding.

## Life on Board

Theme three seeks to represent the conflict between two great forces, the ship's mighty engines and the sea. Next comes a descriptive picture of life aboard with its dance bands, swimming pool, cabarets, etc. The finale provides a glimpse of the mighty liner as she ploughs her way through the seas on a moonlit night.



IS IT A PORTABLE? This German five-valve "straight" set has been so designed that it can be used either as a portable or as a drawing-room receiver. When in use at home it bears no semblance to the average "portable."

bright spot was a week touring the concert halls attached to public houses, but Mr. Boulton thinks he deserved it.

## Didn't Even Twinkle

The would-be stars that failed to twinkle warrant a book to themselves. There was the girl singer who brought a gentleman friend to the audition to hum the accompaniment, a gentleman who played on a bicycle pump, another who drummed on match boxes, and a large lady who played a violin which was bordered by a couple of dozen electric lights.

All walks of life were represented by the prospective broadcasters. There were army officers, railway porters, shop assistants, insurance brokers, asylum attendants, and probably, as Mr. Boulton observes, several of their patients.

for a great central broadcasting station which would cover the whole of the country.

Evidently their thoughts are directed towards Droitwich, also famous for its spa. Incontestably Droitwich covers the British Isles, and who is to say that this fact is not traceable to the mineral nature of the soil?

And if Droitwich why not Auvergne and Bourbonnais? Hein?

## The Band in the Yard

A GLORIOUS true story reaches me from a Scandinavian friend. It concerns the recent broadcast in Norway of Bernard Shaw's "Major Barbara."

During the preliminary work of the Effects Department the producer was anxious to get a realistic recording of band music as a background to the scene in

# Resistance—MEAT or POISON?

## Reconciling Apparently Contradictory Statements About the Effect of Resistance on a Tuned Circuit

By "CATHODE RAY"

**B**ETWEEN the vast number of people who are happy because they know and care nothing at all about wireless, and the very minute number who are happy because they know *all* about it, there are a middling number who know just enough to be perplexed.

Here is one of the perplexities. Typical extract from a technical article: "The selectivity of the tuned circuit is improved by reducing the resistance R introduced by. . . ." Another extract—might be

from the same issue or even from the same article: "The selectivity of the tuned circuit is improved by increasing the resistance R introduced by. . . ." Of course, there is a difference in the Rs, as is easily seen if they appear in a circuit diagram (Fig. 1). The same identical

R cannot blow hot and cold in this way, or we shouldn't know where we were. But unless one has quite a clear understanding of the matter it is very confusing to read in one place that the selectivity is better (or, what means the same thing, the losses or damping are less) when the resistance is higher; and, in another place, when the resistance is lower. It is easy to wonder whether resistance is bad or good. Resistance and losses are generally regarded as much the same thing so far as a tuned circuit is concerned. Hence it is disturbing to be told that the losses may be cut down by increasing resistance.

### An Analogy

If you were the proprietor of a flower shop situated at a large suburban railway station you would regard with intense satisfaction an arrangement whereby one way for the throngs of homing business men to emerge from the station ran right through your shop. You would be particularly gratified if it were what might be described as a low-resistance exit, so that it formed by far the easiest path for the use of the said business men, the majority of whom would thus be brought within a sphere of influence suggesting a handy peace-offering for taking home. The less the resistance the better the business. That is what is known as series resistance;

the resistance lying in the direct path of business (Fig. 1 (a)).

You would view with less approval a proposal to reduce the resistance of the station exit running in parallel with your shop. Such a reconstruction would tend to carry potential customers past you, with no sweet scent of blooms to jerk their heads out of the Late Final.

If you were affected by the craze for business psychology you might even study the situation so far as to determine what reduction in resistance to your shop

(effected, say, by installing working mechanical models in display windows) is equal and opposite to a reduction in resistance to your shop (The problem of the effect of general structural modifications could then be simplified by expressing them all in terms of shop

resistance only (or, alternatively, of other exit resistance only).

Perhaps that is too clever for florists. But, of course, it is elementary to the radio engineer. If there are, say, 15 ohms in series in a tuned circuit, and the valve to which it is connected has the effect of putting 80,000 ohms in parallel, it would be very interesting to know how these two losses compare in their effect, and how much each contributes to the total, and, in fact, what the total is. It certainly is not 80,015 ohms, as anybody can see who has really been following my argument. Becoming quite technical for a moment, I will explain how to do the calculation. It is necessary to know the reactance of the coil (or of the condenser, for that happens to be the same when the circuit is in tune). If L is the inductance of the coil in microhenrys, f the frequency in megacycles per second (kilocycles divided by 1,000) to which the circuit is tuned, and  $\pi$  is 3.14 . . . as usual, the reactance X is  $2\pi fL$ . To convert the parallel resistance into series resistance, or vice versa, divide  $X^2$  by the resistance. That is not absolutely accurate, but it is good enough when, as usually happens, the parallel resistance is much more than X and the series resistance is much less.

Suppose L is 200, and the wavelength is 450 metres, giving an f of 1.5. Then X

is 1,880; and  $X^2$  is 3,550,000. Dividing this by 80,000 we get 44.5, which is the equivalent series resistance. Thus the loss introduced by the valve is nearly three times as much as that residing in series with the coil, and the total is 59.5.

If you wanted to think in terms of parallel resistances only you would divide 3,550,000 by 15, giving 237,000 ohms to add in parallel with 80,000. This being more than 80,000, the effect is less, as already explained; actually about three times less, agreeing with what we have found already. The combination of two resistances in parallel is always less than either. My policy is never to give anything in mathematical form without explaining it, I hope clearly, in words, so that the mathematical operation is something for which the reason is obvious; but, to depart from this course for once, as a matter of interest, the resistance equivalent to two in parallel is

$$\frac{R_1 \times R_2}{R_1 + R_2}$$

Doing that to 80,000 and 237,000 the answer is 59,800. And transferring this total loss into its series equivalent as explained (dividing 3,350,000 by it) we get 59.5, thus arriving by a roundabout route at the result previously obtained. It gives a pleasant feeling of confidence when two systems of navigation show the ship to be in the same position.

Finally, just to consider this resistance business from another angle, what do you understand by *no* resistance? Don't reply too quickly!

If R in Fig. 1 (b), or the valve effect which it represents, were erased or disconnected respectively, there would be, clearly, *no resistance* due to this factor. The source of loss having been annihilated, the tuned circuit is, of course, much more efficient. But suppose, in-

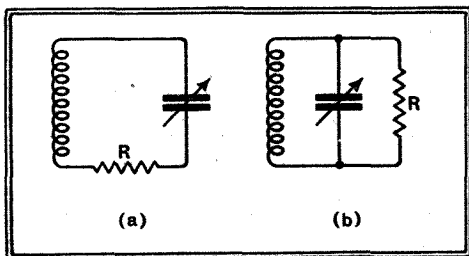


Fig. 1.—Although the presence of resistance R in either position introduces a loss into a tuned circuit, the effects of varying R in the two arrangements (a) and (b) are diametrically opposite.

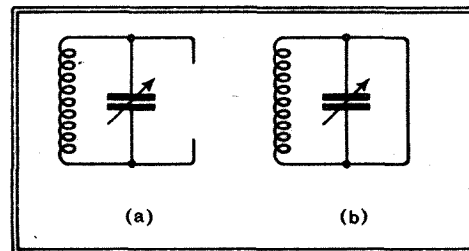


Fig. 2.—In which of these is there no parallel resistance?

stead, that R is successively reduced from 80,000 down to 10,000, 1,000, 10, a fraction of 1, and, finally, zero. There is now, obviously, *no resistance*. But is the tuned circuit the better for it? On the contrary, it has become worse and worse, until finally it is short-circuited and put out of action entirely.

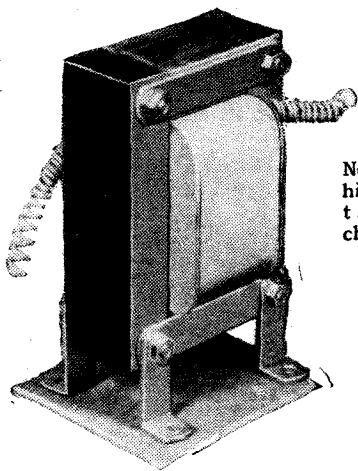
It is curious how the simplest language can land one into paradoxes like this. It just shows how careful one must be when writing or reading.

# New Apparatus Reviewed

## BULGIN 100-HENRY CHOKE

**T**HIS high inductance LF choke is a new model recently introduced by A. F. Bulgin & Co., Ltd., and is described as the Type LF34. It has a nominal inductance of 100 henrys and is designed for light loads only; the maximum DC permissible, before any appreciable reduction in inductance occurs, is stated to be about 15 mA.

Many occasions arise when a choke of this value is needed, such as anode decoupling where voltage loss cannot be tolerated, and HT smoothing for an early valve in an amplifier, to mention but two of its many useful applications.



New Bulgin high inductance LF choke type LF34s.

The new choke is available either in skeleton form or enclosed in a metal case of the universal mounting kind adopted by this firm for their LF components.

The specimen tested had a measured resistance of 1,760 ohms, while its inductance was 120 henrys with no DC flowing, 119.5 with 5 mA, 114 with 10 mA, 107.5 with 15 mA, and 100 henrys with 20 mA of DC.

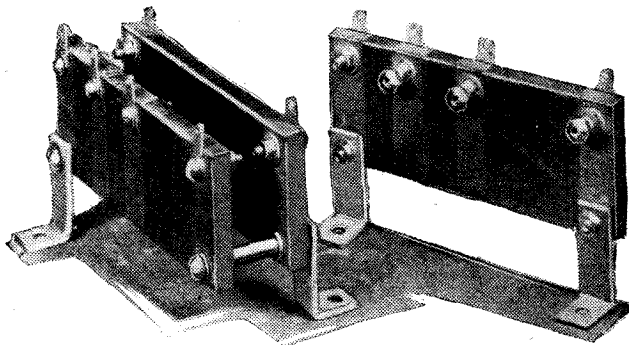
The well-maintained inductance values up to 20 mA of DC through the choke is accounted for by the very generous size of the iron core and the careful adjustment of the air gap.

In skeleton form this choke is described as the Type LF34s, and the price is 10s. 6d. Housed in a metal case it costs 12s. 6d., and is then known as the LF34.

## B.T.S. POWER RESISTANCE

**B**BRITISH Television Supplies, Ltd., has developed a new-style power resistance for use with the universal-type AC-DC valves. The range includes a dozen different models covering the requirements for most combinations of one to seven valves of either the 13-volt or the 40-volt variety, and also combinations of the two styles.

They are wound with nickel-chrome resistance wire on slate formers measuring  $3\frac{1}{2} \times 1\frac{3}{8}$  in. by a shade under  $\frac{1}{4}$  in. thick. Metal feet, insulated from the winding, are fitted for mount-



New power resistances for AC-DC valves made by B.T.S.

## Recent Products of the Manufacturers

ing purposes, and each has tappings for mains supplies of 210, 230 and 250 volts, or, if required, for 200, 220 and 240 volts.

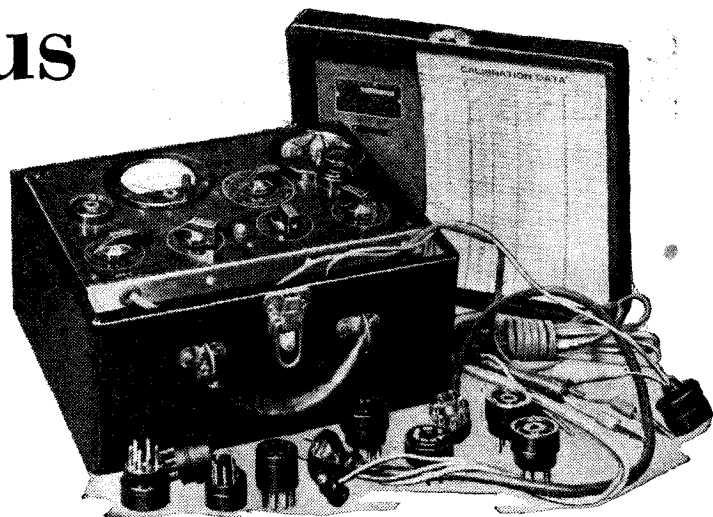
Some specimens have been subjected to a rigorous test, and although overloaded by as much as 50 per cent. in current, have shown no signs of being overstressed, though, of course, considerable heat was generated.

Though bare wire is used and the turns spaced slightly in lieu of insulation, the choice of materials and the method of winding are so well judged that even after a lengthy test with higher currents than their rated values the wire remained as firmly secured on the former as before testing. Neither was there any discoloration in the wire, which remained bright throughout, and no indication was left after these tests that excessive currents had been passed through them.

They are well designed and soundly made resistances and will prove perfectly satisfactory for the purpose they are intended. The majority of the models are wound on single formers of the size mentioned, and these cost 3s. 6d. each. One model, intended for a single valve only, and naturally requiring to have a much higher resistance, employs two formers, and it has been necessary to increase its price to 6s. 6d.

## LYONS-HICKOK ALL-WAVE OSCILLATOR

**T**HIS oscillator, which is essentially a serviceman's test set, is especially interesting in that it exemplifies the modern trend of design of this type of apparatus used largely in the U.S.A. Not only does it provide a modulated HF output over the extensive range of 7.5 to 3,500 metres, but it also gives an audio signal for testing LF amplifiers and components. Used in this



Lyons-Hickok all-wave service test oscillator.

The instrument is fitted with a two-range DC milliammeter—0 to 1 and 0 to 10 mA respectively—which can be used for checking anode current of the valves in the set, or connected as an output meter, a rectifier being included for this purpose. Leads and valve adaptors to suit American valves are included, but provision is not made for using the output meter with a set having British valves, though, no doubt, the required changes in adaptors could be effected without much difficulty.

The oscillator is AC operated, the transformer fitted being suitable for standard supplies in this country. Incidentally, all the necessary changes in the internal connections for the various functions of the unit are effected by switches.

Our first test was to check the calibration of the HF oscillator. It should be mentioned that these instruments are apparently individually checked before dispatch, because a chart accompanies each giving the exact setting of the HF correction control for several points on each of the eight frequency ranges.

Taking into account these corrections, we find the accuracy is particularly high, for not one of our check measurements showed a disagreement greater than one per cent. in frequency.

The output control is adequate for almost every type of set, be it a sensitive superhet or a simple two-valve receiver. The 400 c/s modulation does not affect the HF calibration.

Used as an LF oscillator a slight impurity in waveform was noticed due, it is believed, to a little mains ripple. This oscillator is, however, quite a useful addition and certainly enhances the value and scope of the test set, which is obtainable from Claude Lyons, Ltd., and the price complete is £17 10s.

## The Radio Industry

**O**IL-IMMERSED and air-cooled choke coils for the new Northern Ireland Regional transmitter were supplied by Ferranti. The largest air-cooled type has an inductance of 20 henrys when carrying 0.6 amp. and stands over six feet high.

Our note regarding the public-address arrangements for dealing with the crowds visiting the *Queen Mary* at Southampton related only to the occasion of the "public view." Equipment used on the arrival was installed and operated by Clifford Lister, Ltd., 209, Portsmouth Road, Southampton: 18 loud speakers, three miles of wire, and one of the firm's SEA-L 100-watt amplifiers were used.

manner the test set becomes, in effect, a beat-frequency heterodyne oscillator with a range of 0 to 10,000 c/s.

## Outstanding Broadcasts at Home and Abroad

# Listeners' Guide

WITH characteristic modesty Englishmen are not prone to celebrate St. George's Day with the hearty enthusiasm with which those of St. Patrick and St. David are celebrated. Next week the B.B.C. Drama Department will make a bid to change all this with a special St. George's Day programme (Nat., 8) by Laurence Gilliam, which will take the form of an English Pageant, the story beginning with the legend of St. George and the Dragon. Passing over several centuries the programme takes up the thread again on Shakespeare's birthday, which happens to fall on the same day. Then, continuing to more recent times, this fateful date is traced through modern history—Zeebrugge and the daring deeds of the Dover Patrol, the advance on the Dardanelles—great episodes of April 23rd.

### ALBENIZ

A SELF-TAUGHT musician who could not write down the music he composed until he was forty and had had lessons in composition is to be commemorated in "Foundations of Music." He is Albeniz, founder of the modern Spanish school, who died in 1909. His pianoforte music, which is to be played by Irene Kohler, is a valuable contribution to the literature of the instrument.

### TITUS OATES

Two public whippings and rather frequent appearances in the stocks were the portion of

Titus Oates, the notorious conspirator of James II's reign, whose "Famous Trial" is to be broadcast on Monday (Nat., 8.10) and Wednesday (Reg., 7.40). The trial of this unpleasant *agent-provocateur* has been compiled by C. Whitaker Wilson from an early print in the Guildhall. On the bench was the infamous Judge Jeffreys, whose only regret was that the law, even in those days, did not permit him to pass sentence of death on a perjurer. However, the appalling sentence of two public whippings was enough to kill ten ordinary men, but Titus Oates survived and was pensioned by William III.

### ALL ABOUT LAVENHAM

LAVENHAM, an ordinary Suffolk village, has been selected for a quite unusual broadcast on Sunday at 10.15 p.m. (Reg.). The feature will open with a brief history of the village given by narrators from a studio. Listeners will

then be transported to the village of Lavenham itself, where a number of villagers will come to the microphone to speak of their lives and daily work. They will have the broadcast entirely to themselves, no one introducing them and no visitor asking them questions. Listeners will hear the ringing of the very fine peal of church bells.

### WELCOME THE INDIAN TEAM

VISCOUNT HAILSHAM, President of the M.C.C., will propose the Toast of the Indian Cricket Team at the luncheon to be given by the Royal Empire Society at the Hotel Victoria on Wednesday, April 22nd. The speeches will be broadcast (Nat., 1.40).

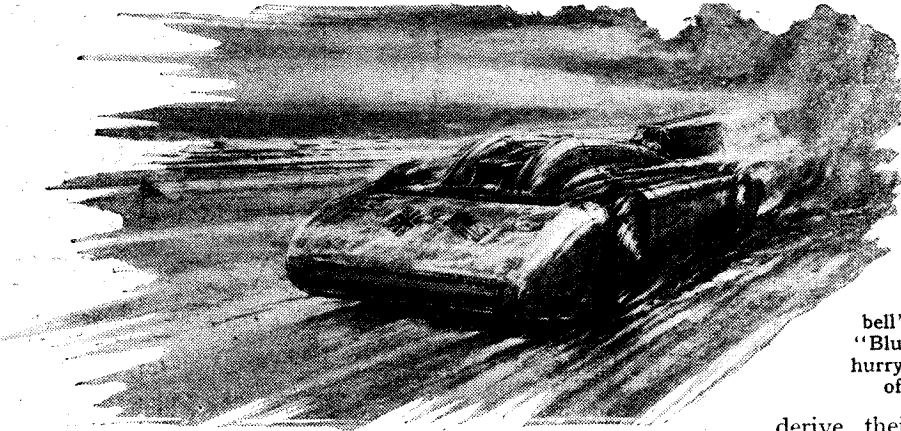
During the summer, broadcasting will bring us many descriptions of the Test Matches; so many enthusiasts will welcome the opportunity of meeting the Indian Team in advance *via* their loud speakers.

The captain of the Indian visitors, Maharaj Kumar of Vizianagram, will respond to the Toast on behalf of the touring team.

### CURIOSITIES

"STRANGE to Relate" is the title of a new Brewer-Baily broadcast at 8.30 on Wednesday (Nat.). It is described as "a miscellany of music, actualities and personalities" built up from material collected by Leslie Baily from the fields of music, literature and drama. Every item in it will have associated with its origin some strange fact or anecdote known only to few. How the Haydn "Surprise" and "Good-night" Symphonies

"SPEED" is the subject of the talk which Max Beerbohm, the famous wit and caricaturist is to give in the Regional programme on Sunday at 9. This "Autocar" drawing of Sir Malcolm Campbell's record-breaking "Blue Bird" symbolises the hurrying, breathless spirit of this modern age.



derive their names may be quoted as an example of the type of things listeners will hear. Supporting the programme will be the B.B.C. Theatre Orchestra.

### ANALYSING THE BUDGET

GRIM realism may be expected to be the basis of the Budget Talks which are to be given next week, the first by the Rt. Hon. Neville Chamberlain, Chancellor of the Exchequer, at 9.45 on Tuesday (Nat.). On the following day Mr. Attlee, representing the Official Opposition, will be heard at 9.50 on the National wavelengths, which will also carry the Budget comments of the Rt. Hon. Sir Archibald Sinclair at 9.50 on Thursday.

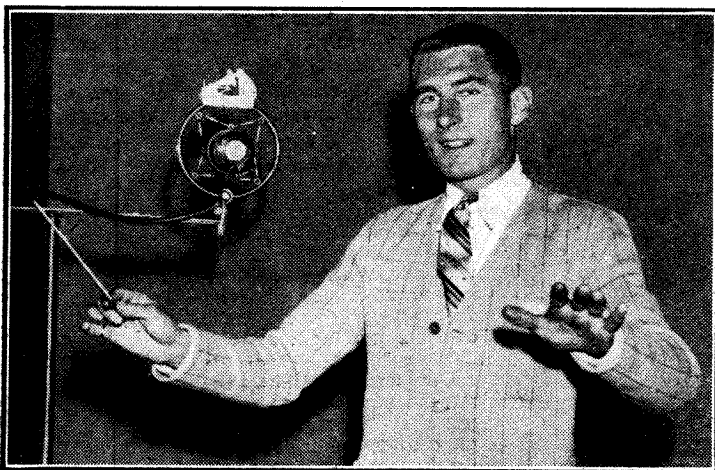
### JACK JACKSON'S BAND

JACK JACKSON, whose band provides the dance music from the Dorchester Hotel on Tuesday, has been a regular broadcaster ever since he left Jack Payne's orchestra in 1933 to form his own dance combination.

Jackson does his own musical arrangements. Two pianos are a feature of his band, the other instruments being three saxophones, two trumpets, trombone, guitar, string bass and drums.

### OPERA ABROAD

OPERA lovers will find a very full week ahead of them as they search through the Continental programmes. Moscow begins at 4.30 to-day (Friday) with a gala operatic performance in which the whole world will be told what is going on by means of commentaries in practically all European languages. The title of the opera has not yet been announced. The most intriguing transmis-



JACK JACKSON and his Band will be heard broadcasting from the Dorchester Hotel on Tuesday next. This picture shows the popular band leader in characteristic pose before an "H.M.V." microphone.

# for the Week

## HIGHLIGHTS OF THE WEEK

FRIDAY, APRIL 17th.

Nat., B.B.C. Dance Orchestra. 8.15, Radio Play: "The Game" (Philip Wade). B.B.C. Orchestra.

Reg., Fred Hartley and his Novelty Quintet. 9, Two-piano Recital by Cyril Scott and Esther Fisher.

Abroad.

Radio-Paris, 8.45, Operetta: "Les Saltimbanques" (Ganne) from the Theatre du Trianon-Lyrique.

SATURDAY, APRIL 18th.  
Nat., Saturday Magazine. 8.30, "Music Hall." B.B.C. Theatre Orchestra.

Reg., 8.30, Saxophone Recital by Walter Lear. "Carmen" (Act II) from Sadlers Wells.

Abroad.

Vienna, 7.30, A Musical Joke: "Masquerade in Operetta Land" (Gribitz).

SUNDAY, APRIL 19th.

Nat., 3, Scouts' Service from St. George's Chapel, Windsor. 9.30, Albert Sandler and the Park Lane Hotel Orchestra.

Reg., Troise and his Mandoliers. 9, "Speed," by Max Beerbohm.

Abroad.

Berlin (Funkstunde), 8, Band of Herr Hitler's Bodyguard.

MONDAY, APRIL 20th.

Nat., 8.10, "The Trial of Titus Oates." B.B.C. Dance Orchestra. "World Affairs." Roy Fox and his Band.

Reg., 8, "Romance in Rhythm" (Geraldo and his Orchestra).

9, B.B.C. Orchestra broadcasting from Paris.

Abroad.

Deutschlandsender, 8.30, Festival Cantata: "Der Flug zum Niederwald" (Windt).

TUESDAY, APRIL 21st.

Nat., 8.15, B.B.C. Symphony Orchestra broadcasting from Zurich. 9.15, Rt. Hon. Neville Chamberlain on "The Budget."

Reg., 8.15, Variety. B.B.C. Scottish Orchestra.

Abroad.

Paris P.T.T., 8.30, European Concert: French National Orchestra and Raugel Choir.

WEDNESDAY, APRIL 22nd.

Nat., Recital by B.B.C. Singers. 8.30, "Strange to Relate." 9.50, Mr. Attlee on "The Budget."

Reg., 7.40, "The Trial of Titus Oates." Teddy Dobbs and his Band.

Abroad.

Leipzig, 8.45, "A Soldier's Life" —Tales, Songs and Marches.

THURSDAY, APRIL 23rd.

Nat., 8, "St. George's Day." B.B.C. Dance Orchestra. 9.50, Rt. Hon. Sir Archibald Sinclair on "The Budget."

Reg., Variety. 9, B.B.C. Symphony Orchestra broadcasting from Vienna. 10, Heavyweight Championship: Jack Petersen v. Jock McAvoy.

Abroad.

Prague, 8, Dvorak Concert from the Smetana Hall.

sion to-night, however, is Warsaw's opéra-comique, "The Zaporogian Cossack" (Artemowski), which is offered at 7 o'clock. This is a Ukrainian work on a Russian theme. Frankfurt, at 11, will give an English commentary on an electrical recording of Eckiebe's four-act opera, "Genovova."

Boito's four-act opera, "Mefistofele," is perhaps the most promising operatic item tomorrow, coming as it does from Milan I at 7.30, though the Radio-Paris transmission of Lazzari's opéra-comique, "Le Sauteriot," at 8.45 should be worth tuning in. An all-night performance of Mozart's "Figaro" is offered by Frankfurt at 12 midnight on Sunday, the performers being the Deutschlandsender station orchestra and chamber choir. It is, of course, an electrical recording.

An almost unknown opera of Dargomijsky's comes from

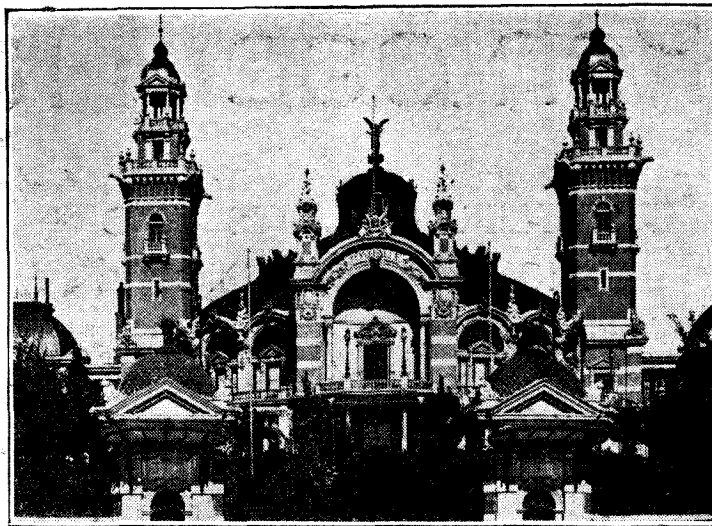


CARL LIST, one of the permanent conductors of the Munich Radio Orchestra, photographed while conducting one of his own works in the studio.

Moscow at 6.45 on Tuesday. It bears the attractive title: "Le convive de Pierre."

## SAXOPHONE SONATA

UNUSUAL items in chamber music are not often looked for, but there are two such next



B.B.C. ORCHESTRA'S TOUR. Under the leadership of Dr. Adrian Boult the Symphony Orchestra gives three European concerts next week. Monday finds them in Paris, Tuesday at Zurich and Thursday in Vienna. Above is the Tonhalle, Zurich, where the orchestra will be heard in William Walton's Viola Concerto, with Lionel Tertis, on Tuesday.

week. On Monday at 5 p.m. Berlin (Funkstunde) is broadcasting a saxophone sonata (Dressel) by Ingrid Larssen, and the composer will be at the piano. Then on Thursday Leipzig is offering at 7.30 a Viola da Gamba Quartet in a recital of sixteenth and seventeenth century music, including music by our own John Dowland, John Ward and Antony Holborne.

## NATIONAL AND FOLK MUSIC

ONE of the best ways of exploiting the idea of "touring the ether" is to pick up programmes of national and folk music. In this way we can sense the differing atmospheres of the countries "visited."

The next seven days present some good opportunities in this direction. To-night at 8 o'clock Radio-Paris offers folk songs of Gascony and other provinces of the South and South-west of France.

To-morrow Hilversum offers a folk-lore programme at 6.55, and on Sunday Berlin (Funkstunde) has a most attractive feature, "Berliners of Yesterday and To-day"—a street cabaret setting forth the characters and entertainments peculiar to the German capital. On the same evening Munich will broadcast folk songs and music of the Rhône district rendered by folk-songsters, children's choir and village band. Then on Monday we find Hamburg transmitting a folk festival at 8.10. Erzgebirge folk songs and humour figure in the Leipzig transmission at 6 on Tuesday. Wednesday finds Poland fea-

turing in the Berlin (Deutschlandsender) programmes. At 3.15 there will be a "Polish Peasants' Spring Festival."

## ITEM

"The Führer's Birthday" is the title of "Homeland Song," which will be heard at 8.10 in the Munich programme on Monday.

## HILL-BILLY MUSIC FROM DENMARK

HILL-BILLY music has seized Denmark by storm and is being treated very seriously, for Mr. Peter Sorensen will sing Hill-billies in a concert of Danish music from Copenhagen on Sunday afternoon from 3 to 5.

## ANATOLE FRANCE NIGHT

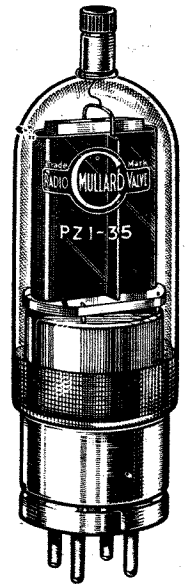
FRENCH students should not miss the Anatole France celebration which is a feature of the Paris P.T.T. transmission to-night at 8.30. There are to be performances of two of the great man's plays, "Crainquebille" and "La Comédie de Celui qui épousa une Femme Muette," and to attempt to follow them will be a good test of linguistic ability.

## A WOMAN JUDGE

DENMARK has one woman judge, Miss Karen Johnsen, who takes her seat every day, in the City Court of Copenhagen. Although English listeners will probably not understand a word she utters, curiosity may lead them to tune in Her Worship at 7.15 on Thursday next, when she delivers a talk from Kalundborg. THE AUDITOR.

# Pentode Transmitting Valves

## SIMPLER CIRCUITS AND HIGHER EFFICIENCY



The new Mullard PZ1-35.

***D**IFFICULTIES and limitations in receiver design were successively overcome by the introduction of the SG valve and, later, of the screened pentode. In the field of transmission, development seems to be proceeding on parallel lines, and the recently introduced transmitting pentode offers advantages in several directions.*

**T**HOSE whose radio interests are confined to problems of reception may sometimes wonder why the transmitting engineer has for so long been limited in his choice to triode valves. So many of the problems affecting transmitting circuits obviously differ only in degree, and not in kind, from those met with in the radio-frequency circuits of receiving apparatus, and these problems, so far as reception is concerned, have been solved in whole or in part by valves of the screened tetrode and the screened pentode types.

It must not be imagined, however, that transmitting engineers have been unmindful of the advantages to be obtained by adopting the tetrode and pentode principles to radio transmission. Delay in doing so has been due entirely to difficulties in the design and construction of suitable valves, more particularly by way of freeing from gas the greater bulk of metal represented by the extra electrodes, and of maintaining good insulation.

### Neutralising Unnecessary

Work has been progressing towards this end, however, for many years, and screened tetrode transmitting valves were introduced about six years ago, their function, as in the case of their prototypes in the receiving range, being to avoid the necessity of neutralising, with all its complications and vexatious critical adjustment. While achieving a full measure of success in this direction, the transmitting screen grid valve, as might be expected, had precisely the same limitations as the receiving screened grid valve, namely that secondary emission from the anode occurred and was collected by the screen grid if the anode voltage swing was sufficient to render the anode potential less than that of the screen at certain portions of the cycle. This secondary emission gave the anode-voltage/anode-current characteristic of the valve its familiar "dynatron kink," and over the whole of the region represented by this abnormality operation was unstable. Stable operation could be assured only by somewhat critical adjustment of circuit conditions, these adjustments in

many cases being in direct conflict with those for maximum quantitative efficiency.

As is well known, the problem was solved for the reception engineer by the screened pentode, in which a third grid, known as the suppressor grid and maintained at cathode potential, is interposed between the auxiliary grid and anode, so that secondary emission from the anode cannot reach the auxiliary grid. Quite recently it has been found possible to produce transmitting pentodes having similar advantages. The Mullard PZ1-35, the first of a complete series, is suitable for maximum anode voltages up to 1,000, and is rated for a continuous anode dissipation of 35 watts. A 15-watt valve is about to be released, and the projected range covers sizes from those needed by the amateur transmitter to outputs suitable for large commercial stations.

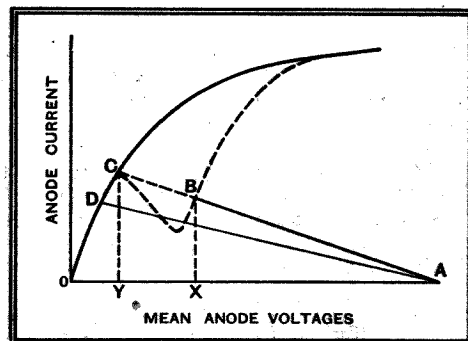


Fig. 1.—Indicating improved output and efficiency of transmitting pentode.

In order to appreciate the full advantages of the transmitting pentode, a rather fuller examination of the points already mentioned is necessary. There is no need to stress the value of avoiding neutralisation, since this feature is also shared by the screen grid valve. As, however, there will be many transmitters who will, in due course, change over from triode to pentode without graduating through the screen grid stage, it will be as well to point out that in addition to avoiding the adjustment of the neutralising arrangement, there is a considerable saving in space and cost by the omission of the neutralising condenser. It is interesting to note,

in this connection, that in the PZ1-35, the suppressor grid itself, and not the high-potential auxiliary grid, functions as the screen, with the result that a very low value of anode/control-grid capacity is achieved, the published figure being 0.06 m-mfd.

### Screening-grid Voltage

The benefits conferred by avoiding secondary emission effects have been summarised by stating that high output and good efficiency are attained without critical adjustment, and that certain circuit simplifications are possible. These statements require considerable amplification. It has been shown that with the tetrode, the condition for instability was when the anode potential became less than the screen potential. This meant that the amplitude of the AC voltage swing at the anode could never be allowed to exceed the difference between the mean anode and screen voltages. This called for means for somewhat critical adjustment of the screen voltage in order to secure stable operation, and it was found necessary to use for this purpose a potentiometer rather than the simpler and much less costly voltage-dropping series resistance. Not only is this arrangement more expensive in first cost, but the running cost is also high, since a fairly large standing current in the potentiometer must be allowed. The secondary emission effect being avoided in the transmitting pentode, the auxiliary grid voltage adjustment is not critical, and may be obtained by a simple and inexpensive series resistance of fixed value.

So much for the avoidance of critical adjustment. Attention must now be paid to the claims to high output and good efficiency. It must first of all be remembered that in the case of all screened valves, i.e., tetrodes and pentodes, the AC output is represented by comparatively large voltage changes and small changes of current, whereas with a triode the output is represented by a comparatively large current component and a smaller voltage component. With screened



**Pentode Transmitting Valves—**

valves, therefore, the condition for high output—high gain is possibly the better term—is a high value of load impedance. Now the load impedance can be represented on the anode-voltage/anode-current graph by the slope of the load line, a line more nearly approaching the horizontal corresponding to a higher impedance than a line approaching the vertical. Fig. 1 shows the typical forms of the anode-voltage/anode-current curves of a screened tetrode and a pentode, the latter in full line, and the former coinciding with the pentode curve except in the negative resistance region, where it follows the dotted line. It will be clear that, in order to avoid the region of instability, the load in the anode circuit of the screened tetrode must not be greater than that represented by the line AB.

In this diagram the point A represents the mean applied anode voltage with the valve working under Class "C" conditions, and it can be shown that the efficiency of the valve is approximately proportional to the anode voltage swing divided by the mean anode voltage, or

$$\text{Efficiency} \propto \frac{AX}{OA}$$

In the case of the pentode, using the same load and therefore represented by the extended line, AC, the anode voltage swing is extended to AY, and the efficiency is therefore correspondingly higher, as is also the output. It will be seen from the graph that theoretically it is possible to use still higher load impedances, such as that represented by the line AD, but there is, of course, a limiting value beyond which an increase in load impedance will produce a reduction in output, due to the impossibility of accommodating a sufficient current swing.

**For Compact Transmitters**

Another claim for the transmitting pentode is its high sensitivity, by which is meant that a maximum output can be obtained with a given excitation power, or, conversely, a given output can be obtained for a maximum excitation power. This claim is based on the fact that the grid current component of the excitation power is much lower in the case of a pentode than with other types, in addition to the fact that a smaller grid voltage swing is required. The high sensitivity of this type of valve is, of course, of considerable advantage in all branches of transmitting practice, since less HF amplification is needed in the earlier stages, so that the equipment is simpler, cheaper and less bulky. It is particularly advantageous for such applications as aircraft transmitters, and for marine and military service, where compactness and portability are of great importance.

The advantages of the transmitting pentode so far mentioned are, of course, merely the counterparts, in transmitting practice, of the advantages of the receiving pentode. The pentode transmitter has, however, another important advantage, in that its output can be modulated for telephony from a modulation circuit

of low power by means of the third grid, for which purpose this grid is brought out to a separate connection. Over a certain range of third-grid voltage adjustment, the relationship between the third-grid voltage and the HF output current is linear, so that audio-frequency voltages of amplitudes falling within this range, if applied to the third grid, will modulate the HF output with very good quality. With the PX1-35, modulation to a depth of from 90 per cent. to 95 per cent. at excellent quality can be obtained in this way with a carrier output power of 12 watts. The mean negative third-grid voltage will be approximately 90 volts.

The basic circuit for this form of low-power modulation is shown in Fig. 2, which is self-explanatory.

As already mentioned, the first of the new series of transmitting pentodes is type PZ1-35, a 35-watt valve rated for a maximum anode voltage of 1,000. It is of tubular shape, measuring 180 mm. in length and 50 mm. in diameter overall. The base is the standard 4-pin American transmitting type, the four pins forming

the control grid, auxiliary grid and two filament connections. The third grid, which functions as suppressor grid and screen, is connected to the metal shell of the base, and the anode to a terminal on top of the bulb.

It is suitable for telegraphy service down

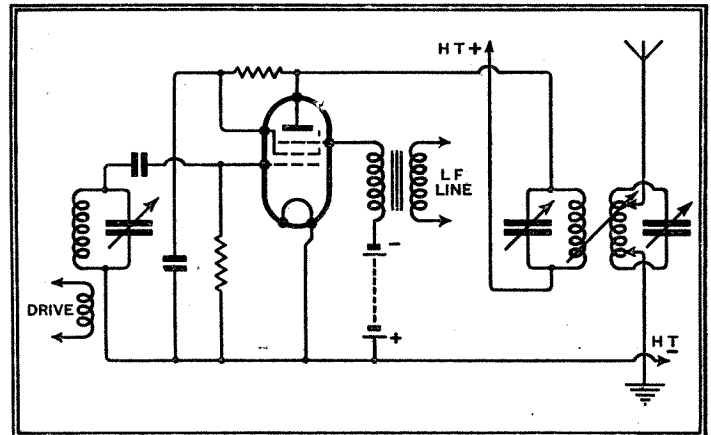


Fig. 2.—Pentode transmitter modulated at the suppressor grid.

to 50 metres with an anode voltage of 1,000, when an output of 50 watts is obtained, or 25 watts with an anode voltage of 500 volts. On lower wavelengths the anode voltage must be reduced to a maximum of 800 volts at 14 metres, while the anode current plus the second-grid current must never be allowed to exceed 110 milliamps.

# Laboratory Equipment

## INEXPENSIVE OSCILLOGRAPH OUTFIT

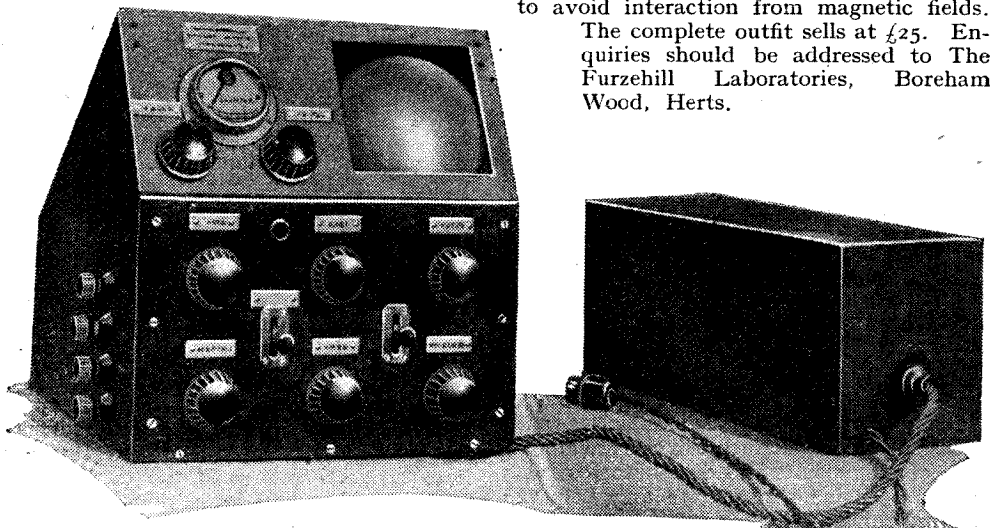
**I**N response to numerous requests Mr. J. H. Reyner, B.Sc., A.M.I.E.E., is arranging to reproduce in marketable form some of the equipment in use at his laboratories.

The first of these equipments is the Cathode Ray Oscillograph illustrated herewith. The main contains the tube and the time base giving linear frequency over a range of 2 or 3 per second up to 10,000 cycles per

second, together with all necessary adjuncts such as shifts, amplitude, and synchronising controls. Two sensitivities are provided, one for normal work and the other for photographic reproduction, while provision is made for the attachment of a synchronous commutator enabling three wave forms to be examined at the same time.

The power unit is separate, being located a few feet away from the oscillograph proper to avoid interaction from magnetic fields.

The complete outfit sells at £25. Enquiries should be addressed to The Furzehill Laboratories, Boreham Wood, Herts.



Cathode Ray Oscillograph with separate power unit designed by Mr. J. H. Reyner.

# Letters to the Editor

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

## Relays and the Ullswater Report

IN accepting your invitation for the personal opinions of your readers on the Ullswater Report, may I take this opportunity of entirely disagreeing with your paragraph relating to Relay Exchanges.

You mention "these rival organisations," etc. Do you honestly ask us to believe that these concerns are in any respect rivals to the great and omnipotent B.B.C.?

I was fully under the impression that by Post Office regulations they could only relay programmes from public broadcasting stations, a feat that private wireless sets can do on a smaller scale. Following your line of argument, a wireless set is, therefore, a potential rival to the B.B.C.

Also, if the Post Office take over and develop the Relay Exchanges as advised by the Report, surely we shall soon see the Government as a formidable rival to the wireless industry as a whole.

I have been interested in radio since its earliest days, and, from personal contact with relay subscribers, I state here and now that these companies enable a considerable number of people who for various reasons do not wish to have a wireless set to live in the great world of broadcasting, and that they are, therefore, at the present time complementary to broadcasting in every sense of the word.

FREDK. J. PALMER

Margate. (M.P.S.)

[Official "Relay" replies to the recommendations of the Ullswater Committee have been prepared by Broadcast Relay Service, Ltd., Bush House, Aldwych, W.C.2, and Relay Services Association of Great Britain, 23, Bedford Row, W.C.1, from whom copies can be obtained by those interested.—ED.]

## Television Interference

I AM very interested in Mr. M. G. Scroggie's letter on "Television and Motor Car Interference." I am therefore taking the liberty of writing you, as my work entails the fitting of car radio and thereby the suppression of the ignition interference of cars.

I agree in detail with Mr. Scroggie's timely comments, and consider he has put the case as fully as is necessary.

As has been mentioned in *The Wireless World*, cars in America are already having suppressors included as a standard fitting before leaving the works. One may therefore conclude that in, say, ten years' time interference will be negligible. By that time considerable harm will have been done to television.

The problem is a very difficult one, especially as thousands of motorists who are not concerned with television are involved.

From the technical side, two things stand out in the elimination of interference:—

1. That the ignition system must be electrically perfect. If given sufficient publicity, the fact that such things as minimum gap of plug points and distributor contacts improve engine performance may help the desired result.

2. That properly screened and properly

earthed engines have a considerable effect on suppression.

A thorough investigation should be made into the fact that one of two cars, neither of which is fitted with suppression, may be silent compared with the other.

At my own home, close to the road, interference is severe at times on all wavebands, but worse below 25 metres.

In conclusion, may I wish *The Wireless World* every success, as it fulfils a need to both radio engineer and ordinary listener.

GEOFFREY R. BENNETT.

Cowes, I.O.W.

[We would draw attention to a note appended to a letter from Mr. E. H. Robinson in last week's issue.—ED.]

## Reception of W8XWJ

I HAVE received a letter from station W8XWJ, a copy of which is appended.

The information therein may possibly be of interest to other readers of your paper. Weymouth.

ROGER C. SWANN.

Dear Mr. Swann,

Thank you very much indeed for your report on receiving W8XWJ. Your report was amongst the first five, all from England, which we received from outside the United States.

W8XWJ has been operating on 31,600 kc/s since January 29th of this year, and on a temporary antenna. With weather clearing and warming up, we hope to have a new vertical antenna in place on top of the aircraft beacon tower atop the Penobscot Building. The change of radiator will undoubtedly increase our signal strength a lot in all parts of the world.

Our transmitter is an R.C.A., type 100-F, high-fidelity unit, with audio-frequency capabilities of from 30-15,000 cycles.

The present operating schedule follows:  
Weekdays, 11.15-17.30, 19.00-22.00, G.M.T., 00.00-03.00.  
Sundays, 19.30-00.30 G.M.T.

Thanking you again for your fine report, and hoping to hear from you again.

I am, sincerely,

C. H. WESSER,

Operator-in-charge W8XWJ.

4465, Penobscot Building,  
Detroit, Michigan, U.S.A.

## Transmission Quality

REGARDING criticisms of transmission quality, it would be of assistance to readers in assessing the value of such criticism if writers would state the type of receiver in use.

This afternoon I listened especially to the B.B.C. Dance Orchestra in view of your correspondent's criticism. The receiver is a Single Span with Quality Amplifier, and on this particular transmission the balance was above criticism. I have not previously noticed a lack of bass on Henry Hall's transmissions. I take it that Messrs. Moscrop and McNicholas do not want to hear "thump, thump" only.

In my view your correspondents would be better employed if they kept asking the B.B.C. to expedite the use of the ribbon microphone in Regional transmissions. A ribbon microphone was on exhibition amongst other "historical mikes" at Manchester Radio Show. This seems to have been the only occasion on which such an instrument "visited" Manchester. Is it to be historical?

The following extract from a letter received by me from the Chief Engineer's Dept. may be of interest:—

"In the case of the Droitwich transmitter, the overall audio-frequency response of the transmitter and the land lines connecting it with the control-room in this building varies within  $\pm 2$  db between 50 and 7,000 c/s. In the case of the London Regional transmitter and land lines

to this building the variation is within  $\pm 1$  db between 30 and 10,000 c/s, and practically the same figures would apply in the case of the North Regional transmitter and the lines connecting it with the Manchester studio centre.

"It will be seen, therefore, that normally the audio-frequency range, except in so far as is limited by the type of microphone in use, is greater in the case of North Regional than in the case of Droitwich."

As Reisz-type microphones are in use and cut off at 5,000 c/s, the audio-frequency response is definitely poorer on North Regional than on Droitwich, excepting when North Regional is taking a transmission from a London studio equipped with ribbon microphones.

In spite of land-line deficiencies the quality is usually better.

In view of the frequencies transmitted by the B.B.C., the limitation of the frequency response of the new QA super to 9,000 cycles is sound sense.

Only listeners to London National with its "special high-quality line, substantially flat from 25 to 15,000 cycles," can take advantage of a wider frequency response. Why this special consideration for a minority of licence holders?

Liverpool, 19. WILFRID BROWN.

## Japanese Reception

IT may interest some of your readers to know that on the night of March 24th at 7.15 p.m. I tuned in station J.V.M. operated by the International Wireless Co. of Japan at Nagaki, Japan, on a wavelength of 27.93 metres. Signals were consistent and of good quality at R5-R6 with slight high-speed fading. Announcements were made in Japanese, French, German, Spanish, and English, and the programme was received in its entirety until the station closed down at 8 p.m.

It would interest me to know if any other reader has heard this station, or does it constitute a record? The receiver used was an American eight-valve all-wave.

NORMAN J. MICHEL.

Northampton.

## Service Engineers

AS a service engineer and a reader of your excellent paper for many years, I was interested in the paragraph on service engineering in general which appeared under Random Radiations in the issue of October 25th last year.

You complained of a lack of good men for this branch of the industry and that manufacturers were unable to find them.

There was a description of a modern service engineer as a rather inane-looking individual with a pair of pliers, a screw-driver, a moving-iron voltmeter (of ancient vintage), and a permanently puzzled expression. Whilst this description is probably true to a large extent, why don't you explain the honest reason for this, which you surely must know?

Radio service work is one of the most skilled of our modern professions. A good engineer needs sound technical knowledge, to which he must keep adding, an intense knowledge of all types of British and American receivers, and an ability to carry out mechanical repairs, sometimes with

**Letters to the Editor—**

modern auto mechanisms of a complex nature. He must have the tact and diplomacy of an Anthony Eden in dealing with ignorant clients who haven't the faintest idea of what a modern receiver even looks like and fondly imagine that a set should go on working for ever, and will not even grant their receiver the same amount of service as their motor car.

He must be honest, smartly dressed, well spoken, work from nine o'clock in the morning until ten o'clock at night. He must have testing equipment, if he is going to do his job at all successfully, costing approximately twenty pounds. Finally, he must own a motor car.

Now, what, we might ask, would be the salary of such a man? Well, the average nett income to-day is fifty-five shillings a week. This, you will find, is three pounds a week less than a first-class electrician who works seven and a half hours a day, ten shilling a week less than a "navvy," and five shillings a week less than the Westminster Corporation dustmen.

It is no good manufacturers or traders squealing because they can't get good men. The organisation that I work for sell every conceivable type of receiver and pay their engineers three pounds seven shillings per week, and out of this magnificent sum they must pay the expenses of their cars, which, you will agree, amount to thirty shillings a week.

I have been in the radio business since its inception, and yet, could I earn five pounds a week, would probably be the best-paid service engineer in the British Isles. A disgusting state of affairs. A state of affairs that, I trust, you will have the courage to expose by printing this letter, as I think you will find that every word is true. Middlesex. "FAIRPLAY."

**A New Effect ?**

I WONDER how many listeners noticed the "sad sea waves" effect on London National on Friday night (March 27th) during the broadcast of the "Ringer"? It was especially noticeable then, and took the form of very rapid fading of about one-second interval. I first noticed it when the West Regional was synchronised with the London station, and now with the North National on the same wavelength the effect seems to be more pronounced.

I presume it is a result of imperfect synchronisation, and the actual change in aerial volts must be considerable, judging by the swing of the tuning indicator. The set in use that night was in West London, and is an adaptation of the Variable Selectivity IV, having the addition of an HF stage (signal frequency) and being for universal operation. As this is the first occasion on which I have written to you, I should like to say how much I appreciate your paper, which I regard almost as an encyclopædia of radio practice and theory.

Leigh-on-Sea. R. F. WOOD.

**Thermostat Interference**

YOUR contributor "Free Grid" has drawn attention to a source of serious radio interference caused by the intermittent switching of thermostats in electric blankets and pads.

From tests we made on some of these appliances we found that fairly heavy loads of from 0.4 to 0.9 amps. are automatically switched on and off at intervals varying from 5 to 30 seconds with monotonous regu-

larity. When it is remembered that electric blankets are in use mainly in the few hours before bedtime and in the winter months, the serious nature of the interference thus caused to listeners can be imagined.

In view of "Free Grid's" article, and the correspondence we have had in the past few months with *The Wireless World* readers on this subject, it may interest him

to know that we anticipated the prayer in his last paragraph two years ago by designing and marketing Electric Blankets, which, whilst still being safe, dispense with thermostats entirely, and are therefore noiseless. So far as we know, these are the only Electric Blankets designed on these lines.

THE WARM-GLOW CO.  
FREDK. GRISLEY, Proprietor.  
Leigh-on-Sea.

**New Variable-Mu HF Pentode**

DEVELOPMENT in modern valves for use in HF or IF stages continues towards the attainment of a high value of mutual conductance with a high internal AC resistance. These factors are essential if high amplification is to be secured together with high selectivity. Alone, however, they are not enough, for if large amplification is to be secured with stability, it is essential that the grid-anode capacity of the valve be very low.

The Ferranti VPT4B meets the requirements of modern amplifiers excellently, for it has a high mutual conductance and a low grid-anode capacity, while its anode AC resistance is exceptionally high. It is of the indirectly heated type and consumes 1 ampere at 4 volts. It is rated for operation at an anode potential of 250 volts with 100 volts applied to the screen, and at -2 volts grid bias a mutual conductance of 3.2 mA/V is claimed. The internal grid to anode capacity is given as 0.0025 mmfd., an extremely low figure. The valve is copper metallised and fitted with the standard 7-pin base and plug top-connector.

**The Ferranti VPT4B**

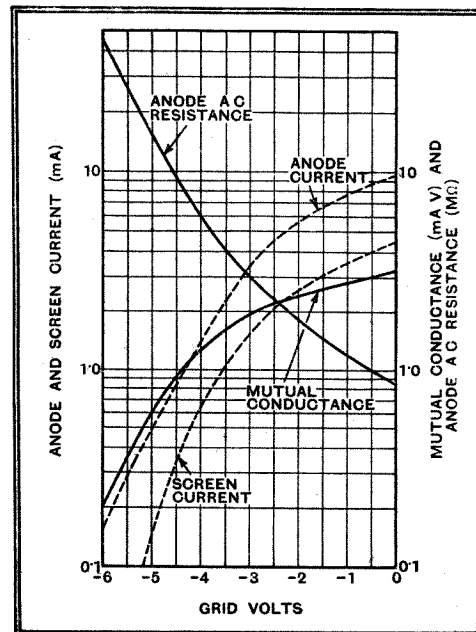
of the electrode assembly. Under these operating conditions the valve draws an anode current of 5.6 mA, and a screen current of 2.6 mA, so that an automatic bias resistance of some 250 ohms is needed.

Under many conditions, however, a mutual conductance of this order is too high for stability, and a higher initial bias may often be advisable. At -3 volts bias the mutual conductance is 1.9 mA/V, and the AC resistance reaches the figure of 3 megohms; as the anode and screen currents are now 3.4 mA and 1.55 mA respectively, an automatic bias resistance should have a value of 600 ohms.

The valve is of the short grid-base type, and a very low value of mutual conductance is obtained with quite a small grid bias. This makes for good AVC action, but some care is needed to avoid distortion if the valve be used in the last IF stage. In general, this stage should not be controlled, or, at any rate, controlled only partially.

The most valuable feature of the valve is undoubtedly its high resistance. This is often considered an unimportant figure with an HF pentode, but it can actually be extremely important, for it is not constant but varies with the AVC bias. In these days when it is easy to obtain IF coils having a dynamic resistance of 0.5 MΩ, considerable damping may be imposed by a valve having an internal resistance of 1 megohm or so. The damping, and hence the selectivity, vary moreover with the signal strength on account of the bias control of amplification. Unfortunately, the variation of resistance is in the wrong direction to enable automatic variable selectivity to be achieved, for the effect tends to reduce selectivity when the sensitivity rises, just when high selectivity is most required.

The effect can be reduced to negligible proportions by choosing a valve of sufficiently high resistance at its initial bias point, and the VPT4B is particularly good in this respect. The valve consequently forms a welcome addition to the range of HF pentodes at present available.



Measured characteristics of the Ferranti VPT4B.

The accompanying curves show the measured characteristics of one sample with an anode supply of 236 volts and 100 volts screen potential. At -2 volts bias the mutual conductance is 2.4 mA/V, and the AC resistance no less than 1.8 megohms. The mutual conductance of this specimen is lower than the makers' figure, but not unduly so in view of the complicated nature

# Random Radiations

By "DIALLIST"

## The All-wave Superhet

IT'S a pity that some short-wave superhets—and some all-wave sets on their short-wave range—are so designed that they bring in stations at two different settings of the dial. This was usual in medium- and long-wave superhets some years ago, but it is a fault that we seldom, if ever, come across to-day on these ranges. The need for selectivity and for accurate calibration on the short waves is becoming greater as the number of stations increases. Particular attention will have to be paid on the short-wave range to the suppression of both "second dial readings" and second channels.

There is a tendency at present to make the lower-priced all-wave sets cover the short waves from about 16 to 60 metres on one range. This is a satisfactory arrangement up to a point; it makes for low production costs and therefore for a moderate selling price, and if a fine tuning device is provided in the shape of a very slow-motion tuning control there is no great difficulty about picking up most of the more strongly received short-wave stations. But the set which has two or three short-wave ranges is a much easier thing for the ordinary listener to use, since it calls for no feats of hair's-breadth tuning. Naturally it costs more, but the extra expense is very well worth while, at any rate to those who take short-wave reception at all seriously.

## Battery All-wave Sets

FOR some time there have been on the market small all-wave sets of the straight type designed for battery operation. Battery all-wave superhets, however, have been few and far between. I am glad to see that makers are now paying attention to this class of receiving set, and I believe that they will find there is a ready market for a set which is a good performer and does not impose too great a drain on the high-tension battery. Not everyone realises that the number of homes in which batteries must be used for operating the wireless set because no electric mains are available runs to between four and five millions. These figures do not take into account homes which have electric light but cannot use the lighting system for operating receiving sets. In many places, for example, the mains still supply DC at 100-110 volts, whilst in some localities the direct current, though of suitable voltage, is so rough that it is exceedingly difficult to reduce background noise to a reasonable level. Then there are country houses which have their own lighting plant. This is usually DC, and the voltage ranges from 32 to about 100 in most cases. The number of battery users is therefore very large, and I am sure that there is a big market waiting for the right kind of receiving set.

## Unauthorised Stations

THERE is a great deal of unauthorised working going on at the present time in certain parts of the short waves. In some cases the call signs of licensed amateur transmitters have been used by "pirates." One friend of mine was much surprised at receiving recently several "verification cards" from amateurs who had picked up transmissions with his call sign at considerable dis-

tances. Actually he had made no use of his transmitting gear for several months.

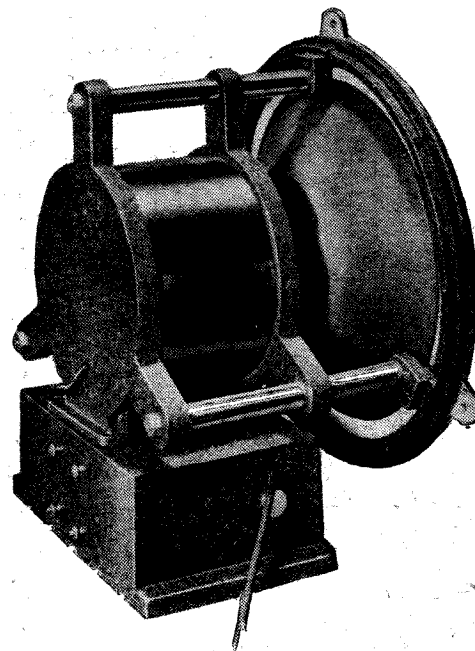
Another form of piracy is the use of the amateur short wavelengths by broadcasting stations which send out more or less regular programmes upon them. As it isn't difficult to identify this kind of offender one hopes the Governments concerned won't be long about taking steps to put an end to the nuisance.

## The Super Organ

THE building of the huge organ which will be installed this summer in St. George's Hall goes rapidly forward. It is expected that it will be installed in July and that the final adjustments will have been completed before the middle of September. This organ is going to cost £10,000, and it will be one of the finest of its kind. Myself, I have never been fond of the theatre or cinema organ, whether heard directly or over the wireless. To me its performances always suggest an elderly lady dancing the *can-can*. There is, though, no doubt that organ music is enormously popular with listeners, and the B.B.C. has done the right thing in ordering the finest instrument that can be obtained. I am told that it has four manuals and more than 250 stop-keys.

The installation of the organ is going to make matters rather difficult for Mr. Eric Maschwitz, the B.B.C.'s Director of Variety. St. George's Hall will have to be closed during the greater part of July whilst the organ is being erected, and again for a fortnight just after the Exhibition whilst it is

## Loud Speaker for the PA Amplifier



The Epoch Domino Type 101½ which is illustrated here can be recommended for use with the PA Amplifier. The frequency response curve published in *The Wireless World* for March 29th, 1935, shows it to have a wide response and it is of a type which is capable of handling a large input.

undergoing its final tests and adjustments. As St. George's Hall is the best of all variety studios, and as the demand for variety is at its height during the holiday months, he will probably have to fall back on outside broadcasts to a much greater extent than usual during July, August and September.

## Studio Design

A VERY interesting section of the 1936 B.B.C. Annual is devoted to the subject of studio design and acoustics. The ground plan of the "corrugated studio" and the description of its acoustic properties will appeal to many readers, particularly in view of the correspondence on the subject of quality at the transmitting end in recent issues of *The Wireless World*. It appears, though, that the last word has by no means been said on the subject of studio design. Dance bands which make use of the Maida Vale studios have complained that the corrugated room does not suit their particular style. It is excellent for military bands and for speech, but it does not enable the dance orchestra to be at its best when broadcasting.

## Shall We Specialise ?

I should not be at all surprised if in the future broadcasting stations in all parts of the world go in more and more for studios designed to make the most of this item or that. We may, in fact, find that the more important broadcasting stations have their special studios for intimate speech such as the news bulletins; for debates; for orchestras playing classical music; for those discouraging lighter fare; for operas, operettas and musical comedies; for variety (at which an audience seems to be almost essential); for plays; for the Children's Hour, and so on.

The whole question is a most interesting one. We certainly haven't arrived at the perfect studio for all purposes, and I very much doubt if we ever shall. So long as there is a need for a control panel we are clearly not getting the real thing from broadcasting stations. In the future studio design on scientific lines may make a world of difference to the reality of the transmissions—and it will then be up to the makers of receiving sets to provide us with apparatus which will enable perfect transmissions to be received perfectly.

## N. Ireland Heard in India

A YOUNG relative who is at present stationed near the middle of the Punjab writes to tell me that he had first-rate reception of the new Northern Ireland station whilst it was making its preliminary tests. He usually switches on his set whilst dressing for early morning parade—and in India early morning parades are early! This reception took place at 6.30 a.m. Indian Standard Time, which corresponds with 1 a.m. G.M.T. The set used was an 11-valve superhet of the all-wave type, and he was very surprised to find a medium-wave station coming in so well. It will be interesting to know whether the Lisburn station is heard in the East now that it has taken over the full programme service and finished its small-hour tests. Listening times, however, are not very convenient at this season of the year, and will become less so as summer draws on. Dusk in this country occurs just now at about 12.30 a.m. Indian time, and it is 5.30 in the morning there when our stations close down.

# Below 100 Metres

## Notes from a Listener's Log Book

**I** THINK I may say that my prophecy given in the last notes regarding an expected improvement in conditions during the first week in April may be said to have been fulfilled, although conditions did not really become fully excellent until Monday and Tuesday, April 5th and 6th.

In this connection it is noteworthy that sunspot activity has not yet regained the high levels of February and early March, although a new group was observed on April 6th. During March it will be remembered that sunspot activity was at a minimum round about the 21st, and conditions were very poor on this date. This adds interest to a report from Alberta, Western Canada, to the effect that the "Northern Lights" were observed on March 20th. This fact has been noted on quite a number of occasions, that is, visible aurora in Western Canada are generally associated with bad short-wave conditions, and with a *dip* in sunspot activity, an interesting negative correlation!

In addition to the above, two "Dellinger fade-outs" have been reported during the past fortnight, one by the Japanese at 0400 G.M.T. on April 2nd, and one in this country at 1400 G.M.T. on Monday, April 6th. The first of these would not, of course, have been audible in this country. The effect is presumably a daylight one only, and the second does not appear to have been a complete fade-out.

It was on record that a fifty-four-day fade-out took place on February 14th last, while another was predicted for April 8th, and this duly took effect between 4.50 and 5.06 p.m. G.M.T.

Finally, there does not seem to have been quite enough sunspot activity during the past few weeks to have made the ultra-short wave bands good again, although signals have been heard spasmodically, but conditions down to 12½ metres have been quite satisfactory. Consistent signals on this wavelength have been intercepted from Brazil as late as 9 p.m. The Empire transmitter GSH on 13.97 metres has also, one understands, been giving good service in Africa, the East and the U.S.A., and is being relayed in most cases daily by Hong Kong, Colombo, Nairobi, Lagos, Accra and Sierra Leone, with excellent results!

### Improving Conditions

Dealing now with the fortnight's listening, and starting with Wednesday, March 25th, we find conditions were improving slightly. W2XAD, however, was showing signs of weakness before the close of his hour's transmission at 8 p.m., although he strengthened up somewhat then, and even W2XE on 19.64 metres was equal to W2XAD at this time.

Later in the evening the *Queen Mary* GBTT was heard testing with Rugby GBC on 67 metres, but as the transmissions intercepted were not of a broadcast nature no details may be divulged here.

Conditions were passable again on March 26th, but a fairly good signal from W3XAL on 16.87 metres in the early evening was spoilt by interference from "The Shadow,"

a rough AC modulated unstable CW signal, presumably emanating from either electro-medical apparatus or from an electric furnace. It should be noted that if the modulation is 60 cycle, then the point of origin is probably in America, and if it is 50 cycle, probably in this country or elsewhere in Europe. (If it is 16½ cycles, probably the Swiss National Railways!!!)

Sunday, March 29th, saw a really noticeable improvement in conditions, and W8XK was really good on 19.72 metres at 11.30 p.m. This was a fine performance, and, as is usual with such conditions, the band of useful waves extended upwards as well as downwards, and W2XAF and the other "longer wave" transmitters were very good too! The travel talk from W8XK on Vesuvius and Pompeii was followed in its entirety, with 100 per cent. intelligibility.

At 9 p.m. on Monday, March 30th, W2XAF was completely blotted out by LKJ1, but later, after Oslo had gone off the air, W2XAF was a local-station signal. W1XAL and W8XK were good in the 25-metre band, but W2XE on 25.36 metres was spoilt by a bad heterodyne from HJ4ABA Medellin.

The best reception for a long time was obtained on W3XAU on 31.28 metres at 10.10 p.m. on March 31st, but by far the best signal again this evening was W8XK on 19.72 metres, and it was noted that the T.A.T. transmitter WKF on 15.81 metres was still an excellent signal at 11 p.m.

On April 1st very strong signals were obtained from EAQ at 8 p.m., testing on its daylight wave of 15.2 metres with New York. Several half-waves of U.S. commercials were strong on 11 metres at 9 p.m.

A really good signal from W3XAL was intercepted at 7.40 p.m. on April 2nd—a definite pro-

gramme value signal and considerably superior to W8XK on 19.72 metres at this time.

No comparison could be made with W2XAD, as, since April 1st, this station has been working from 3-7 p.m. daily, and is not a really good signal until about close-down. A more suitable schedule for W2XAD would be from 7 p.m. until midnight.

The skip distance was short on 30 metres in the evening of April 2nd. GSB on 31.55 metres showed a strong down-coming ray in London at 7 p.m. On 10 metres W3DR and WAJ (half-wave) were good at 7.45 p.m., and the signals from Rome on 31.13 metres were about the strongest ever recorded. The WAJ half-wave on 11 metres was still very strong at 9 p.m., but, strangely enough, conditions seemed to deteriorate very rapidly at 11.20 p.m., and continued to be distinctly poor and fluttery on April 3rd.

An improvement was again noted on Saturday, April 4th, and W2XAF was really excellent in the late evening. An outstanding station in the morning was PMA, which now uses a simple multiplex system similar to that of CGA.

Peak conditions similar to those of early March are now being experienced at the time of writing, and I shall conclude by remarking that information from Buenos Aires indicates that peak reception of the U.S. ultra-short-wave stations, such as W8XAI, W2XEM/N, W9XAZ, and NSS, also occurs in the Argentine round about sunset, as I feel it does in this country, and that good reception of these stations coincides with a period of general good conditions on the normal short waves.

ETHACOMBER.



### SOUND EFFECTS

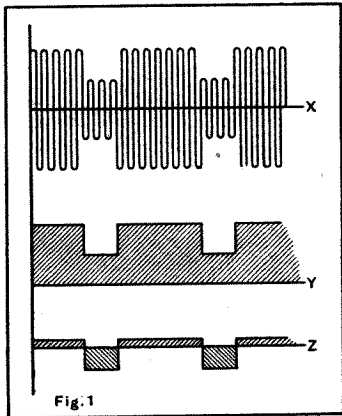
The calibrated scale behind the record in the top picture indicates the particular groove carrying a known sound effect which the needle is traversing at any moment. This method is used by E.M.I. An American system, illustrated in *Electronics* recently, and shown on the left, selects the desired sound effect by an accurately timed mechanism operated by a push button.

# Recent Inventions

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

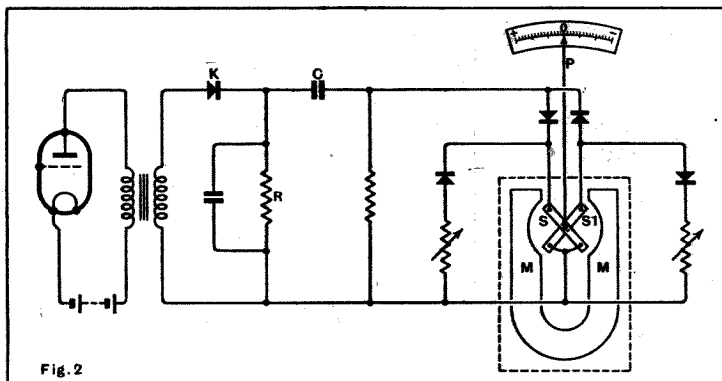
## DIRECTIONAL WIRELESS

ONE known scheme for guiding aircraft and other vessels along a predetermined course is to radiate two "overlapping" beams, one of which is modulated, say, with the morse letter N, i.e., a dash followed by a dot, and the other by the letter A, which consists of a dot followed by a dash. Along the centre line of the two beams, these two signals supplement each other and merge into a continuous "dash," which tells the navigator that he is keeping on the correct course.



Incoming signals before and after rectification.

The invention relates to means for giving a visible indication to the navigator, instead of the more-usual audible one. For instance, the pointer P of a centre-zero ammeter shows when he is on the centre-line course, and when he strays off-course to port or starboard. The incoming signals, having the form shown at X in Fig. 1, are rectified at K, Fig 2, and set up voltages of the form shown at Y across the resistance R. A condenser C filters out the direct-current component, so that the



Circuit of the aircraft guiding device.

voltage applied to a pair of cross-coils S, S<sub>1</sub>, set in the field of the magnet M, is as shown at Z, in Fig. 1. This gives a dead-beat movement of the pointer P, which is not affected by the changing distance of the aeroplane from the beacon transmitter.

Telefunken Ges Fur Drahtlose Telegraphie m.b.h. Application date (Germany) June 4th, 1934. No. 441370.

## Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section.

### TRANSMITTING AERIALS.

THE aerial is constructed of tapering form, the diameter at all points being a logarithmic function of the distance from the end. The aerial may be made as a dipole, which tapers off in the same way from the centre towards both ends. The natural wavelength of such an aerial is less than that of a standard aerial of the same length. When erected vertically, high-angle radiation is minimised.

P. S. Carter (Assignor to Radio Corporation of America). No. 2007640 (U.S.A.).

### SHORT-WAVE OSCILLATORS

INSTEAD of using ordinary wire, the oscillatory circuits and supply leads of an ultra-short-wave generator take the form of two parallel but discontinuous strips, the broken sections of which are arranged in staggered relation. In effect these constitute a number of series capacities through which the high-frequency currents flow in such a way that the inductance of the current path is substantially nullified.

A. Leib (assignor to Telefunken Ges fur Drahtlose Telegraphie m.b.h. No. 2008286 (U.S.A.).

### RADIATING POWER

A GROUP of frame aerials, arranged in vertical planes pointing outwards from a common centre, radiate an intense field of annular form. This is intercepted by distant receiving aerials, which feed the induced currents to any desired load circuit. Alternatively, the "power" may be radiated in the form of beams

directed on to the consuming stations.

J. Kolarz. No. 2021557 (U.S.A.).

### PIEZO-ELECTRIC CRYSTALS

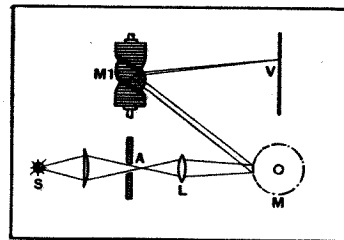
A PIEZO-ELECTRIC unit is cut from the mother crystal in such a way that the electrode faces are set at an angle to all three of the major axes of symmetry. This allows the funda-

mental frequency of the completed unit to be predetermined before the cutting operation is commenced. It also enables a crystal oscillator to be cut which will exhibit a constant frequency in spite of variations in temperature; or one which will have either a positive or negative temperature coefficient. These characteristics are independent of any relation between thickness and diameter.

Marconi's Wireless Telegraph Co., Ltd. (assignees of C. F. Baldwin and S. A. Bokovoy). Convention date (U.S.A.) April 21st, 1934. No. 441438.

### SCANNING SYSTEMS

A MIRROR-SCREW scanning device is arranged so as to produce a real image upon the viewing screen. As shown, a ray of



Scanning system combining mirror-drum and screw.

light from a source S is passed through an aperture A, and then through a lens L which focuses the ray on to the viewing-screen V. From the lens the ray passes first on to a rotating mirror-drum M, which, in turn, traverses it across the mirror-screw Mt. If the aperture A is fitted with a rotating disc bearing two curved slots, the system can be used for interlaced scanning.

C. O. Browne. Application date June 12th, 1934. No. 442668.

### TELEVISION RECORDS

IN the early days of high-definition television, the hours of transmission will probably be somewhat restricted. It may accordingly be convenient to have some way of putting a television receiver through its paces—either for test purposes, or for amusement—at times outside the official hours of transmission.

According to the invention, "bottled" records are prepared which, when applied to a television receiver, will reproduce an original programme item, or any similar performance, as and when required. The record is prepared by applying both picture and sound impulses to separate optical modulating systems, which simultaneously impress them, in parallel tracks, on a travelling light-sensitive film. Both the audible and visible impulses are recorded in graphical form, as distinct from

making a duplicate of the original. C. P. Hall and H. Flynn. Application date July 25th, 1934. No. 441558.

### LIGHT VALVES

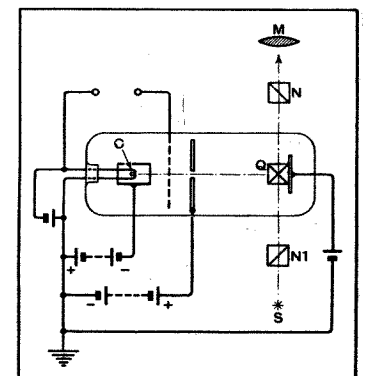
WHEN certain organic substances are in the "nematic" phase, that is halfway between the solid and liquid states, they are found to exhibit the well-known Kerr effect to a greater degree than when they are either definitely solid or definitely liquid. This fact is utilised to construct a light valve of high sensitivity, suitable for television. Suitable organic substances are ethylanisalamino-cinnamate, and certain other cinnamates. Methods are described of preparing these substances so that they remain "nematic" under ordinary temperature and pressure.

Marconi's Wireless Telegraph Co., Ltd., B. Levin and N. Levin. Application dates July 13th and August 3rd, 1934. No. 441274.

### LIGHT-RELAYS

THE well-known Kerr effect depends upon the fact that the plane of a polarised beam of light is rotated through an angle which varies directly with the voltage applied to a "sensitive" crystal or liquid. As used in television the light-sensitive cell is placed between two crossed Nicols, and the incoming signal voltages are applied to it so that a light-ray of varying intensity is produced to build up the picture.

This Kerr effect is now applied to a cathode ray tube as shown in the drawing. A "sensitive" crystal Q of quartz takes the place of the usual fluorescent screen and is mounted in line with a pair of crossed Nicols N, N<sub>1</sub> and a source of light, S. The fluctuating voltage required to produce variations in the intensity of the light, as seen at M, is supplied by the impact upon the crystal of the electron stream from the cathode C of the tube. The device can be used either as a simple light-sensitive relay, or as a television receiver if



Light-sensitive relay using a cathode ray tube.

scanning electrodes are inserted to traverse the electrons over a "mosaic" surface of quartz.

K. Pulvari-Pulvermacher. Convention date (Germany) November 30th, 1933. No. 442381.

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

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## Editorial Comment

### Television and the Radio Show

#### "Sitting on the Fence" Must Stop

**W**HAT part television will play in the Radio Exhibition at Olympia this year is a matter which, not unnaturally, interests most of us at the present time. We know that the B.B.C., in co-operation with the Baird Company and E.M.I., are busy preparing the transmitters at the Alexandra Palace, but there have been considerable delays and the date for the first transmissions to begin has been put off again and again. Now it seems probable that, with the Exhibition occurring somewhere in August—most likely the latter part of the month—the television transmissions will have been in operation a short while before the Exhibition opens.

There is, as yet, no indication of any feverish activity on the part of set manufacturers to produce television receivers. They have been, perhaps, rather afraid that this new interest would detract from the sales of their broadcast receivers and it was for this reason that television was discouraged at last year's Olympia Show.

This year, unless the radio industry is foolish enough to contemplate a boycott of television, they should welcome it with open arms and make the very most of the opportunities which the Exhibition will offer to educate the public on two essential points. The first is to provide ample demonstrations which will enable the public visiting the Exhibition to form an accurate idea of what television has to offer, and the second to use the Exhibition as an opportunity to make it abundantly clear that a television receiver is quite a separate entity from the broadcast set. This should dispel the impression which has, we think,

got about that by waiting a little while the public will be able to buy a set for ordinary broadcast use which will incorporate television.

Many months ago *The Wireless World* recommended that the moment the television service opened facilities should be available for members of the public within the service area of the station to see demonstrations of television at the large stores and other suitable places. This suggestion has, we know, been adopted, and the B.B.C. has investigated suitable sites, taking into consideration the question of their freedom from electrical interference and suitability for accommodating the public. But the Radio Exhibition provides the ideal opportunity to give demonstrations, and it is to be hoped that the organisers will make the very most of the chances which offer to educate the public and eradicate the erroneous notions concerning television which have been circulated.

#### A Better Alternative

If the argument is put forward by any section of the radio manufacturers that their annual exhibition ought not to make television a centre of attraction because television receivers may not be ready and that it would divert the attention of the public from the normal broadcast receivers, then our reply is that it is far better to bring the public to Olympia to see television demonstrations which are so closely associated with the industry than to continue to draw attendances by means of the B.B.C. "Music Hall" side-show, which never has had any effective link either with broadcasting or the industry, but has undoubtedly taken the public away from the radio exhibits.

# Improved Reproduction

## The Possibility of Increasing Playing Time and Decreasing Surface Noise

By F. N. G. LEEVERS, B.Sc., A.C.G.I.

THE introduction of the piezo-electric pick-up has proved an important contribution to high quality reproduction. When operated under the conditions recommended by the makers, it gives a good response over a wide range of frequencies from commercial disc recordings, and its average sensitivity is remarkably high. Moreover, the inertia of the moving parts is small, and the damping very light, so that very little weight is necessary to make the needle follow the record groove even at large amplitudes. The amount of record wear is therefore small. But refer-

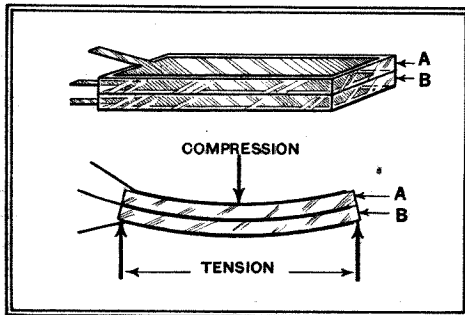


Fig. 1.—Piezo-electric crystal element.

ence to the principle on which the pick-up functions reveals several interesting characteristics which are unusual in an electro-mechanical device of this nature.

The conversion of mechanical energy into electrical energy is done by a piezo-electric crystal element. As shown in Fig. 1, this consists of two laminations, A and B, cut from a crystal of Rochelle salt. Each lamination has electrodes applied to its major surfaces, and the pair of laminations is then cemented together so that by bending the whole element one lamination undergoes longitudinal compression and the other undergoes tension. Now longitudinal distortion in a suitably cut crystal of this nature sets up a voltage across the electrodes which is proportional to the force applied and which is independent of the rate at which that force is applied. This is known as the piezo-electric effect.

### Crystal and Magnetic Pick-ups Compared

For the small amount of bending possible with these crystals, the resulting voltage will be proportional to the bending force, so that if a needle chuck is suitably connected to one end of the element and the other end is fixed as in Fig. 2,

the voltages produced by motion of the needle point will be proportional to the amplitude of motion and be independent of the velocity. This means that the piezo-electric pick-up is fundamentally an amplitude or pressure-operated device, and in this respect is essentially different from all electro-magnetic pick-ups. The latter generate voltages proportional to the velocity of motion of the armature, and are therefore called velocity-operated devices. This difference is of great importance, since it determines the type of frequency response curve obtained with the pick-up on any given type of recording.

### Constant Velocity Recording

The recording characteristic favoured by the principal gramophone companies is based on the constant velocity principle. For notes of equal volume the velocity of the needle point (R.M.S. value) is constant at all frequencies. Under these conditions the amplitude becomes inversely proportional to the frequency, that is, it increases by 6 db. for every octave fall in frequency. Physical limitations, however, prevent this characteristic being used for very low frequencies, since the amplitudes developed become very great. Frequencies below about 400 cycles are therefore attenuated to approximate to the constant amplitude type of characteristic. A typical recording characteristic is shown in Fig. 3 (a).

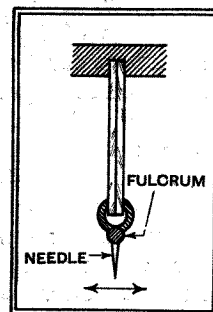


Fig. 2.—Method of using crystal element in a pick-up.

of the higher frequencies on the disc. The latter factor will increase as the needle approaches the centre of the disc, since the linear speed of the groove past the needle decreases with decreasing radius. The curve is accordingly shown dotted at

## from Discs

It is pointed out that the piezo-electric pick-up differs essentially in certain respects from the earlier electro-magnetic reproducer. To obtain best results from the piezo-electric device, it is necessary to bear this fact in mind. Simple methods of correction are described.

high frequencies to indicate that the amount of boost is adjustable and is usually increased as the cutter approaches the centre of the recording blank.

In plotting the response curves of pick-ups it is customary to correct for this characteristic and plot the voltage against frequency at constant velocity for the whole range 50-8,000 cycles, although this condition is never realised in practice. Fig. 3 (b) shows such a curve for a

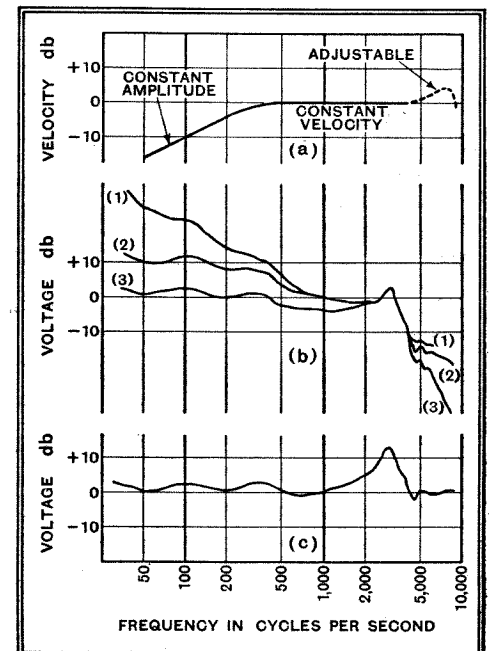


Fig. 3.—Diagram (a) shows normal recording characteristics, while the curves of diagram (b) indicate response of a normal Rothermel-Brush pick-up shunted by resistors of different values. Diagram (c) shows curve (b) corrected for constant amplitude.

Rothermel-Brush piezo-electric pick-up on open circuit. The same curve taken at constant amplitude (Fig. 3 (c)) shows even more clearly that the pick-up is of the amplitude type, the irregularity around 4,000 cycles being due to the mechanical resonance of the needle and stylus bar. This may be reduced by an equalising circuit.

Since the electrodes of the element are



**Improved Reproduction from Discs.—**

insulated from each other it is necessary in practice to shunt the pick-up by a resistance when connecting it to the input of a valve amplifier. This modifies the original response curve because the impedance of the pick-up is mainly capacitive, and in the case of the Rothermel-Brush standard type is equivalent to a series condenser of about 0.001 mfd.

The lower the value of loading resistance, therefore, the greater the loss at low frequencies, and if it is desired to retain the original characteristic, this resistance should be at least 5 megohms.

By varying the value of this resistance, a useful adjustment of the response at low frequencies may be obtained, as shown in curves 1, 2 and 3 of Fig. 3 (b). It will be seen that a value of 500,000 ohms is suitable for normal disc recordings, as it allows sufficient bass response to make

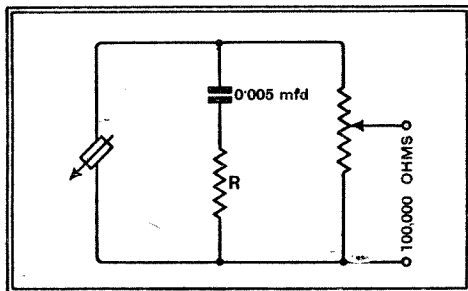


Fig. 4.—Pick-up circuit for high-impedance input.

good the attenuation previously mentioned. A value of 100,000 ohms gives a response proportional to velocity, the main stylus resonance giving sufficient lift at frequencies up to 4,000 cycles. Above this frequency there is a serious loss due to the compliance, or flexibility, of the needle and stylus bar. This has the same effect as a small inductance in series with the pick-up would have in reducing high frequencies when a low-resistance shunt is used.

In view of the foregoing, the method of volume control used deserves special consideration. The normal method for a high-impedance input with a potentiometer of 500,000 ohms resistance suffers from the defect that a loss of high frequencies takes place when the slider is moved from the maximum position. This is due to input capacity of the valve, and may be counteracted by connecting a small condenser between the slider and the "live" side of the pick-up.

**A Compensating Resistance**

The large output of the pick-up makes possible the arrangement shown in Fig. 4. With the values given, the output voltage available is reduced to one-sixth that given by the pick-up alone. The high frequency loss when using 100,000 ohms across the pick-up, as mentioned earlier, is made good by resistance R, which is of the order of 5,000 ohms.

In public address, broadcasting and sound recording work, low-impedance volume controls and amplifier inputs are

standardised, 200 ohms or 600 ohms being the usual values. By suitable choice of values in the circuit in Fig. 4, the pick-up may be connected direct to a low-imped-

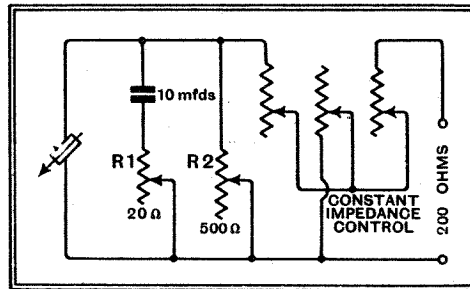


Fig. 5.—A low-impedance input circuit giving good control of high- and low-frequency response.

ance input without the use of a matching transformer. Fig. 5 shows an arrangement used by the writer in re-recording from disc to film. Variable resistances R1 and R2 give a wide control of high and low frequency response respectively, thus enabling the matching of discs of widely different origins.

This special attention to the method of loading the pick-up is necessary on account of the normal recording characteristic, which was shown to be a compromise between the constant amplitude and constant velocity systems.

But why compromise? The constant amplitude system of disc recording has several advantages where electrical reproduction is concerned. Since adequate amplitude is maintained at high frequencies the surface noise is reduced considerably, while the playing time for a

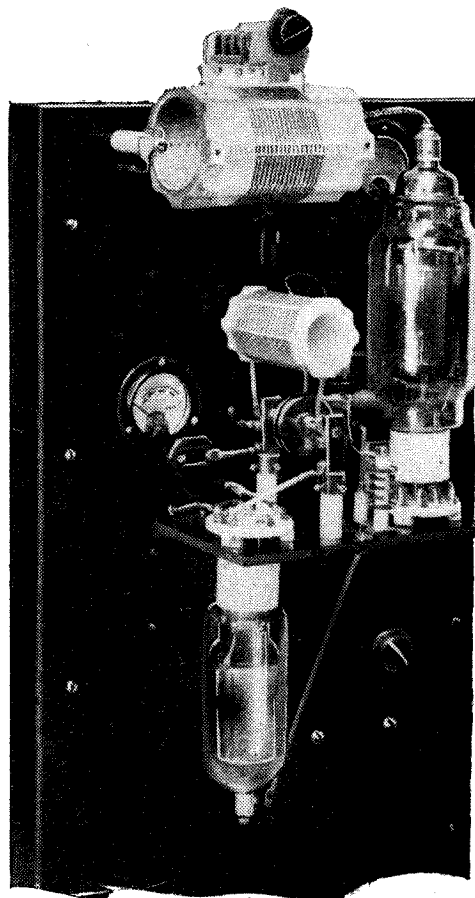
given size of disc can be increased by cutting the grooves closer together, since there is no undue danger of low frequencies overmodulating. In this way a playing time of over ten minutes could easily be obtained on a 12-inch disc.

**Home Recording**

It has been suggested that overmodulation and distortion at high frequencies would take place, but in practice this does not seem to be so—possibly because any spurious harmonics are above the useful frequency range, and consequently are not reproduced.

For home recording and other purposes where immediate playback is required, blanks consisting of a cellulose material coated on an aluminium base are becoming popular. When cut correctly, this type of disc shows a marked absence of surface noise, but unless the amplitude is restricted distortion is usually experienced, due to the peculiar properties of the coating. Unlike wax, the cellulose compound used shows a certain amount of resilience under the cutter; and after the groove is cut heavy amplitudes tend to "straighten themselves out." This effect becomes evident as amplitude distortion and a certain loss of bass (since the greatest amplitudes usually occur at low frequencies). The employment of the constant amplitude characteristic would to a large extent avoid this trouble by preventing the development of excessive amplitudes in the bass.

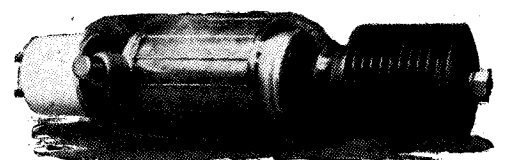
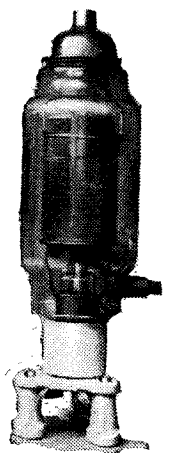
Although such recordings would not be suitable for reproduction on acoustic-type gramophones, the rapid increase in popularity of the electric type would seem to indicate that a general adoption of the system is feasible, particularly since the introduction of a type of pick-up which is so suitable for this method of recording.

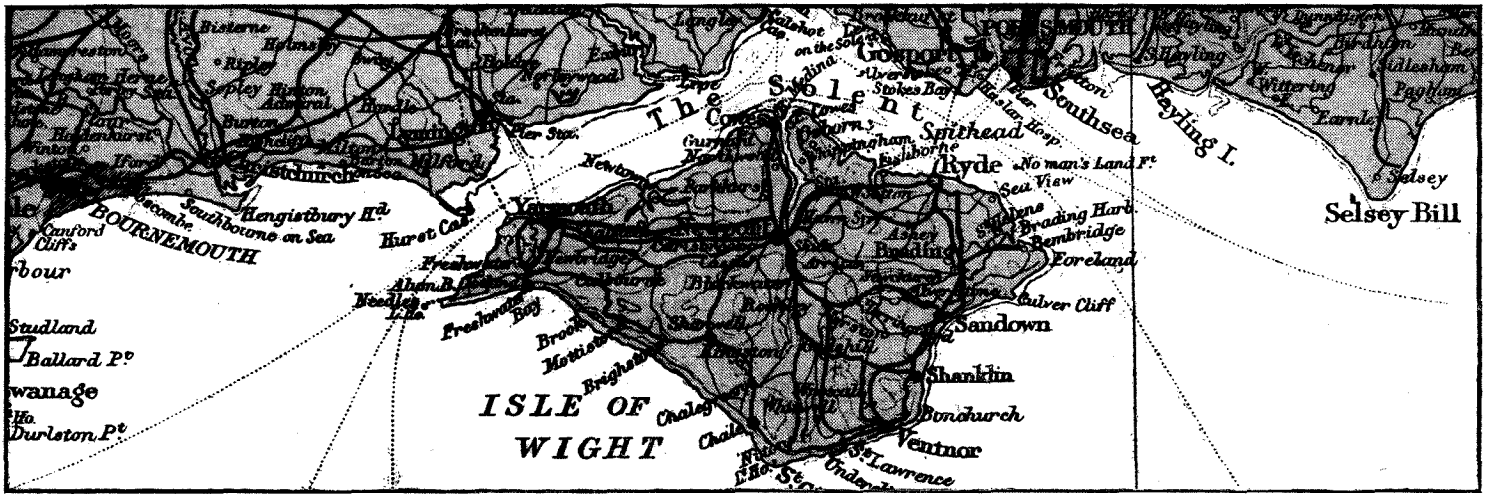


**Electron Multipliers**

*Pictures from U.S.A.*

THE accompanying photographs show electron multipliers of the types described in the article on page 336 of our issue of April 3rd. On the right is a 1-kW amplifier and another rated at 4 kW with air-cooling vanes is shown below. The panel illustrated on the left shows a master oscillator unit for a frequency of 5 megacycles.





# Better Service for Southern Listeners?

## New Regional Scheme Possibilities

By LESLIE BAILY

**W**RITING from the South Coast during my recent tour of investigation for *The Wireless World*, I described the inadequate service given by the B.B.C. to that part of England where Droitwich National provides excellent reception but the Regionals are a sadly second-rate alternative, while the only South Coast transmitters—Bournemouth and Plymouth—have an effective range nowadays of hardly 10 miles. I reported that most listeners down there make Fécamp their chief alternative to the National programme, and I remarked that this was hardly a position that a self-respecting British broadcasting organisation could long tolerate.

### Isle of Wight

Now we learn that something is to be done about it. A mobile transmitter has visited the Isle of Wight, preparing the ground for a new station with something like 10 kilowatts to replace Bournemouth's 1 kilowatt. Similarly, Plymouth will get more power.

This will extend the range of Bournemouth and Plymouth, but the expansion is limited by the fact that these transmitters will continue synchronised on a common wave. Considerable areas of the South will be in their common "mush" area. Brighton, for instance (a town where I heard strong complaints of the Regional service), is not expected to be within the service area of the new Bournemouth transmitter. What is to be done to "mop up" these unlucky tracts of Southern England? One may ask the same question of East Anglia, around Norwich, where listeners are troubled likewise by London Regional fading.

The increase of London Regional's

*THOSE* unlucky tracts of Southern England which can scarcely be said to be included in any of the B.B.C. regions may find their rightful niche in one of the interesting schemes now simmering in the melting-pot at Broadcasting House. Basing his remarks on the experiences of a personal tour of all the Regions, the author here foreshadows the end of "diagonalisation" and the institution of a three-programme scheme—National, North and South.

power from 50 to 70 kilowatts, now being undertaken, will not minimise this fading. A further increase, to at least 100 kilowatts, will be made when this station is rebuilt; a task the B.B.C. intends to tackle before long. If it were possible to ally these power increases with the provision at Brookmans Park of an anti-fading mast-aerial like that at the North Irish transmitter (which has proved itself an undoubted success), there is little doubt that most of South-east England and East Anglia would win a first-class Regional service. I am confident that the B.B.C. has such possibilities well in mind, but the snag seems to me to lie in the Air Ministry regulations which restrict masts at Brookmans Park to 200ft. Would so low a mast-aerial be effective?

If that way of solving the problem of Regional coverage for South England proves impracticable, the alternative will be a series of low-power relays. The idea of a Norwich relay has not been forgotten at Broadcasting House.

But such efforts by the engineers are insufficient in themselves to place the B.B.C.'s service to Southern listeners on a par with (for instance) its service to its Northern audience; a radical programme reform is also needed if the South is to have a system "Regional" in something more than name.

The so-called "Regional" programme relayed by the London Regional, Bournemouth, and Plymouth transmitters is; as

everyone knows, representative in no way of the Region it serves, as are—at least in some measure—the Northern and the Midland and other Regional programmes. It is a second kind of National programme. I suggest that a fundamental reason why the B.B.C. alternative programme scheme fails to satisfy is that these two programmes are a merely mechanical contrast, item by item, instead of being a contrast secured by a basic difference of inspiration and temperament—such as the North-country listener gets (as I say, at least in a measure)—because his North Regional programme has its roots in Northern life.

### Local Programmes

One very drastic suggestion has been actively canvassed within the B.B.C. It is highly interesting. What may be called the South Region Plan seeks (a) to cultivate programme resources in the southern counties and in East Anglia, and (b) to link this fresh supply of programmes up with the West and Midland Regions, to form one comprehensive South Region, with a programme always different from National and always different from every other Regional programme. At the same time, it is suggested that the North Region, being the only Region that could possibly put up a 100 per cent. local programme, should be given the requisite money and staff to permit it to do so.

**Better Service for Southern Listeners?—**

Thus we get three alternative programmes, always different: National, North, and South. Additionally, the Welsh, Scottish, and North Irish Regions would continue on their present basis, combining a certain amount of local material with a selection of items relayed from other Regions.

The present Midland Region has studios at Birmingham, a good Regional orchestra, and a keen (if none too large) staff. It would be possible, in my opinion, to increase the output of this Region without lowering quality, but there are clear limits to such expansion. To support a "100 per cent. local" programme, there is neither the talent for studio work nor the material for feature programmes and outside broadcasts, etc.

**A Southern Region**

Examining the West Region, with its studios at Bristol and Plymouth, one comes to a similar conclusion; indeed, the possibilities of expansion in the West seem less than in the Midlands.

But by pooling these two regions and by adding to them the hitherto untapped south-east counties—Kent, Surrey, Sussex, Hampshire, Berks, Bucks, Hertfordshire, Bedfordshire, Essex, Suffolk, and Norfolk—we have an area capable (it is suggested) of supporting a full programme of entirely Southern complexion, day and night, week in and week out. This, it seems to me, is a contention that merits close examination, for if broadcasting could be effectively rearranged in this way it would meet the criticism of those who object that not infrequently only two programmes are sent out simultaneously by all B.B.C. stations; it would thus bring more variety into British programmes, it would give Southerners a *fundamentally* different alternative programme, and it would perform for them the duty which the B.B.C. is already doing in other Regions of underlining the attributes and history and modern activities of the locality. This "local pride" is absent in Southern listening because the counties named above are a B.B.C. No-man's-land for which no Regional Director is responsible.

Let us examine some of the implications of this Plan. "Diagonalisation" would obviously go. The rule that the National, North and South programmes must always be different would only be relaxed for the rarest occasions of State importance, such as a speech by the King. The present all-stations broadcasting of fat stock prices would be remembered as a crude folly of B.B.C. adolescence. Feature programmes and plays which justified more than one performance would have to be repeated at widely different times on the same wavelength; a National play twice on the National wave, or even three times, if "big" enough.

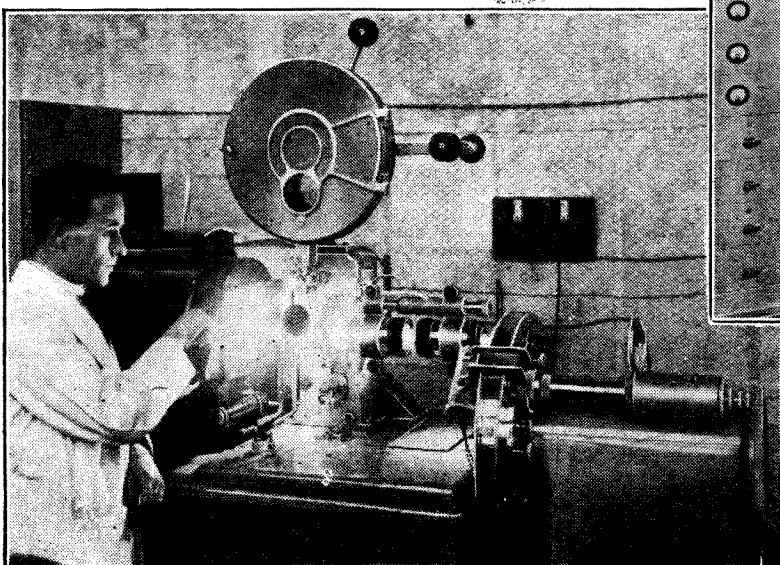
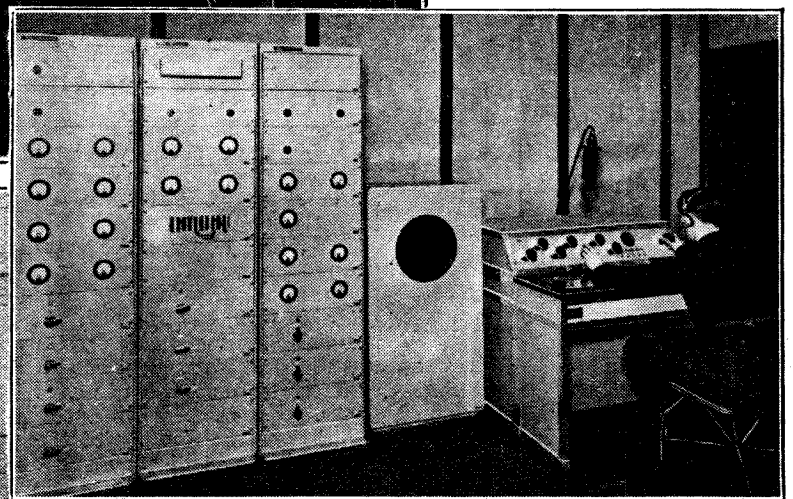
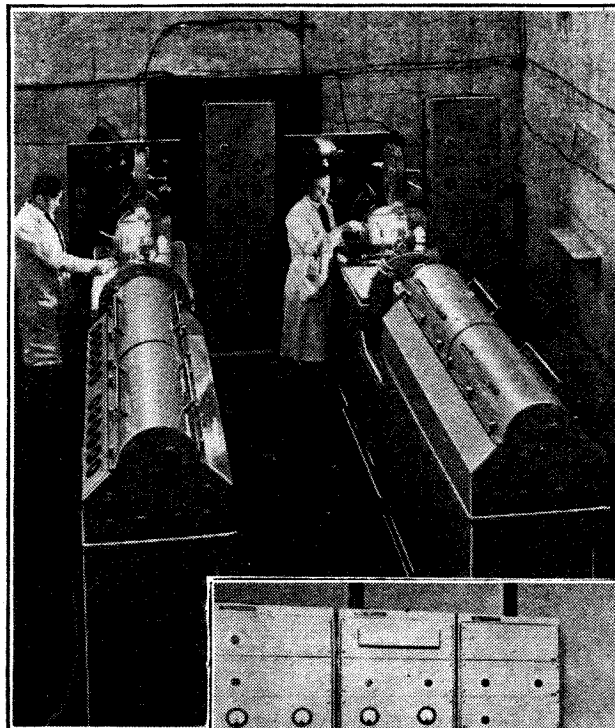
It is, presumably, the aim of each Regional Director to present to the world a programme characteristically Western, Scottish, or whatever it may be, but under present circumstances the local character is severely watered-down by the considerable amount of "foreign" make-weight. By creating a South Region big enough to support a full-time programme of its own, this weakness would be overcome.

The present West and Midland Regions would lose their "independence," but what is independence worth when it only results in a local programme of occasional bits and pieces? The Midland, Western, and Southern counties of England have, temperamentally, much in common; they contrast strongly with the North of England. A South Regional Director could do great things with all that southern end of England to build his programmes from—and for.

**Headline Links**

All the studios and Regional transmitters in the Midlands, West, and South would, under this scheme, be permanently linked by landline to a South Regional headquarters, not necessarily in London. It might not be a bad idea to let B.B.C. headquarters concentrate on the National and Empire programmes!

One could continue at length to speculate the pros and cons of the South Region Plan. I have said enough to indicate the extent of the idea. On full examination it may prove unrealisable, but, if so, what is to prevent the B.B.C. going forward with a lesser scheme, leaving the Midland and West Regions as they now are, but making the "No-man's-land" counties named above into a Southern Region, with an improved London Regional transmitter and the new Bournemouth and Plymouth as its transmitting points, and with a South Regional Director to inspire something more than the existing deadly mechanical sort of alternative programme service?



**TELEVISION TAKES SHAPE**

Equipment designed and developed by the Baird Company in preparation for the opening of the official B.B.C. television service. The top picture shows two Baird Telecine disc scanners, to the right the control desk and check loud speaker for the sound system, and on the left, a close-up of an optical and disc scanning unit.

# CURRENT TOPICS

## Testing Aircraft Transmitters

A NEW Air Ministry Notice to Aircraft radio operators states that aircraft transmitters must not be tested on the ground in the vicinity of Air Ministry radio stations without prior authority from the radio station supervisor.

## Russian Amateur Tests

THE Leningrad Short Wave Amateurs' Club has just concluded a highly successful world-wide communication test in which twenty-two of its members took part. The "star" two-way contact was held to be that between a Russian amateur and a DX man at Tahiti, in the Pacific.

## £80,000 to Fight Interference

REPLYING to a recent question in the House of Commons, Sir W. Womersley, Assistant P.M.G., stated that the number of engineering officers at present employed in dealing with cases of interference with broadcast reception of British programmes, expressed in terms of full-time staff, was 234. The total annual expenditure was at present about £80,000.

## More Wireless Licences

621,602 WIRELESS receiving licences were issued by the Post Office during March, 1936. This figure represents a nett increase of 44,004 in the number of licence holders during the month, after making allowance for expired licences and renewals.

The total number of licences in force at the end of March, 1936, was 7,617,797, as compared with 7,011,753 at the end of March, 1935, an increase during the year of 606,044.

During the month there were 354 successful wireless prosecutions.

## Salesmanship!

NOVEL dodges to sell car radio receivers are reported from the United States. Some dealers endeavour to sell a car radio to each new car buyer, but others are more discreet, and wait until the car instalments are paid off before suggesting any extras! Long-distance hauliers are said to be good "prospects," when they are persuaded that a radio will keep their drivers alert.

One wireless trader in Oklahoma appoints all the local car dealers as his agents. They

are encouraged to recommend his own car radios by the inducement of a dollar commission for every sale resulting.

## U.S. to Take Stock of Radio

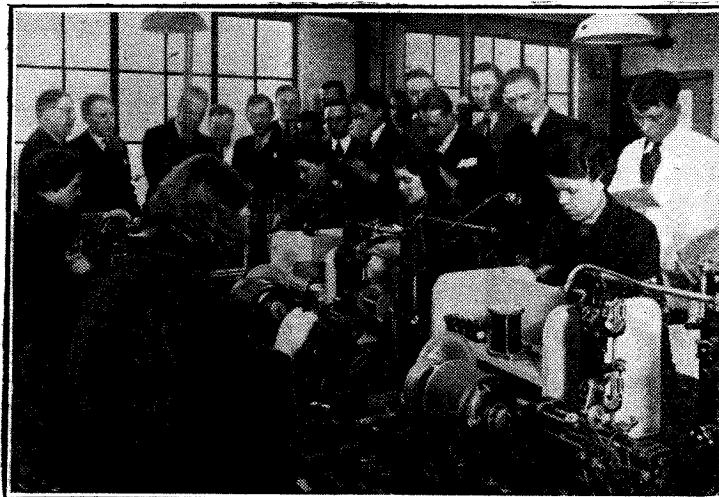
WHAT is the future of radio? This question is being asked in no idle fashion by the U.S. Federal Radio Commission, which appears to be somewhat overwhelmed by the widespread ramifications of modern radio developments, and the practical step is being taken of calling an extraordinary conference beginning on June 10th in which the nation's radio engineers concerned with all phases of the subject will troop before the Commission to give their views on the future of television, facsimile transmission, ultra-

taxis for the entertainment of drivers.

By means of an automatic device on the company's vehicles the wireless receiver cannot function until the driver "throws the flag" and the passenger turns the switch. Says the company: "The radios are thus primarily for the entertainment of the passenger rather than the driver, and observe the city's police regulation in this respect."

## Popoff Commemorated in English

A. C. POPOFF, whom Russia claims as the inventor of wireless in 1895, is to be commemorated in a special programme in English to be broadcast from the Moscow trans-



SHEFFIELD UNIVERSITY STUDENTS photographed during a recent visit to the works of Whiteley Electrical Radio Co., Ltd. at Mansfield. They are seen watching work on a Kandula machine, which winds a transformer in a few seconds. A break or kink in the wire automatically switches off the machine.

short wave broadcasting, aircraft wireless, ship and land services, and all the other manifold offspring of Marconi's invention.

The whole of the radio spectrum from 10 to 28,000 kc/s is to be explored, and it is probable that, to cope with the increasing congestion on certain wavebands, there will be a wholesale re-allocation of waves to the various services.

Although the findings of the Commission will directly affect only the United States, their verdict will be closely watched by the radio authorities of the world.

## Taxi Radio Again

AT least one taxicab company in New York has successfully circumvented the municipal ordinance against the installation of radio receivers on

mitters (1,724 and 25 metres) at 9 p.m. G.M.T. on May 8th. The latest developments in Soviet radio will be described.

## More French Giants

PROMISE of broadcast developments "in advance of those of other countries" was held out by M. Pellenc, Director of French broadcasting, in a speech given on the recent "radio day" held in connection with the Lille Commercial Fair.

New budget credits, he said, had made possible a start on the latest projects, which had made possible the acquisition by the broadcasting service of two large sites in the centre and south-west of the country. The first site, nine miles to the east of Vierzon, was intended for the great National transmitter of 150 kW, which would



RUSSIA'S WIRELESS PIONEER, Prof. A. C. Popoff, who carried out radio tests in 1895. A commemorative programme in English will be broadcast by Moscow on May 8th.

be ready for testing at the end of this year. The other site, at Noyant-sur-Allier, near Moulins, was intended for the new Colonial short-wave transmitter operating on 100 kW.

Work is going ahead on the construction of the new Bordeaux high-power station, and plans are being executed for giving good radio "coverage" to the French Alpine districts.

## Total Eclipse

TO assist in observations during the total eclipse of the sun in 1937 the New Zealand Government is lending a portable wireless transmitter to an expedition visiting the Phoenix Islands, 600 miles north of Fiji.

## Melba's First Broadcast

ON Sunday last the American N.B.C. stations broadcast the identical concert given by Dame Nellie Melba on the occasion of her historic appearance before the microphone at Chelmsford in 1920.

The programme was presented by Frank St. Leger, who filled the same rôle at Chelmsford sixteen years ago when on a world tour with the celebrated Australian soprano.

The report of the *Daily Mail* on April 20th, 1920, read: "The singer's glorious voice was clearly heard in Paris and Berlin and also at the Hague. . . . A grand piano was close by the transmitter, and the carpet where Dame Nellie Melba stood was rolled up lest the sound of her voice should be interfered with."

A description of the event as heard at the *Daily Mail* office stated: "'Hallo, hallo, hallo,' sang a voice into the receivers. 'Dame Nellie Melba is going to sing to you.' And then followed an apology for the Marconi Company not having control over the atmospherics."

# Simplified Volume Expansion

A SYSTEM NEEDING NO EXTRA VALVES

By W. N. WEEDEN

AS the subject of volume expansion has been covered quite thoroughly little will be said about the purpose of the expander, although the writer would like to state that it has become nearly as important to him, and many of his friends, as wide frequency response. Regardless of the fidelity of reproduction, a receiver which does not employ expansion leaves one dissatisfied. Expander reproduction grows on the listener until he is discontented when listening to a receiver not equipped with the device.

In the writer's view volume compression by electrical (automatic) means should at once replace manual control at the transmitter. The compressor should contract a 60 db range to 30 db. The

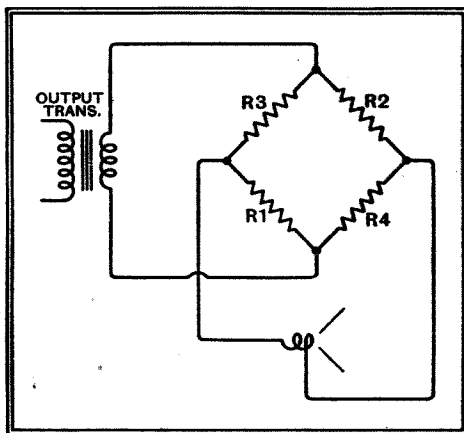


Fig. 1.—Simplified diagram to explain the action of the Crosley volume expander.

listener who is forced through economic or family pressure to listen at low level would be at least as well off (probably better off) as at present, due to more consistent operation of the compressor as compared with the monitor, and also to freedom from over-modulation and higher average signal-to-noise ratio than when transmission of a wide range is attempted. The listener with plenty of output power, and the desire to listen to a symphony orchestra at a volume level simulating the original performance has everything to gain.

An expander designed to operate in an inverse manner to the compressor, both regarding volume range and, of almost equal importance, speed of action (time constant of the compressor and expander should be nearly identical) would almost perfectly restore the programme to its pristine condition. Therefore, neither class of listener should suffer; instead, both should gain by the change in technique.

One of the difficulties with the expanders so far described has been their somewhat complicated nature, and the fact that in

*IT is well known that the resistance of an ordinary lamp filament increases many times when heated. An American contributor explains how this effect has been turned to account in devising a new compensating circuit for restoring the original volume contrasts in reproduced music.*

several systems the valves must be very carefully matched—not only at the normal operating point but also at plate current cut-off. If they become mis-matched the possibilities of distortion are very real.

A new system has recently made its appearance in a medium-priced American receiver manufactured by Crosley. Although the range of expansion is not so great as that offered by some of the more complicated systems, nor is there any provision for selecting the desired degree of expansion, the advantages of simplicity and cheapness should far outweigh the limitations mentioned.

Fig. 1 shows a simplified diagram of the Crosley "Auto-Expressionator." It will be seen that the four resistors are connected to form a Wheatstone bridge. If this bridge were perfectly balanced, no sound would be heard from the loud speaker. However, if the resistance of R3 and R4 be increased (it is assumed that their resistance is initially equal to that of R1 and R2) the signal across the speaker will increase until the point is reached where the total signal from the output transformer (less the power consumed in resistors R1 and R2, which are in series with the voice coil) will be impressed on the speaker.

In the Crosley Auto-Expressionator, this is precisely what happens. Resistors R3 and R4 are replaced by two incandescent lamps, similar to automobile head lights. When the applied signal is small (e.g., pianissimo passage of orchestra) the resistance of the lamp filaments (cold) is nearly equal to that of R1 and R2. Nearly, but not exactly, thus causing the bridge to be slightly unbalanced, so that some voltage is developed across the speaker voice coil. As the signal increases the current flowing through lamps 1 and 2 increases, causing

an increase in their temperature and also their resistance. This increase in the filament resistance produces the same effect mentioned previously—to cause further "unbalance" in the bridge, and the concomitant development of more power in the speaker. This continues until the full power of the receiver, minus that lost in the resistors R1 and R2, is applied to the loud speaker at such times as the orchestra reaches a crescendo. It will be realised that this progressive unbalancing of the bridge provides a greater volume range from the speaker than at the receiver input, thus true volume expansion is accomplished.

## Extent of Expansion

This system differs in one respect from most of the expanders operating through valves. In most cases full expansion can be utilised regardless of the acoustic power developed by the speaker. In the case of the Auto-Expressionator, however, this is not true. The degree of expansion depends on the setting of the volume control, or the amount of power developed

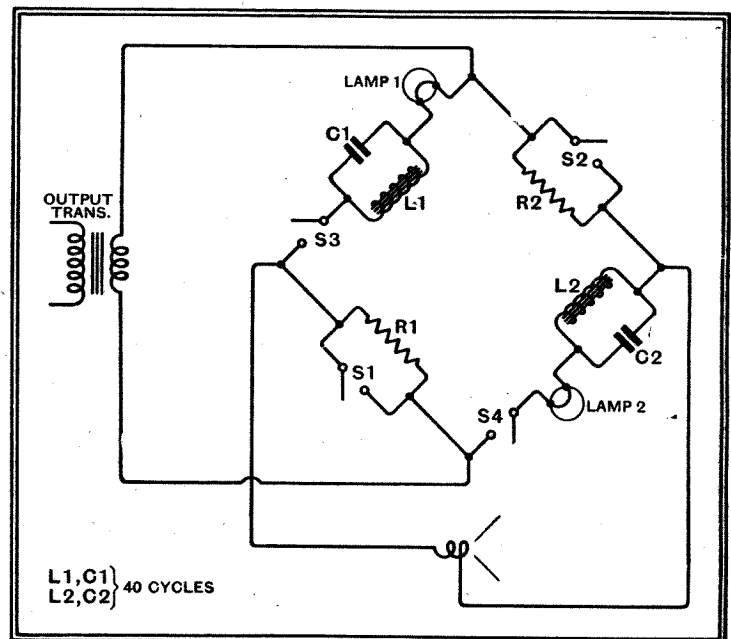


Fig. 2.—Circuit arrangement of the "bridge" volume expansion system, in which lamps are used as resistances in two of the arms.

across the output transformer. Also, with most systems with which the writer is familiar, the listener may use a limited degree of expansion—if he does not care

**Simplified Volume Expansion—**

to restore the original volume range of the performance.

One important feature is the time constant of the circuit. The change in balance of the bridge should not be so rapid that single notes of increasing volume seem to jump at the listener. This is taken care of by the thermal lag of the filaments or the time required for their temperature (and resistance) to change.

The listener has the option of employing the expander or not by the manipulation of a control which opens S<sub>1</sub> and S<sub>2</sub> and closes S<sub>3</sub> and S<sub>4</sub> (Fig. 2) when expansion is desired, and closes S<sub>1</sub> and S<sub>2</sub> and opens S<sub>3</sub> and S<sub>4</sub> when the expander is not desired. When the expander is not in use the bridge is removed from the voice-coil circuit to prevent waste of power.

In Fig. 2 will be seen two inductances with associated condensers (L<sub>1</sub>, C<sub>1</sub> and L<sub>2</sub>, C<sub>2</sub>). These form two parallel resonant circuits tuned to approximately 40 cycles. At low levels, the impedance of these tuned circuits at and near their resonant frequency causes unbalance of the bridge, accentuating the low frequencies in much the same manner as a tone-compensated volume control. As the level increases the

bridge becomes more unbalanced, thus preventing the impedance of the tuned circuits from affecting the low-frequency response. This bass compensation does not function when the expander is out of operation. With such a circuit the low tones should be comparable in intensity with those of medium pitch even at low levels. The writer is not convinced of the desirability of this bass accentuation when employed in this manner, because of the fact that during pianissimo passages the bass tones will normally be very subdued, even if one is listening directly to the orchestra. If one is forced to listen at such low level that orchestral peaks seem to be lacking in low notes, the automatic bass compensator might prove useful.

A point which the writer has not had time to consider is the possibility or probability of mis-matching of output valve impedance to speaker, due to change in impedance of load circuit with level. It is probable that the impedances are matched at high level, when the load impedance is maximum. At low levels the tubes will work into an impedance probably much lower than their plate resistance, but the distortion will probably be negligible at this low output.

stable even without an earth connection, and the hum level is exceptionally low, though screened input leads are essential in view of the high overall gain. Incidentally, an input volume control of 50,000 ohms is included.

Valve.	Anode Volts.	Anode Current.	Cathode Volts.
1st Stage (MH4)	215	5.8	2.9
2nd Stage (MHL4) ...	160	8.3	4.0
Output Stage (PX25's) ...	530	(1) 50 (2) 51	45 45.8

The above measurements were made from the chassis.

The amplifier has a particularly good frequency response for, as the curve here reproduced shows, it is ostensibly flat from about 50 c/s to 10,000 c/s, and this includes the output transformer.

The rated undistorted output of 12 watts was actually exceeded with our model, the output, measured at the anodes of the last stage, indicating that a shade under 14 watts is given before noticeable distortion appears.

To obtain this power an input of 0.7 volt was required, which gives an amplification of approximately 430. This is sufficient for many types of transverse current carbon

## Hartley Turner GA12S Amplifier

### Inexpensive AC-operated Model with a Good Frequency Response

THE GA12S amplifier made by Hartley Turner Radio, Ltd., is a general-purpose model for AC operation and having a rated undistorted output of 12 watts. It employs four valves, excluding the rectifier, and the circuit consists of an input stage resistance-capacity coupled to a penultimate amplifier and then two PX25 valves operated in push-pull, the coupling between these two stages being a parallel-fed transformer.

An output transformer with a ratio of 40 to 1 is included to match the last stage to a 4-ohm impedance loud speaker.

The power supply is quite orthodox apart from the fact that generous smoothing is employed. LT is obtained from two separate 4-volt windings on the mains transformer with the load equally distributed between them and each supplies one early stage and one of the output valves.

The valves fitted are Marconi MH4, MHL4 and two PX25's, while the mains rectifier is an MU14.

Provision is made to take power for operating a wireless receiving unit, the supply point giving about 20 mA at 530 volts for the anodes, and 2 amps. at 4 volts for the

filaments. Voltage dropping resistances will, of course, be needed to bring the HT supply down to the required working value. If more than two valves are used the extra LT current could be obtained by tapping across the LT winding not internally joined to this supply point. An additional two amps is available from this source.

Although the amplifier is designed on strictly economical lines, liberties have not been taken to further this end and each stage is adequately decoupled, and separate cathode bias resistances, with electrolytic by-pass condensers, are fitted. This also applies to the push-pull stage, so in the unlikely event of one valve failing, it cannot lead to damage to the other.

As a result of these precautions the amplifier is rock

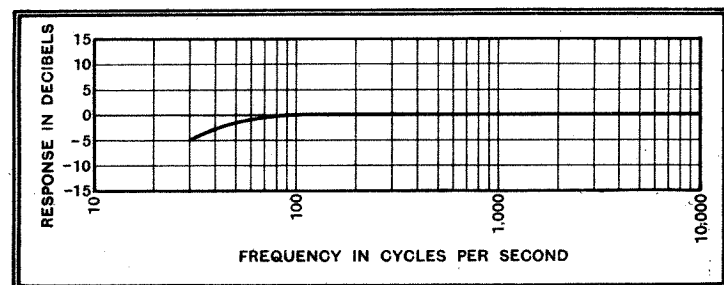
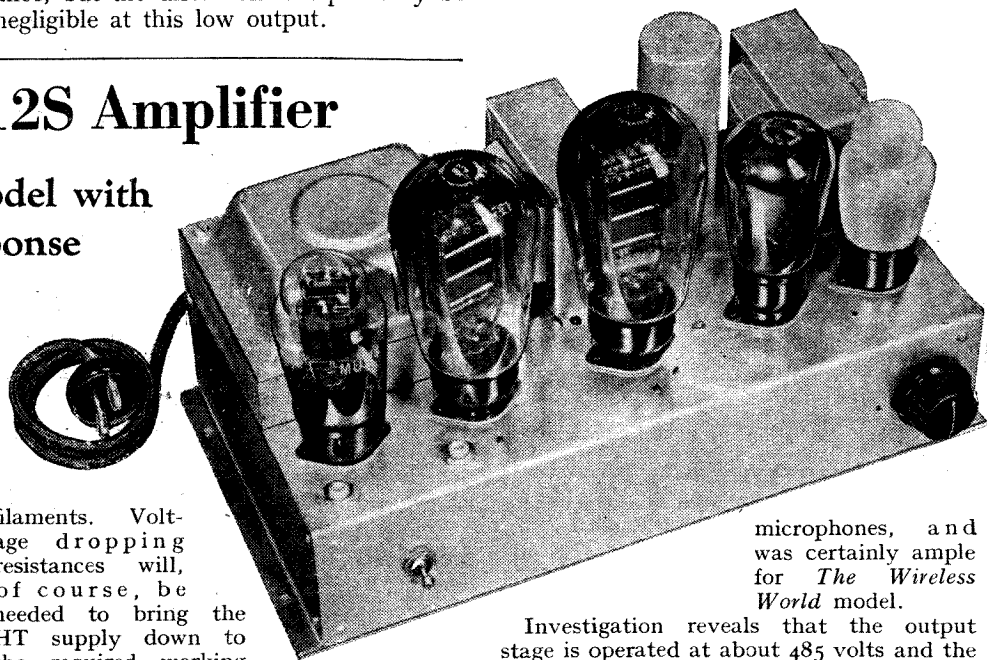
microphones, and was certainly ample for *The Wireless World* model.

Investigation reveals that the output stage is operated at about 485 volts and the bias resistances increased to 900 ohms, which gives a grid bias of -45 volts in each case for an anode consumption of 50 mA. This, no doubt, accounts for the slight increase in power output observed during our tests. The early valves are operated in the normal manner, the Table giving the measured voltages and currents for each stage.

With each model is supplied full instructions as to the method of installation either for radio, for gramophone, or for microphone reproduction, together with a circuit diagram giving the value of all components. The latter will be found very useful by all users, but especially so by experimenters who may wish to employ the amplifier for purposes not envisaged in the instructions.

To sum up, the GA12S amplifier is a soundly designed model fully capable of giving its rated output power and it has a characteristic which is virtually flat over the normal working range of audible frequencies, and at the price of £13 10s., including valves, it represents good value for money.

H. B. D.



Response curve of Hartley-Turner 12-watt amplifier.

# New Empire Flying Boats

## THE WIRELESS EQUIPMENT DESCRIBED

### Provision for Working on Short, Medium and Long Wavelengths

**O**F the many problems confronting the designer of wireless equipment for aircraft, that of ensuring efficient operation under all conditions, yet in no way detracting from the air performance of the machine, is possibly one of the most difficult to solve. How it is being tackled in the case of the new giant flying boats is briefly described in this article.

**C**OMMERCIAL aircraft to-day is expected to maintain the same regularity in its services as that of any other form of transport, no matter what the weather conditions may be, and the fact that it bears favourable comparison is due in large measure to the very efficient organisation of wireless for purposes of communication and navigation.

Anyone who has listened on the aircraft wavelengths knows to what extent pilots on the Continental routes rely on the assistance of Croydon, Lympne, and other ground stations, many of which are equipped for direction-finding, so that within a few minutes the position of any machine can be given with extreme accuracy.

The giant Empire flying-boats now under construction for Imperial Airways will be expected to maintain the same regularity as other air services, but navigation will be a far more difficult matter

less equipment will have to be relied on almost exclusively.

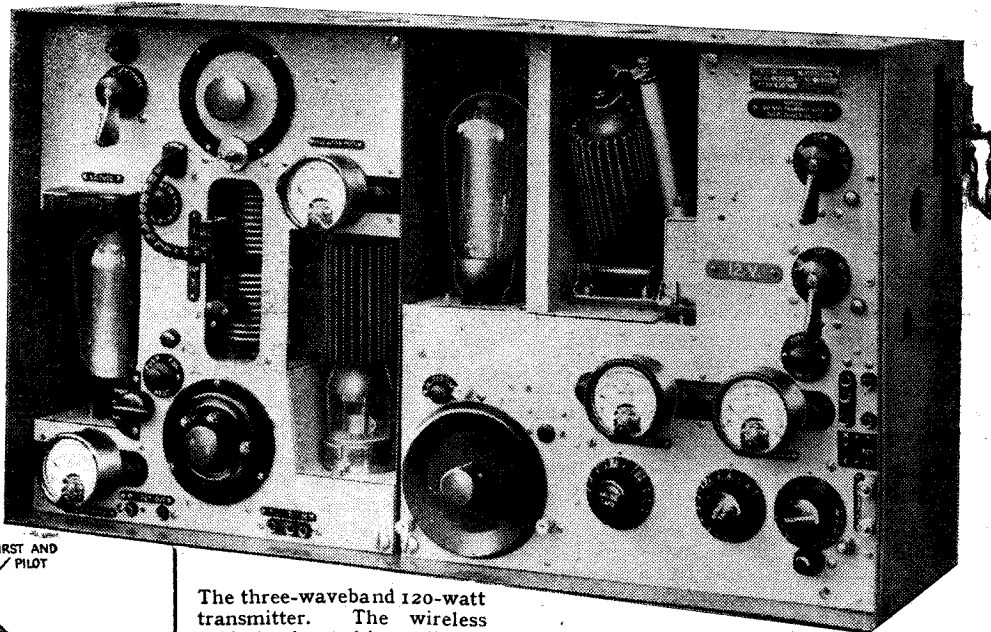
While the flying-boats are taking form at Rochester, the wireless equipment is being constructed in the Aircraft Establishment of the Marconi Company at Hackbridge, near the Croydon airport. This consists of a wide-waveband trans-

being employed on the short waves and telegraphy or telephony on the other wavebands.

A superheterodyne is used for reception, its waverange being as for the transmitter, but it extends up to 2,000 metres. There is a separate tuning control for the short waves and another for the direction finding circuits.

We have had an opportunity to examine the equipment during its manufacture, and it is interesting to record that the receiver embodies a number of standard components of the kind available to the home constructor, though, of course, there are many parts that have been designed for the special functions the apparatus has to discharge.

Since these machines will have a speed of over 200 miles an hour, particular



The three-waveband 120-watt transmitter. The wireless cabin is situated immediately behind the pilot's cockpit, so avoiding delay in passing messages.

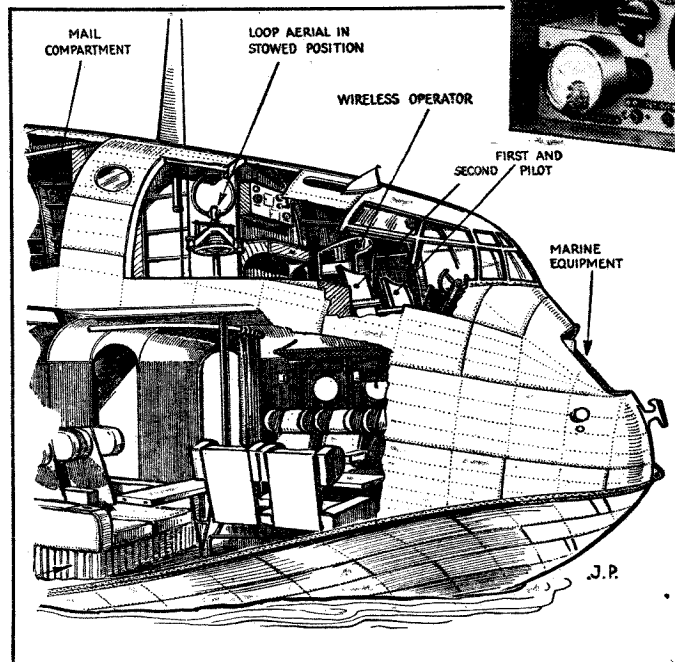
Sketch by courtesy of "Flight"

mitter, a communication receiver, direction finder, and a homing device.

In order to avoid duplication of the apparatus, the one receiver is used for all purposes, though for direction-finding a small loop aerial replaces the fixed or trailing aerials that are to be employed for communication work. The installation includes a nominal 120-watt transmitter designed for working on wavelengths of 16 to 75 and 600 to 1,100 metres, telegraphy

attention has had to be given to the avoidance of wind resistance in all parts of the wireless equipment outside the cabin; the DF loop already referred to is arranged so that it can be lowered within the hull when not in use, whilst in place of the usual wind-driven generator, power for the transmitter is derived from a motor-generating set housed inside the wireless cabin and driven from the aircraft's 24-volt battery. This is kept charged by generators coupled to two of the four main engines.

The wireless power generating plant includes, in addition, a small two-stroke petrol engine which can be instantly coupled up by a sliding clutch. It is intended for use only in the event of a forced landing, when the possible failure of the battery supply (for the cells are of

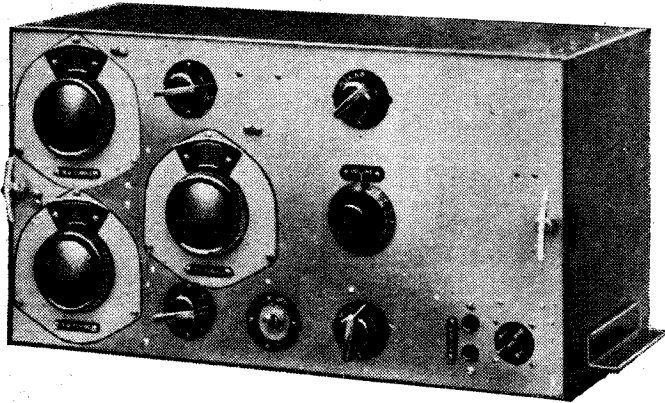


as they will not have the assistance, at least at the outset, of a well-organised chain of wireless stations, so that for position-finding the machine's own wire-

less equipment will have to be relied on almost exclusively.

**New Empire Flying Boats**—(comparatively small capacity) would put the wireless out of operation at a time when it was most needed.

With the self-contained generator communication will be possible for an indefinite period, for there should be no lack of petrol, and, furthermore, the motor of the generating set could, in an emergency, be employed as an LT generator driven from the petrol engine to keep the



One receiver with separate tuning controls is used for communication and DF work.

batteries fully charged, for they will be needed to start up the main engines when repairs have been completed. Of course, adequate precautions are taken to render this auxiliary petrol engine absolutely safe when used in the manner described.

### Aerial Systems

Finally, a word about the aerial systems. As mentioned already, three separate aeriels are available—a loop for DF work; a long, trailing aerial for use in the air and a shorter fixed one running fore-and-aft.

The trailing aerial will be led out through a long fairlead which will project through a trap-door in the hull. It can be withdrawn when not required, and the trap-door, being fitted with a water-tight joint, automatically seals the aperture when the fairlead is drawn up.

The fore-and-aft fixed aerial is supported at the forward end by a kingpost just above the wireless cabin, and extends back to the tail. It will be used when the machine is on the water or for short-range communication. The short kingpost is telescopic, and could, for emergency work, be raised several feet, so giving a longer working range in the event of a forced landing.

The loop aerial, when raised through its trap-door, can be orientated from inside the cabin, and bearings read off directly from a compass card. Any two or more ground stations of known position can be used for deter-

mining the location of the machine, and this should prove a valuable asset during poor visibility and when flying at night.

Provision is also made to utilise the DF equipment as a homing device; that is to say, the loop is fixed fore-and-aft, and any ground station used as a beacon to fly on, its signals being heard at equal strength in both earphones while the course is kept, but becoming stronger in one if any deviation is made. A throw-over switch gives indication whether the deviation is to port or starboard, and the course corrections can be passed on to the pilot's cockpit, which communicates with the wireless cabin.

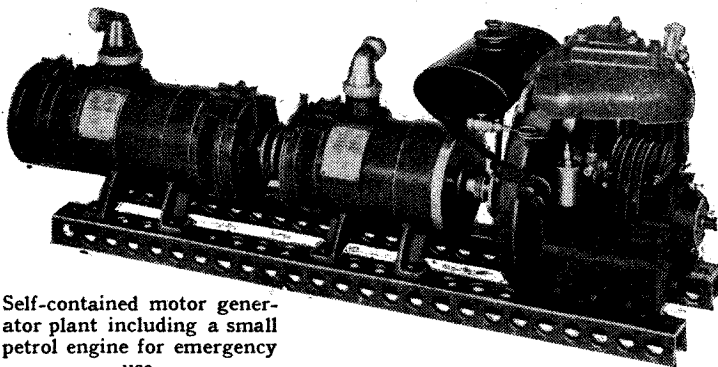
A new development of this homing scheme may be embodied in the equipment. It dispenses with the aural indication of course deviation, and is replaced by a visual indicator which would most likely be located on the pilot's dashboard.

There is no doubt that very great care is being devoted to the perfection of this new aircraft equipment, and everything is being done to render the navigation by wireless of these giant flying-boats as perfect and as reliable as possible. The air communication side of the equipment has, of course, received just as much care, for the Marconi Company has a wide experience to call upon, but, throughout, the Aircraft Establishment is leaving nothing to chance in the design or in the manufacture of the apparatus.

H. B. D.

## DISTANT RECEPTION NOTES

**M**Y best thanks to those kind correspondents who have sent me some of them maps and others calculations in answer to the question that I asked a while ago: Would a great circle track between my home in a Chiltern valley and New York reach me from a north-westerly direc-



Self-contained motor generator plant including a small petrol engine for emergency use.

tion? The reason for the question, readers may remember, was that I do find that the range of hills on one side of the valley screens me from certain European stations, though that on the other side does not act in the same way towards North American

stations, which are very well received. It appears that the great circle track in question does run north-westwards from me, and as that is, roughly, the direction of my valley, the failure of the hills to throw a wireless shadow is explained.

This is confirmed by some old notes that I have just come across which were made at the time when I managed to receive U.S.A. stations not this time with a portable, but with a superhet using a two-foot frame aerial. This set, which had nine valves, was a particularly sensitive one for its time; there was, in fact, practically nothing in Europe that it would not bring in. On the night in question I was receiving American stations extraordinarily well with another set connected to an outdoor aerial, and decided to try what the frame-aerial receiver could do. Having carefully pointed the frame to the west I switched on, made a careful search and received exactly nothing. Quite by accident the frame was turned through about 30 degrees towards the north and a station was instantly heard. A fresh search, with careful variation of the frame, brought in fifteen more. The notes record my surprise that the radiations should appear to arrive from a north-westerly direction. Possibly readers who, like myself, failed to take great circle tracks into consideration may have had similar experiences and have been equally puzzled.

### Listening in the 'Small Hours'

It is probable that Radio-Normandie, usually known as Fécamp, will suspend for a while its small-hour transmissions between midnight and 2 a.m. This will be welcomed by listeners who indulge on occasion in the fascinating pastime of sitting up for North and South American stations. To them any European transmission which goes on much beyond midnight is a nuisance, in the same sad way that to the grower of good hay the buttercup is just a weed!

By the time that you read these notes Bologna should be at work with 50 kilowatts, for the opening of the new station, which bears the proud name of "Radio-Marconi," was due on April 21st. The opening of this station completes the original Italian Regional programme, though, as I mentioned recently, there are to be additions in the shape of an increase to 100 kilowatts in the power of Rome I and in the construction of a second Rome station, also with a power of 100 kilowatts. I hear that once these two 100-kilowatt stations are in operation it will not be long before considerable increases take place in the output rating of Florence, Milan I, Genoa, Bari I, Turin I and possibly other stations. In a long, narrow country like Italy it is by no means easy to provide an adequate broadcasting service even with a considerable number of stations. The difficulties are largely increased by the rib of mountains which runs down the country from north to south.

The French Government had at one time the intention to increase the power of Radio-Paris to at least 150 kilowatts. A change of policy took place, and it was decided to construct an entirely new station—a French National corresponding to Droitwich—in a much more central position. A site near Bourges has been chosen and the work of construction will start quite soon. The French National long-wave transmitter, which should be opened next year, will probably work for a start with an output of 150 kilowatts. The plant, however, will be so constructed that an increase to 300 kilowatts or even more will present no great difficulties.

D. EXER.



# BROADCAST BREVITIES

## At the "A.P."

THERE are not enough precedents to enable one to say that the Alexandra Palace is at last looking like a television station, but as it is certainly beginning to look like nothing else on earth one may safely say that progress is being achieved.

The passer-by now sees the new lattice mast rearing upwards to a third of its ultimate height above the reconditioned East tower. If he climbs the spiral staircase he may be rewarded with a blow on the ear from a cement-filled pail as it swings gaily upwards on a crane hook through the staircase well.

## Open-Air Television

A new concrete "apron" on the terrace covering an area equal perhaps to that of a bandstand suggests an open-air stage for televising with the "electric eye."

Inside the B.B.C.'s wing of the Palace work goes furiously ahead. The Baird engineers have already installed a large part of their apparatus, and the space is now clear for installing the twin transmitters for sight and sound. A miniature cinema with regulation fire-proofed projection room is practically complete. This will enable producers to see films prior to televising them and to effect any necessary "cuts" and general sub-editing.

## The "O.B." Department

THE B.B.C. Department suffering most from the anticlimax following Jubilee Year is the "O.B." Last year was filled with notable events which offered splendid opportunities to the men with the wandering microphones. There was Jubilee Day itself, followed by the Royal Review of the Fleet, the Royal Inspection of the R.A.F. at Mildenhall, a bumper Tattoo at Aldershot, and countless other highlights.

This year it is different, and I cannot find that the "O.B." people have any outstanding items in their programme except the "Queen Mary" broadcasts.

## Things Have Changed

Appearances are deceptive, of course, for the organisation of this department has undergone a change. When Mr. Gerald Cock was "O.B." Chief he was practically given *carte blanche*

to seek outside broadcast material; having caught the hare he presented it to the Programme Department, who were usually thankful for small mercies, and big ones as well.

Under the direction of Mr. de Lotbinière, the "O.B." department has become more Executive in type. It is now the job of the Programme Department to devise suitable outside broadcasts, the "O.B." people being entrusted with the sometimes more difficult and delicate task of carrying them out.

## Those Breakdowns, and Why

A NUMBER of breakdowns have occurred on the Scottish Regional transmitter during the past few weeks. The reason is that experiments are being carried out to investigate the distribution of field strength in Scotland, and for this purpose a temporary aerial is being used.

It is necessary that the work should be done in programme hours, but as it creates considerable inconvenience to listeners who disembowel their sets to see what is the matter, the tests will be terminated very shortly.

## Baseball

FOR the first time on record a commentary on a baseball match is to be broadcast to British listeners, the date being May 23rd. The match will be between White City and West Ham, and will be played at the White City. Mr. Robert Bowman, of ice hockey fame, is to be the commentator, so is it necessary to add that the commentary will be full of pep and excitement?

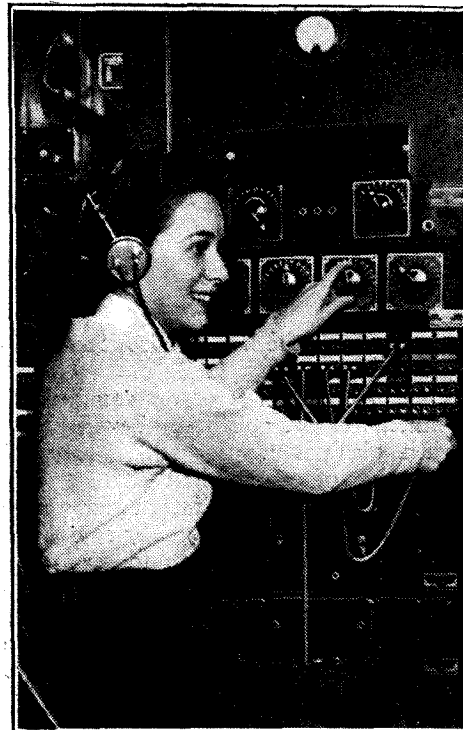
Baseball is becoming increasingly popular in this country, though the players are principally Canadians and Americans temporarily residing over here.

## Radio Gazette

DRAMATISED news suggests all kinds of possibilities, so there should be a goodly number of listeners for the first broadcast of "Radio Gazette," which is to make its bow in "Saturday Magazine" on May 2nd. It will consist of a summarised news feature presented in the form of an exciting sound news-reel relating not only to home events but to happenings all over the globe.

## By Our Special Correspondent

**WOMAN TELEVISION ENGINEER.**  
Miss Eleanor Thomas, 18 years old, who has just graduated in radio-television engineering at Kansas City. She is assistant control engineer at station W9XBY.



The B.B.C.'s Mobile Recording Department is being enlisted to help, and in addition the engineers at the Tatsfield receiving station will always be ready to pass on any suitable foreign news for recording purposes.

If successful, "Radio Gazette" may eventually branch out as a short regular feature on its own account.

## New Talks Series

THE B.B.C.'s summer talks programme sees the introduction of several new regular features.

"This Time Last Year" is the title of a seasonable series of talks in which speakers are to describe how they spent their holidays in 1935. They are to be given on May 4th and subsequent Mondays at 6.50 p.m. Talks for discussion groups consist of four series. The first is being given by Professor J. Ritchie on Mondays at 7.30 p.m. on "Behind the Scenes in Nature," and deals with familiar happenings in the country which the listener can observe for himself.

## Yesterday and To-day

A new Discussion Group series entitled "The Voluntary Social Services" is being broadcast every Thursday at 7.30 p.m., and when the series ends on May 21st it will be followed with talks by Lord Elton on "Public Opinion and Politics in Great Britain during the Last Century." Finally, there are the talks with the self-explanatory title "The British Commonwealth and Colonial Empire," which are being given by Prof. R. Coupland and H. V. Hodson on Tuesday evenings at 7.30.

## "Having a Meal"

The really conversational talk has set a new vogue on Sunday evenings, recent notable exponents being Max Beerbohm and G. K. Chesterton. Arthur Bryant will soon be heard on "Travelling," Mrs. H. Richardson on "The Seaside," and Alice Ritchie on—is this the best title of all?—"Having a Meal."

## Bells on the Air

CARILLONS invariably broadcast well. An interesting recital will shortly be given by Nora Johnston, who comes of a family associated for generations with the making of church bells, and is the only Englishwoman to hold the diploma of the Belgian National Carillon College. Some listeners may have heard Miss Johnston on the Hyde Park Carillon, where she gave no fewer than thirty-two concerts. Miss Johnston gave thirty-one recitals on the Jubilee Carillon in 1935. She uses a bell clavier specially constructed for the stage. It is a replica of the one at Malines Cathedral belfry, which dates back to 1556.

## Wanted: a Fatstock Uncle

COPY of letter received last week by "The Announcer," Fat Stock Prices, Oxford Circus, London, W.:—

Dear Sirs,—A few days ago I ordered a piece of filleted veal at the local stores, weight 4lbs. 6ozs., price charged 7/4. I thought this price was far beyond what I should have paid (fillet of veal was not boned), and am I doing right at paying their price, I ask? Thanking you for a reply.

Yours truly,  
(Signed) .....

Clearly there is an opening for a Fatstock Uncle to give advice in such cases.

# UNBIASED

## Broadcasting's Stonehenge

NOW that Easter is behind us and we are all beginning to think of removing our winter woollies and getting our summer undies off the dusty shelves of the pawnshop, the B.B.C. also is awakening from its long winter sleep.

One of the earliest of the summer departments to get going is, of course, the nightingale party. It will be several weeks yet, of course, before these tiny toilers of the night return from the Riviera or wherever it is they spend the winter, but there is much to do before then. I do *not*, of course, refer to preparations in connection with that old canard concerning the use of gramophone records which was started many years ago

## By FREE GRID

by some unscrupulous person; my old readers will remember that I was one of the first to point out that this story was obviously untrue; for if it *had* been true the B.B.C. would have had the good sense to go on to greater triumphs such as the broadcasting of the Bul-buls from Baghdad—which, of course, they didn't.

However, it is not about nightingales that I set out to talk to you. What I wished to ask you was whether you realised that London, the greatest city in the world, possessed one of the most antique broadcasting stations. Brooklands Park is now well over six years old—truly a venerable age for a broadcasting station—and you realise this only too painfully when you compare its efforts with those of the North Ireland Regional; why, even the wavelength is different! It is now nearly three years (12.5.33) since I gave a solemn and public warning to the B.B.C. of the direction in which it was heading, and now we see the fruit of its lackadaisical attitude in the shape of a transmitter held together by string and old bootlaces and fully ripe for handing over to the old-iron man, and yet with nothing ready to replace it.

### Keeping Abreast of the Times

What on earth is the use of our noble and altruistic set manufacturers working their fingers to the bone and sacrificing all their profits to their research departments when the older transmitters of the B.B.C. fall far below the capabilities of the sets which they are turning out. It is, of course, realisation of this fact that has induced them all to turn their atten-

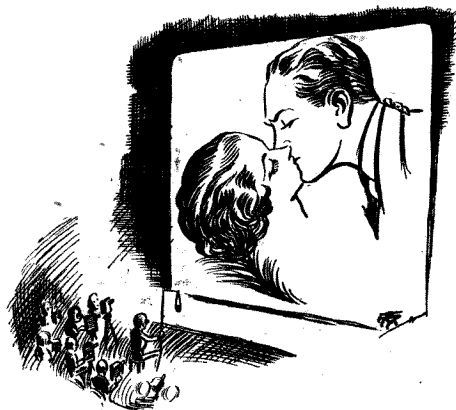
tion to the production of all-wave sets so that there may be at least some valid case for urging the public to renew their receivers. It is quite useless to ask the public to buy new sets on the grounds that they are capable, as they undoubtedly are, of giving better results on the ordinary broadcasting wavelengths than their last year's ones if the transmitters haven't been renewed in order to keep up with that progress.

It will be seen, therefore, what big effects can arise from comparatively obscure causes, for had the B.B.C. kept their transmitters up to date so that they were really worthy of the sets being marketed, we should not have been treated to the sight of manufacturers getting killed in the rush to produce all-wave receivers.

## Television Truths

WHEN you see it stated, as you not infrequently do, that modern television provides better results than a good home cinema, it is fairly safe to bet that the writer is fully acquainted neither with home cinemas nor with television. He is, in fact, about on a par with the writer of sea stories who talks about "the deep diapason of the typhoon" or the equally famous lady novelist who once told us, anent the Boat Race, that "all were rowing fast but none so fast as our George."

At any rate, good as high television undoubtedly is, not even its most ardent advocate would claim that it is better than a first-class home cinema show.



Rows of B.B.C. camera men.

Such statements do as much harm to television as did the lyrical lies about broadcasting with which unprincipled writers



used to spoil good paper some dozen or more years ago. Television is quite good enough to stand on its own merits without the doubtful bolstering up supplied by this sort of writing.

Another kind of mis-statement to which I take strong exception concerns what the B.B.C. are supposed to be going to do if they can't come to terms with the big film magnates regarding the televising of sections of popular films. I have heard it hinted that in the event of any trouble they might merely book up a whole row of seats in the cinema where the film they want to televise is showing. These seats would be occupied by B.B.C. camera-men armed with small 16-mm. cameras. As number one camera-man came to the end of his reel of film, number two would take on, and so on, so that by the time the final camera-man had finished his reel, number one would have re-loaded ready to start the whole process over again.

It would, I think, be rather unfortunate if the shutter mechanism of the B.B.C.'s cameras were not in step with the projector, as they would then stand a good chance of drawing a blank, although I suppose they could avoid this difficulty by racing the B.B.C. cameras at double speed and then correcting for this in the television projector. Also no mention is made concerning the bottling of the sound side of the films, but doubtless this would be overcome by putting a man in the front row with a microphone dangling on the end of an umbrella. However, I fancy that the B.B.C. television staff, like their brethren on the sonic side of broadcasting, are far too clever to have to descend to crudities of this sort in order to get the better of recalcitrant film magnates.

## Wanted : Aspirins

"DO tramcars start coming through your loud speaker?" asks the writer of the wireless notes in a well-known Northern journal. I have always known those fellows up North to be hardy sort of individuals, but, speaking personally, I have always found it best, when this sort of thing happens to me, to swallow a couple of aspirins and take to my bed for a few hours.

# New Apparatus Reviewed

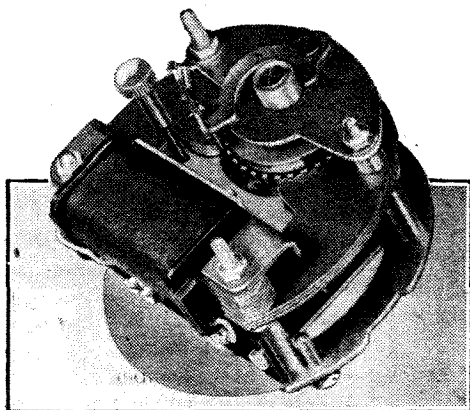
## Recent Products of the Manufacturers

### M.R. ELECTRIC CLOCK UNITS

**A**N electric clock embodied in the wireless cabinet not only gives the set distinction but also has a real utility value, and it may therefore be of some interest to know that movements for constructing them can be obtained from M.R. Supplies. These units are well made and are of the synchronous type, being designed for operation from time-controlled 50 c/s supply mains.

They are full-size instruments capable of driving large hands; the smaller model, measuring 2in. in diameter, can be fitted with hands up to 10in., while the other model, which is  $\frac{1}{2}$ in. larger, will drive hands up to 15in. long.

They run at the comparatively slow speed of 187 r.p.m. and are perfectly silent.



Electric clock movement obtainable from M.R. Supplies.

Three concentric spindles are provided for fitting hour, minute and second hands, and the prices are 13s. 9d. for No. 1 size and 16s. 6d. for the larger model.

### BENJAMIN PLATFORM VALVE-HOLDER

**T**HIS new product of Benjamin Electric, Ltd., is a chassis-mounting valve-holder of the type used largely by set makers, but it is available also to the home constructor.

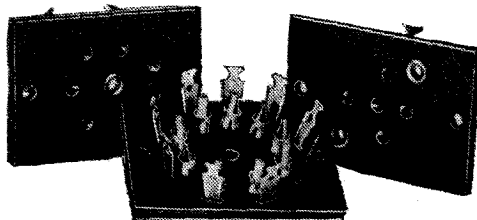
The contacts are of special interest as they are made in one piece, with the socket part consisting of two spring contacts gripping the valve pin on two sides. These are reinforced by two half-rings of metal which close the contact springs when the valve is withdrawn.

Connection is made to the sockets by soldering the wires to an extension lug which is sufficiently long to prevent the heat of

the soldering iron from affecting the temper of the springs.

This new valve-holder is made in four-, five-, seven- and nine-pin types, and costs 6d., 7d., 9d., and 10d. each respectively.

Several specimens have been tested, and from a close examination of the spring con-



New Benjamin skeleton-type chassis-mounting valve-holders.

tact action we feel confident that it will prove quite reliable, and make good contact with all pins even after a long period of use.

### ZENITH DOUBLET AERIAL

**T**HE Zenith Doublet Aerial consists of two 30ft. lengths of aerial wire separated in the centre by a triangular-shaped insulator, where they are joined to a low-impedance feeder consisting of a twisted pair of well-insulated flexible wires.

A special transformer is supplied to match correctly this low-impedance feeder to the input circuit of the receiver, and this is contained in a cylindrical metal case measuring 2 $\frac{1}{2}$ in. in diameter and 1 $\frac{1}{4}$ in. deep.

It has two screw terminals for the feeder connections and two wires for joining to the aerial and earth terminals of the set, also a two-position switch, the function of which is apparently to change the aerial tapping on the transformer when conditions warrant. The unit is sealed, however, and cannot readily be examined to verify this point.

The advantages of this type of aerial lie mainly in the better signal-to-noise ratio that can be obtained in locations where man-made static is bad, for this is often more troublesome on the short wavelengths than on the medium- or long-wave bands.

Though the dimensions of the doublet are such that it favours the short waves, perfectly satisfactory reception is obtained on the medium- and long-wave bands, where any loss in signal strength is of little consequence with modern receivers, as their sensitivity is usually sufficiently high to compensate for such losses as may accrue due to the shorter effective aerial length.

The Zenith aerial tested was found to be quite satisfactory from about 12 metres up-

wards, and on all wave-bands gave a lower background level at a receiving site where electrical interference was particularly bad.

The noise rejecting properties of the system, however, are only really effective provided the horizontal span of the aerial is either raised above the interference zone or located far enough away from buildings to be outside the noise area.

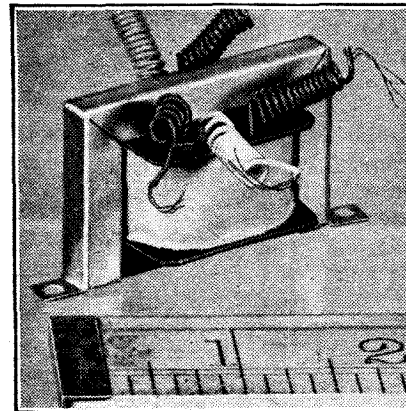
It is well, also, to bear in mind that on the short waves, the doublet aerial is markedly directional, best results being obtained when it is erected at right angles to the direction from which the signals are received.

The Zenith aerial kit comprises, in addition to the parts already mentioned, two insulators for the free ends of the aerial and two stand-off insulators for the feeder down lead. It is marketed in this country by J. Toubins, of Manchester, and costs 25s.

### BULGIN MIDGET MICROPHONE TRANSFORMER

**O**NE of the most recent additions to the Bulgin range of components is a midget microphone transformer intended primarily for use in deaf-aid appliances and small amplifiers where space is strictly limited. It is truly a midget as the overall size is only 1 $\frac{1}{2}$ in. x 1in. x 1 $\frac{1}{4}$ in. Yet both windings have surprisingly high inductances considering the size of the component.

The primary, with no DC flowing, has a measured inductance of a shade over one henry, while that of the secondary, under the same conditions, is over 600 henrys. These values decrease rapidly when DC is passed through the primary winding, so to obtain the best performance the microphone should be operated with the lowest possible



New Bulgin Midget microphone transformer.

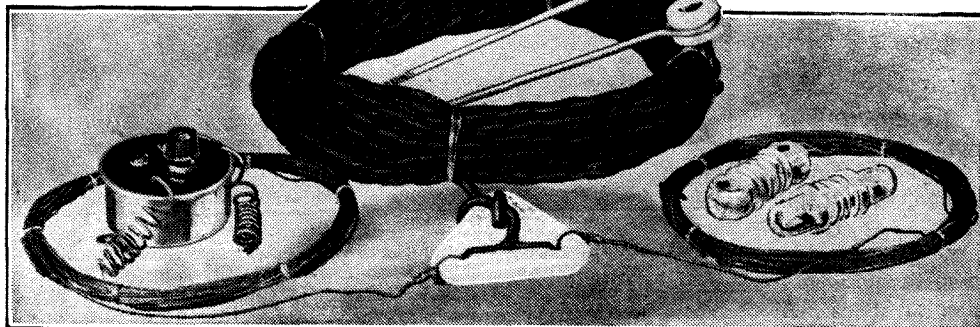
polarising voltage. For example, with 8 mA flowing in the primary its inductance falls to 0.32 henry.

Even so, this value of inductance is satisfactory for carbon microphones of about 50 ohms resistance, and although it could be used, of course, with higher resistance models, or with larger primary currents, the bass response will not be so good.

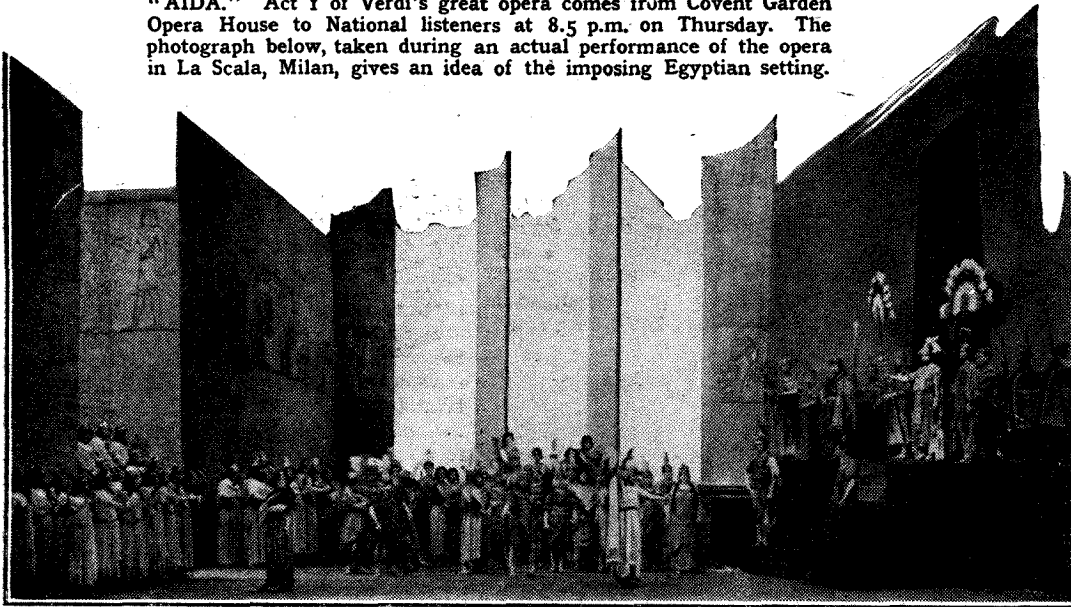
The primary winding is centre-tapped for use with microphones consisting of two buttons arranged in push-pull, under which conditions the magnetising effect of the microphone current will be neutralised and the no-DC value of primary inductance then realised.

The overall step-up ratio is 1:35, and this new transformer, Type LF35, costs 5s.

Zenith Doublet aerial kit.



"AIDA." Act 1 of Verdi's great opera comes from Covent Garden Opera House to National listeners at 8.5 p.m. on Thursday. The photograph below, taken during an actual performance of the opera in La Scala, Milan, gives an idea of the imposing Egyptian setting.



# Listeners'

written one of her characteristic monologues, and Claude Hulbert and Enid Trevor are to be heard in a typical domestic "scene."

## THE CUP FINAL

To many listeners the broadcast of the week occurs to-morrow—the running commentary on the F.A. Cup Final match at Wembley between Arsenal and Sheffield United (Nat. 2.30). We shall miss the familiar voice of Mr. George Allison, who prefers fresh fields and pastures new; but "the game's the thing," and in Messrs. Ivan Sharpe and F. N. S. Creek, the International and Corinthian player, the B.B.C. has chosen worthy commentators for football's biggest event.

## COVENT GARDEN

THERE are so many dazzling distractions at Covent Garden on the opening night of the Season that it is safe to say that the music lover can obtain almost as much satisfaction from the performance by listening to it on his loud speaker as by sitting in his boiled shirt in the auditorium itself.

"The Mastersingers," Wagner's great work, has been chosen for Monday's inaugural performance, and it is important to note that the three acts

## Outstanding Broadcasts at Home and Abroad

OF all the episodes of the great war, none gripped the public imagination more than the bravery and resource of the Australian and New Zealand forces at Gallipoli. Consequently when the time came to fashion a radio play on the subject the graphic materials were to hand in such profusion that the major task was that of selection. This task Val Gielgud carried out to such good effect on the twentieth anniversary of the landing at Suvla Bay that General Sir Ian Hamilton—an eager listener to the original production—wrote to offer his congratulations to the author and to enlighten him upon points of detail of which only the Commander-in-Chief could have cognisance.

This fact alone gives added significance as a historical document to the revived broadcast next week of "Gallipoli," which will be heard by National listeners at 9.25 on Sunday and on the Regional wavelengths at 8.10 on Tuesday.

Besides a vivid sound picture of the landing at Suvla Bay, the broadcast includes extracts from the works of Winston Churchill, John Masefield, Rupert Brooke, Henry Nevinson and Compton Mackenzie.

### GALA NIGHT AT SADLER'S WELLS

A SADLER'S WELLS Gala performance really is a gala performance, so listeners operatically inclined should not miss to-morrow's special broadcast from the theatre of

Act 2 of Smetana's "The Bartered Bride," which has been selected for this End-of-Season performance (Reg. 8). The cast—an exceptionally strong one—includes Tudor Davies as Jenick (tenor), Arnold Matters as Kecal, John Cross as Marenka (soprano), and other leading artistes.

"The Bartered Bride" is an opera in the lighter tradition. Act 2 takes place in an inn, where Marenka, the heroine, tries to rid herself of an unwelcome suitor only to find herself betrayed—or so she imagines—by the man she loves.

### CRICKET

EVERY type of Cricket is to be represented, from Test Match to the back-yard variety, in "Willow the King," a Miscellany written and arranged for broadcasting by Herbert Farjeon. It was first heard at the beginning of May last year and, in response to requests, is to be repeated in the Regional programme at 7.30 on Wednesday next. It is a Bristol production.

Not the least attractive element in the programme is Mr. Farjeon's gentle satire, directed both at himself and at his fellow cricketers.

### "LIGHT FARE"

MABEL CONSTANDUROS, Claude Hulbert and Enid Trevor are three favourites who will appear in "Light Fare," another of Ernest Longstaffe's programmes designed to appeal to the largest possible number of tastes. At

8.15 on Wednesday (Reg.) Mr. Longstaffe will also bring to the microphone for the second time Leslie Elliott, a woman artiste who has not only made her name as an entertainer at the piano, but is well known for the number of successful numbers which she has written and published.

Some misgivings are felt in regard to Nina Devitt's "turn," for this talented Australian artiste is to sing a special song appealing for dogs of all kinds, and it is feared that the front hall of Broadcasting House may be quickly filled with canine applicants.

Mabel Constanduros has



"GALLIPOLI." The story of the bravery of the Australian and New Zealand forces in the Dardanelles campaign will be retold in Val Gielgud's broadcast, "Gallipoli" on Sunday and Tuesday next. The above wartime photograph shows a corner of the Anzac position.

# Guide for the Week



are all being broadcast. Act 1 will be heard Regionally at 6.25, Act 2 on the "Nationals" at 8.25, and Act 3 on the Regional waves at 9.45. Sir Thomas Beecham is the conductor.

## ANOTHER GREAT TRIAL

BURLESQUE sometimes comes as a breath of fresh air, and more than one listener will gulp the oxygen which is wafted to London via Aberdeen at 7.20 on Thursday (Nat.). This is "The Trial of Harry Gordon," in which one of Scotland's most popular comedians will be heard pleading his own



MABEL CONSTANDUROS is one of the favourite artistes appearing in Ernest Longstaffe's feature, "Light Fare," in the Regional programme on Wednesday at 8.15.

cause before the bar of public opinion.

## THE WEEK'S OPERAS ABROAD

NOT all operas with a magnificent stage setting have equally attractive music. More often the setting and the music are in inverse ratio to each other. But in Strauss's "Der Rosenkavalier" the pleasure which comes to the eyes—the opera is always beautifully staged and dressed—does not overshadow the delightful music, and listeners will find that the broadcast of the opera from Bordeaux-Lafayette tonight at 7.55 well worth tuning in, particularly as the musical standard of this station is unusually high.

To-morrow's best operatic "draws" are Ponchielli's 4-act "La Gioconda" (The

## HIGHLIGHTS OF THE WEEK

### FRIDAY, APRIL 24th.

Nat., 8, B.B.C. Symphony Orchestra at Budapest. 9.50, "The Budget" by Mr. W. S. Morrison, M.P. 11.15, Joe Loss and his Band.

Reg., Fred Hartley and his Novelty Quintet. 8.55, Organ Recital by G. Thalben Ball.

### Abroad.

Rome, 8.45, Opera: "Iris" (Mascagni) from the Scala, Milan.

### SATURDAY, APRIL 25th.

Nat., 2.30, F.A. Cup Final. ¶Band of H.M. Irish Guards. 8.30, "Tone and Colour."

Reg., 8, "The Bartered Bride" (Smetana) from Sadler's Wells. 10.30, Henry Hall's Hour.

### Abroad.

Vienna, 8.10, "Spring"—vocal and instrumental potpourri.

### SUNDAY, APRIL 26th.

Nat., Troise and his Mandoliers. 6.45, "The Drama of To-day," by Sir Cedric Hardwicke. 9.25, "Gallipoli," by Val Gielgud.

Reg., London Symphony Orchestra, conducted by Albert Coates. 9.30, B.B.C. Theatre Orchestra.

### Abroad.

Oslo, 8, Schubert's Mass in A Flat.

### MONDAY, APRIL 27th.

Nat., 8.25, "The Mastersingers" Act II, from Covent Garden. 10, World Affairs.

Reg., 6.25, "The Mastersingers" Act I. ¶Victorian Melodies. 9.45, "The Mastersingers" Act III.

### Abroad.

Strasbourg, 8.10, Ballet Programme from the Paris Opera.

### TUESDAY, APRIL 28th.

Nat., 8.30, The Fol-de-Rols. 10.20, B.B.C. Orchestra, conducted by John Barbirolli.

Reg., Henry Hall and the B.B.C. Dance Orchestra. 8.10, "Gallipoli." ¶Billy Merrin and his Commanders.

### Abroad.

Frankfurt, 8.10, Operetta: "Der Bettelstudent" (Millocker).

### WEDNESDAY, APRIL 29th.

Nat., 8.15, B.B.C. Orchestra, conducted by Constant Lambert. 9.15, "Is that the Law?" ¶Bransby Williams.

Reg., 7.30, "Willow the King"—a Cricket Miscellany. 8.15, "Light Fare." ¶Casani Club Dance Orchestra.

### Abroad.

Brussels I, 8.30, Brussels Philharmonic Chamber Orchestra: "Youth 1936."

### THURSDAY, APRIL 30th.

Nat., 8.5, "Aida" from Covent Garden. ¶Henry Hall and the B.B.C. Dance Orchestra. ¶Leslie Bridgewater Quintet.

Reg., 8, Snooker Championship at Thurston's. ¶Piano Recital by Iso Elinson. ¶B.B.C. Orchestra.

### Abroad.

Stuttgart, 8.10, Mozart's "Requiem" by Station Orchestra and Choir.



"OFF DUTY." An interesting glimpse in the station canteen at Copenhagen. Miss Grete Otto, the well-known woman announcer, enjoys a well-deserved cup of tea while chatting with artists. Note the inspiring mural decorations.

Ballad Singer) with its brilliant ballet music, to be broadcast from Milan at 8.45, and Mozart's "Don Giovanni" which has been selected as the midnight studio opera performance by Stuttgart.

The remaining opera broadcasts of the week consist of an electrical recording of Wagner's "Parsifal" from Frankfurt at midnight on Tuesday, and a relay from the Paris Opera-Comique (opera unspecified) by Eiffel Tower at 8.30 on Thursday.

## OPERETTA HIGHLIGHTS

"FERNFLOWER," by Malinowski, an operetta very popular in its composer's country, Poland, and scarcely known to the outer world, is featured in the Warsaw transmission at 7 on Saturday. Malinowski was born towards the end of last century, and is chiefly known for his pianoforte music and songs.

A good "follow-on" will be the Radio Toulouse concert version of Oscar Strauss's "A Waltz Dream," which will be heard at 9.10.

There are two other operetta highlights next week. At 8.30 on Monday Lyon-la-Dona is offering Lecocq's tuneful "Le petit Duc," and at 8.10 on

Tuesday Frankfurt is featuring "Der Bettelstudent," the jolly 3-act operetta by Millocker.

## NATIONAL MUSIC

PROGRAMMES in English come under the "National" heading to-night. At 8.15 Athlone is offering a Donegal folklore feature, while at 10.5 Moscow presents a programme for English listeners which will include cavalry songs. Musically speaking, a more attractive programme comes from Vienna at 9.5 entitled "The Heyday of Viennese Folk Song."

Most interesting of the week's National features, however, should be the Deutschlandsender offering at 3.15 on Monday—"Songs and Tales from the Banat." The Banat is a part of old Hungary, and thus was dealt with by the Treaty of Trianon, belonging now in part to Roumania and in part to Yugoslavia. Many of the people are of German origin, and as most of this part of the Continent is unspoiled, the broadcast should provide much that is new, all of it interesting.

"Irish Airs and Parodies" is a promising item in the Athlone list for 8 on Thursday next.

THE AUDITOR.

# The Gas Discharge Tube

By R. POLLOCK

**T**HE rectification of AC for power supply units involves the use of a device which might have the following idealised properties. It must conduct in the required direction with a very low voltage drop and in a manner free from discontinuity which might cause interference. It must be an insulator in the opposite direction, and to be fully effective the transition from these states should occur as the applied alternating voltage passes through zero.

An approach to the ideal rectifier characteristics outlined above is only found in the commutator switch, and here the inclusion of the non-interfering clause renders the device useless for ordinary purposes. To what extent, then, does the mercury vapour rectifier approach the ideal?

## Operation of Mercury Vapour Rectifiers

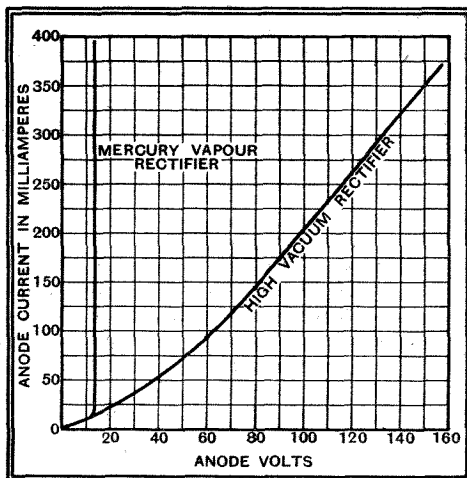


Fig. 1. Characteristics of vacuum and mercury vapour tubes compared. Note that the latter acts virtually as a short-circuit after the critical voltage is reached.

It is essentially a high vacuum rectifier into which has been introduced a quantity of mercury giving a "gas filling" of mercury vapour. On the application of anode voltage the electrons from the cathode will ionise mercury atoms when a voltage of some thirteen volts is reached (the ionisation voltage of mercury) and give rise to positive ions as well as negative electrons. The ions, flowing towards the cathode, neutralise the shell of negative space charge surrounding it and remove the barrier to full emission of all available electrons to the anode.

It is therefore possible to pass anode currents of some amperes at voltages between 13 and 15 volts, and this represents the only loss of voltage in such a valve—a negligible item in rectifying some hundreds of volts.

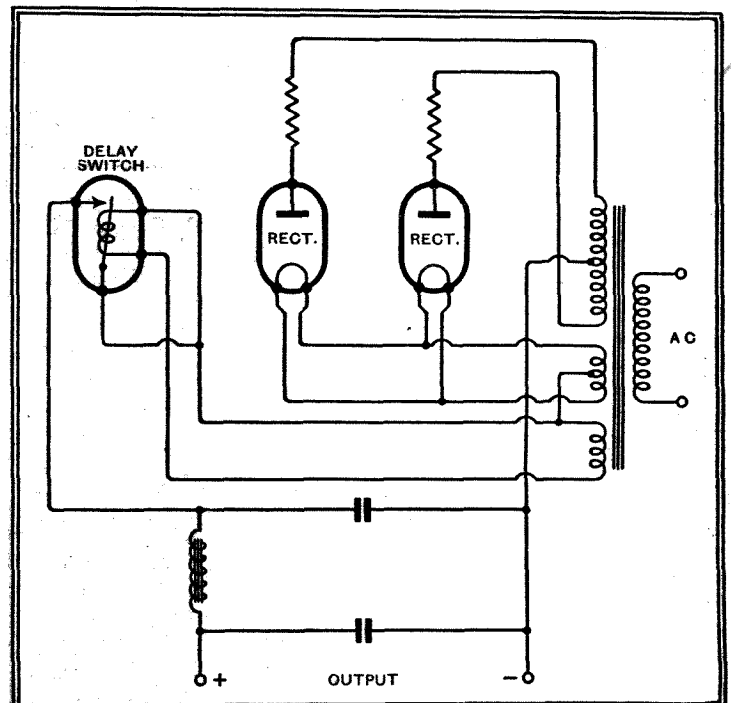
**O**N account of the comparatively high voltage drop occurring in most rectifiers of the high-vacuum type, mercury vapour rectifiers are finding a widening sphere of usefulness for feeding Class "B" amplifiers, receivers operating at frequencies approaching zero, and for other equipment of fairly high power where the relatively poor regulation and wattage loss of the ordinary "hard" valve is a serious drawback

Inverse current is zero for voltages in the opposite sense as the anode is a non-emitter and ionisation ceases as the anode voltage is reversed. There is a possibility of radio interference from rectification, and this will be discussed later. It is evident, however, that for rectification of voltages well in excess of 15 volts the mercury vapour rectifier is ideal, as can be seen in Fig. 1, where anode voltage/anode current curves of a standard type of rectifier and a mercury vapour type are drawn to show the comparative voltage drop at a given anode current.

A rough calculation shows that, at 250 mA the mercury vapour discharge represents a loss of some 3.8 watts, while the hard rectifier wastes nearly 30 watts, and, moreover, contributes an impedance of some 160 ohms to the rectifying circuit, giving rise to poor voltage regulation. The impedance of the mercury vapour rectifier, under the same conditions, would contribute only 6 ohms and would thus be an inappreciable item in the presence of even a well-designed smoothing choke in its effect on regulation. Before reviewing a few of the practical aspects of these rectifiers it will be necessary to discuss the precautions necessary for correct operation and freedom from failure.

In the conductive direction the discharge is a close approach to a short-circuit between anode and cathode,

Fig. 2. A practical HT unit with two gas discharge tubes giving full-wave rectification.



and direct application of HT will, unless external circuit resistance exists, result in sufficient current passing to damage the

cathode. This will also happen if the filament is operated at too low a temperature, for then a normal value of anode current may represent the total possible emission from the cathode. In these circumstances the positive ions bombard the cathode with considerable energy, there is an accompanying rise in anode-cathode PD, and the emissive coating of the cathode will be destroyed. Actually, visible shattering of the coating can be seen at times under these conditions and it is usually accompanied, when operating with an alternating anode voltage, by breakdown in the reverse direction.

## Delayed Anode Voltage

It is therefore necessary when using any power supply unit with such rectifiers to delay the application of anode voltage, preferably by means of a thermal delay switch, until the filaments attain normal temperature before any current is passed. Such a thermal delay switch is now made by most manufacturers of the rectifiers and is operated from a separate LT winding on

the transformer, or, if of suitable rating, from the rectifier LT winding. It consists of a bi-metallic strip contact, suitably

**The Gas Discharge Tube—**

mounted in a high vacuum or inert gas, actuated by a heater connected as indicated. Suitable delayed action mercury switches are also on the market and are suitable for switching a separate primary circuit energising the HT winding. The thermal delay switch, operating in the HT circuit, is shown in Fig. 2, which shows a bi-phase circuit using two rectifiers. The switches are rated for various delay periods at certain heating voltages. For the usual type of rectifier this should be at least thirty seconds. On some large industrial

A circuit such as this may be found advantageous in place of the usual bi-phase system, apart from any considerations of voltage doubling. It will have an improved ripple content in the output, for reasons that are easily appreciated. The

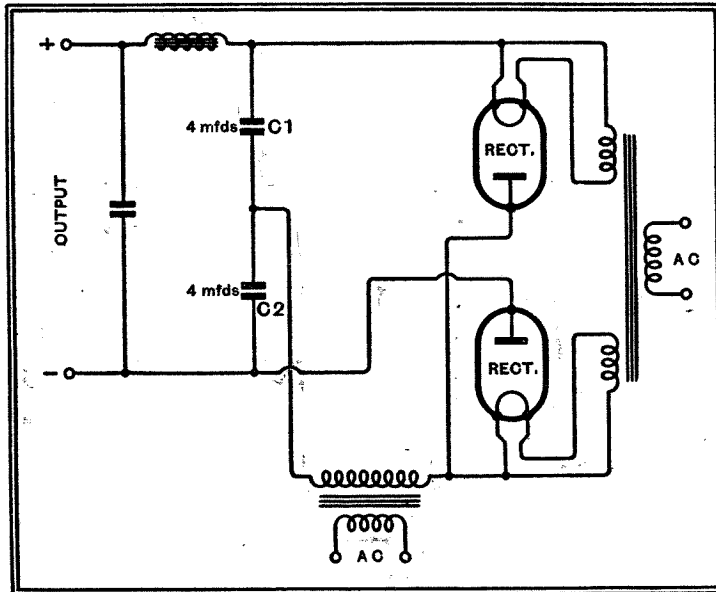


Fig. 3. A voltage-doubling circuit giving full-wave rectification.

equipments, where large heat-shielded cathodes are found in the rectifiers, the initial heating requires some thirty minutes!

The circuit of Fig. 2 shows a small resistance in the anode lead of each valve. This is an important component in some installations, as, with the application of HT a surge will flow through the smoothing condensers during the period of initial charging and may represent an instantaneous short circuit unless some resistance is present. A similar action might be experienced at each half cycle if the rectifier is working under a fairly heavy load, so that the rectifier's output is more of the nature of a series of sharp pulses and imitates the effect obtained when an HT battery is suddenly connected to an uncharged condenser.

**Suppressor Resistances**

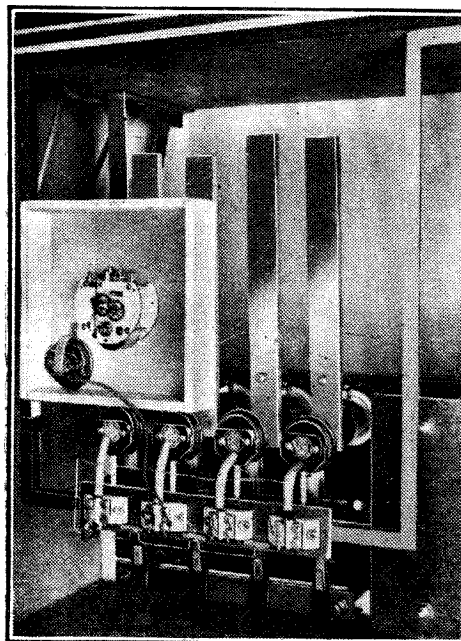
When operating a radio receiver such a power unit may cause severe interference unless the anode resistances are used in the rectifiers. Quite low values of resistance will be found to produce quiet operation, and 25 ohms will usually be ample, and still sufficiently low to cause no serious regulation troubles in the output voltage.

A very useful and interesting rectification circuit, yet one which has not found great favour on account of its poor regulation characteristics, is the voltage doubling arrangement using two separate valves. In this arrangement, outlined in Fig. 3, two condensers are connected in series and alternately charged on each half cycle, the DC load being connected to their outer terminals.

The effectiveness of this arrangement is controlled by the ability of the rectifier to fully charge each condenser under various loads, and the low impedance of the mercury vapour tube makes this possible.

DC output has a voltage at any instant given by the sum of the voltages to which the condensers are charged. Suppose the load to be adjusted so that at the instant C2 receives it full charge C1 is drained to half charge; it is evident that the next half cycle will not find C1 drained completely, as this is when its charge cycle begins and C2 begins to drain. In this condition the ripple will be that due to variations between full voltage and three-fourths full voltage, whereas a bi-phase circuit would have fluctuations between full voltage and half full voltage.

**When Leipzig Stands By**



The interval signal at Leipzig is of the electro-magnetic type and consists of a four-note chime.

**Random Radiations**

By "DIALLIST"

**Smart Work**

ONE of the quickest bits of police work with the aid of wireless took place during the Easter holidays. The Brighton headquarters police, who are thorough believers in radio as an aid, received a message from London at 3.5 p.m. that a motor bicycle had been taken away without authority and was last seen proceeding in the direction of Brighton. The message sent out from Brighton Headquarters was picked up by a constable on his beat, and exactly an hour and a quarter after the communication from London he spotted the machine in question and an arrest was made. This is the second time within a week or so that Brighton police radio has been in the news. On the first occasion it led to the arrest of a burglar who was actually given three years at the Quarter Sessions within eighteen hours of indulging in a little housebreaking. Pretty good work!

**Europe's Listeners**

THE charts recently published by the International Broadcasting Union which show the totals of licensed listeners in European countries at the end of 1935, and the percentage increase or decrease during the previous twelve months, reveal many interesting facts. In only three countries—Great Britain, Germany and France—does the total exceed the million mark, though Holland, Sweden and Czechoslovakia are not very far short of it. Perhaps the most surprising figures are those for Italy, which has now a pretty extensive broadcasting service. The fourteen Italian stations at present in operation include two of 50-kilowatts, two of 20-kilowatts, two of 10-kilowatts, and eight of smaller power, only one of which (Turin No. 2) is rated at less than 1-kilowatt. Yet there are only 530,000 receiving licences in force. France, though her receiving licences now number over two and a half millions, has not so far shown the enthusiasm for broadcasting that might have been expected. The Eiffel Tower was the first station, certainly in Europe, and, I believe, in the world to transmit regular programmes, and under the nearly completed Ferrié scheme France has a splendid array of Government stations as well as a good many that are privately owned. She rejoices also in excellent anti-interference laws. In view of all this and of the fact that France is remarkably prosperous, how is it that the proportion of licensed listeners to the population is so small?

**Germany Catching Up**

At the end of 1934 this country had a long lead over Germany in the matter of wireless licences, but on December 31st, 1935, this had been reduced to only a little over 200,000. The actual figures were Great Britain, 7,403,109; Germany, 7,192,952. During the year the percentage increase in Germany was rather more than 17, and that in Great Britain just over 9. Should these rates be maintained Germany will soon deprive us of the proud title of

the most wireless-minded country in Europe. Actually, at the beginning of March our lead had been reduced to a little under 50,000. The reason for Germany's big increase is quite possibly to be found in the growth of her high-powered stations, all of which, with their anti-fading aeri-als, have very large service areas. If all of the B.B.C. Regionals could go up to 100 kilowatts there would probably be a big jump in our own figures.

### Radiolympia

AS I write it is still undecided whether this year's Radio Exhibition at Olympia is to be held from August 19th to 29th or August 26th to September 5th. I hope that the later period will be chosen, and I hear that there is strong support for it in the wireless industry. I have always been against mid-August exhibitions for a good many reasons. Chief of these is that so many people have, willy nilly, to take their holidays during August and are therefore prevented from coming to Olympia. I can't help feeling that the ideal dates would be during the first fortnight of September, for people would then mostly have returned from holiday-making, whilst boys and girls, who are amongst the keenest of wireless enthusiasts, would not have returned to school. Failing the first half of September, I would like to see the Exhibition held in May or June. The old idea that there is a wireless season which begins with the ending of British Summer Time and more or less ends when we put our clocks forward in April still persists, though the truth of the matter is that wireless is an all-the-year-round pastime nowadays. There is, of course, more listening done in the winter time, when everyone spends longer hours at home, but there are few houses in which considerable use is not made of the wireless set right through the summer. In recent years a good many firms have taken to bringing out new models long before the Exhibition, and this policy has evidently been successful since they continue to work on the same lines.

### An Old Ramp Revived

IN the queer old days, when the chief kind of man-made interference that we knew was the squeal due to a neighbour's oscillating receiver ("A considerable amount of interference is reported in the neighbourhood of the High Street, Muggleton. Will listeners living in that area please look to their sets?" Do you remember?), in those days there were sharks who made house-to-house calls, carefully choosing a time when paterfamilias was absent, and reaped no bad harvest. Their method was to say that they had been sent by the Post Office to investigate complaints of oscillation and to demand to be allowed to examine the receiving set. When permitted to do so, they announced that it contained an illegal circuit and that they were authorised to remove it for alteration. Hundreds of sets were stolen in this way.

The up-to-date method is an ingenious adaptation of the old scheme. Nowadays the crook, who may be wearing some kind of uniform cap, states that he is acting for either the G.P.O. or the B.B.C. and asks to see the wireless receiving licence. If it is produced he moves on, but if there isn't one, or if it can't be found, he announces sternly that his orders are to confiscate the receiving set and that it had better be handed over forthwith if serious trouble is

to be avoided. Needless to say, it is never seen again by its owner. I have no sympathy with unlicensed victims of this ramp; they deserve all that they get. But it has been worked successfully on households where the receiving licence could not be found at the moment. Hence, it is best to make it quite clear to yours that neither B.B.C. nor G.P.O. officials have any right to remove a set, and that the latter, at any rate, carry with them a card proving their identity.

### Bedtime at Ten

ARE the possessors of loud loud speakers becoming more considerate? Or has the error of their ways been brought home to them by the installation by their friends and neighbours of sets also capable of great volume, thus making reprisals possible? From several sources I hear that it is now becoming customary for sets to be switched off—or at any rate turned right down—shortly after ten p.m. The records of the relay companies show the same thing. As soon as Nationals and Regionals have finished their second news bulletin, or news summary, as the case may be, the load falls steeply away.

That is probably why there is now a big demand for Henry Hall and other dance band leaders to appear more often in the main evening programmes before 10 p.m. If you like dance music, it's not much fun having the best of it broadcast at times when you can't listen.

### "The Indian Listener"

I HAVE just received a copy of "The Indian Listener," the official organ of the Indian State Broadcasting Service. This is a newcomer amongst radio papers since its first issue was published in January. As there are only three Indian State stations

in operation at the moment its detailed programmes don't cover many pages, but they will require a good deal more space as time goes on and a full broadcasting service is developed in that huge country. The stations now at work are Delhi on 340.136 metres, Bombay on 350.9, and Calcutta on 370.4. Bombay also transmits on 31.36 metres and Calcutta on 49.10. On weekdays the programmes run from midday to 11 p.m. with an interval from 2.30 to 5.30 or 6 p.m. The hours are of course Indian Standard Time, which is 5½ hours ahead of Greenwich. So far I have not heard that anyone has recorded direct reception on the medium waves of any of these stations, though Delhi at any rate has a 20-kilowatt plant. All three stations, however, are received well over a large part of India. Where stations are few and far between it is surprising what distances can be spanned with comparatively small power.

### Lost Opportunities

A glance through the advertisement pages of "The Indian Listener" shows that only a few British manufacturers realise the possibilities of the Indian market. India's population is very nearly equal to that of the whole of Europe, and there is already a big demand for sets of the right type. American and other manufacturers are quite alive to this fact, and unless our people wake up they may find that they have lost great opportunities. What is required in India, as in many other parts of the Empire, is an all-wave set of the superheterodyne type, preferably with a high-frequency amplifying stage. There is a demand both for mains and battery models of good performance. The market for mains sets is a growing one owing to the rapid strides that are being made in many parts of India with electricity supply schemes.

## Letters to the Editor

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

### The Little Nationals

MR. P. G. A. H. VOIGT'S letter in your issue of April 3rd is interesting, but such inherent quality as may be present in the transmissions of the Little Nationals is, I am afraid, only of advantage to those listeners who live very close to one of these stations.

Since the change over to the common wavelength it has been impossible to listen to North National in the Liverpool district for any length of time without distortion and fading, due presumably to interference phenomena between the signals from all the Little Nationals. Upon switching over to Droitwich one gets the impression of considerably better quality and infinitely greater pleasure in listening.

Prior to the advent of the common wavelength the quality and signal strength of North National were consistently good.

Liverpool. T. A. LEDWARD.

### Old Sets in Use

RECENTLY one of your contributors remarked upon old sets in regular use.

The only set I have had, and that in regular use since autumn, 1927, is a *Wireless World* "Everyman III" made by myself.

The original 2-volt valves are still in use. About five years ago I added a metal rectifier HT unit. In May, 1933, lightning burnt out the aerial aperiodic coil and the HT fuses, even though I use the bell-wire system as an aerial.

I get the two London programmes, and these cover all my requirements, on the original loud speaker. W. E. WARREN, Surrey.

### Twenty-five Years

I WAS very interested to read that *The Wireless World* celebrates twenty-five years of publication this month, and on behalf of the staff of "The Irish Radio News" would like to extend our hearty congratulations for the occasion.

JAMES KITCHEN, Editor.

YOU will have, undoubtedly, received a great number of congratulatory messages on *The Wireless World* attaining its Silver Jubilee, and it is with extreme pleasure that I add my voice to the general acclamation.

I am sure that others will attempt to assess the considerable progress in radio science attributable to the efforts of your journal,



as this happy occasion provides an opportunity for anyone desiring to wax historical, and equally for those bold people who want to prognosticate. I prefer, however, merely to say that among the present-day technical radio publications of the world your journal is one of the select group that are really worth reading.

Its timely and stimulating Editorial Comments, its practical designs incorporating the latest innovations, its critical and trustworthy Test Reviews of Sets and Components, and its valuable Correspondence Columns are several of the features that combine to make *The Wireless World* a *sine qua non* for the professional engineer and enthusiastic amateur. With all good wishes for the "years to come." DONALD W. ALDOUS.

Ilford, Essex.

### Short-wave Reception

I WOULD like to report reception of the following stations working on 40 metres. My set is a Philco All-Wave Empire 5, and this "bag" of stations represents my first and second attempts at station searching on the short waves:

**First attempt, Friday, April 3rd.**  
G5ML Kenilworth, time 19.45. 14.88 mc/s.  
W3XAL Bound Brook.  
W8XK Pittsburgh.

**Second attempt, Sunday, April 5th.**  
Times between 10.15 a.m. and 11.11 a.m.

	Mc/s.		Mc/s.
G6OS Hull.	7.1 approx.	G6UI	7.2
G5GS	7.27	G5UI	
G2LC Essex.		G6MD	
G5TD	7.3	G2NH	
G6QB Croydon.	7.13	G6MN	7.18
G5GD		G5CP	
G2BH Barnsley.		G5WR	7.21
G6UF			

All received at fair loud speaker strength. Also two French stations at approximately 7.08 and 7.26 Mc/s, the former broadcasting a song from "Carmen."

I trust you will be able to print this letter, and should any of the amateurs above-mentioned read it perhaps they will send me a QSL card. I should also be very pleased to hear from any reader in Birmingham who could introduce me to a radio club.

DONALD F. DEAKIN.

110, Billesley Lane,  
Moseley, Birmingham.

### Hill and Dale

I WAS much interested in your recent editorial reference to the great advantages of hill-and-dale recording. It is greatly to be pitied that Edison's method of recording was ever abandoned, as month by month the tonal quality of records (to which, under the present system, no improvements can now be made) is made poorer by comparison with the extending response of wireless receivers.

Can it be that the gramophone companies, alarmed by the fall in the sale of records and by the growing popularity of wireless, and fearing the "expense" and inconvenience of any change in the method of recording, have decided gradually to abandon records in favour of wireless manufacture? Their apathy in this matter certainly seems to point that way.

One of your correspondents suggests the hill-and-dale recording for the subscription societies, but this seems unwarrantably conservative. Since Columbia already issue special recordings, *i.e.*, "talkie" discs revolving at 33 r.p.m., and H.M.V. special effects records for which the sale must be very limited, surely they could issue vertical recordings as alternative, "high-fidelity"

versions of the latest releases, gradually ousting the present obsolete system as the other's advantages became known? They cannot plead expense, as the new system entails no radical change in pressing, etc., and the "talkie" discs are just as difficult to produce. "High-fidelity" sound-boxes for acoustic gramophones, and moving-coil or crystal pick-ups for radio-grams, could easily be marketed through that world-wide organisation which is the boast of the gramophone combines. C. T. KILLICK.

London, S.W.4.

### Radio Set Testers

MANY of the radio set testers now on the market are supplied with adaptors and multi-core flexible cable for testing valves while they are in the receiver. Owing no doubt to the capacity of the flex, when these are used the set very often becomes unstable, rendering the readings obtained useless.

"As every schoolboy knows" when he makes his first battery set, if you twist the anode and grid leads together the set will very likely become unstable. So while valve manufacturers are taking every precaution to reduce grid anode capacity to a minimum, the instrument makers are supplying test leads, running anode and grid leads side by side.

For one set tester it is claimed that, by

the leads from one pin to another, but the set will probably remain stable and the readings undisturbed, which is worth considering.

H. ELLIOT.

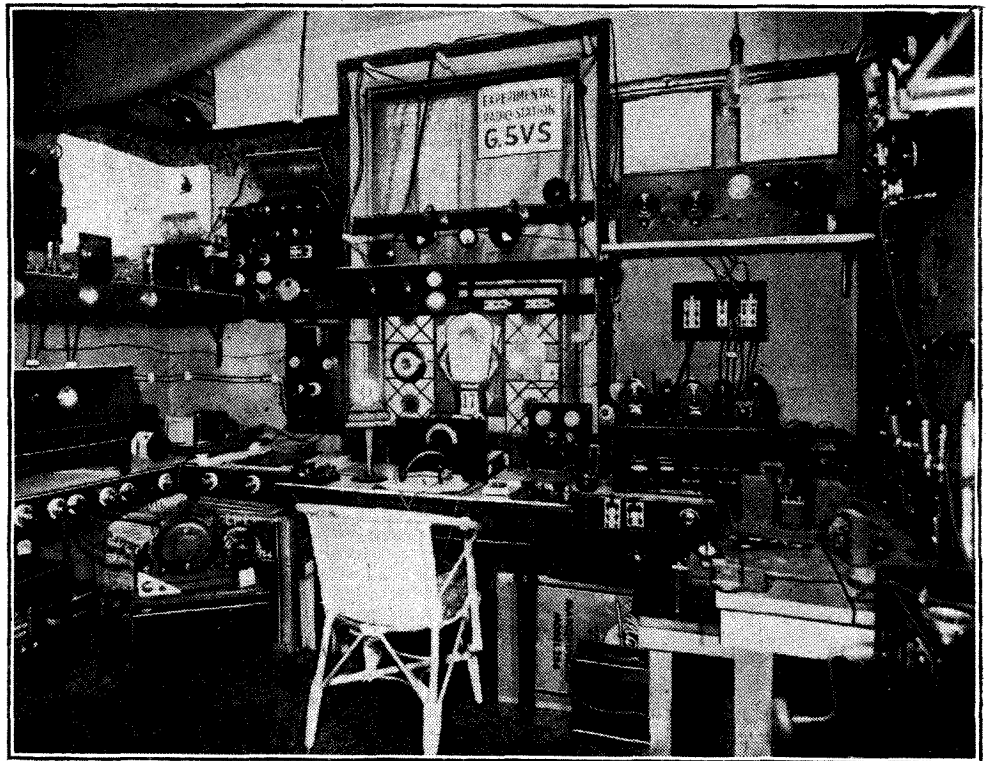
Harrow, Middlesex.

### A Southend Amateur Station

AN unusually ambitious amateur radio installation is that of Mr. Victor A. Sims (G5VS), of 14, Kilworth Avenue, Southend-on-Sea, and the photograph gives a very good idea of the general layout.

The transmitter, which is on the left, consists of crystal oscillator, first and second frequency doublers and power amplifier using the following valves: DE5B, LS5B, LS5B and P650. Battery grid bias is employed. Keying is effected by breaking the negative grid bias feeds to both the second frequency doubler and the power amplifier. Underneath and to the right is the speech amplifier giving an undistorted output of 25 watts. To the right of this is the power pack, feeding both transmitter and speech amplifier and consisting of a 500-0-500 transformer and a Tungram full-wave rectifier followed by two 4 mfd. 750 tested T.C.C. smoothing condensers. Next can be seen the distribution panel.

The aerial system is the well-known "Zepp" fed antenna, the "dummy" being dropped for transmission on 1.7 Mc/s.



STATION G5VS, owned and operated by Mr. Victor Sims, Southend-on-Sea.

the touch of a switch, the meter can be put into any part of the valve circuit. But what is the use of the reading when the set is in a state of abnormal oscillation?

One maker of high-grade test gear, when tackled on the subject at Olympia last year, admitted, after a long dissertation on the ease and simplicity of application of his adaptors, that they were useless for HF valves.

The split-pin adaptor with a break in each pin to include the meter in the circuit is hard to beat. Grids and anodes are never tapped together. It means more work and expenditure of time for the user in shifting

The short-wave receiver comprises a screen grid valve as detector and a steep slope Pentode with high amplification as the output valve. To the right of the table is the eliminator gear for the 1.7 Mc/s receiver, and the broadcast receiver on the shelf above. On the floor to the left can be seen the gramophone turntable and a B.T.H. generator which, however, is not now used, the mains supply having recently been changed over to 230-volt 50 cycle AC.

Mr. Sims extends an invitation to enthusiasts who may find themselves in Southend to visit the station.

# Recent Inventions

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

## MIRROR-DRUMS FOR SCANNING

A MIRROR drum in the form of a truncated cone is fitted with a series of reflectors arranged so as to mark out two or more different spiral and continuous tracks. An aperture is provided for defining the size of the scanning spot, and a selecting device is interposed in the optical path between the mirror drum and the aperture, so that the different tracks can be combined for interlaced scanning. The track of the light spot across the scanning surface is kept substantially rectilinear.

J. C. Wilson and Baird Television, Ltd. Application date July 26th, 1934. No. 441410.

## FLUORESCENT SCREENS

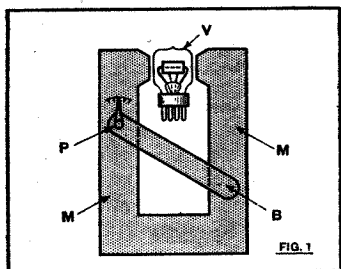
AS the fluorescent screen of a cathode-ray tube is bombarded by the electron stream it is liable to build up an electric charge which tends to deflect the oncoming electrons, thereby giving rise to distortion. This can be prevented, for instance, by so constructing the screen that it readily emits secondary electrons, and so maintains a more or less constant potential. But then auxiliary electrodes must be provided to collect and draw off the electrons so emitted.

According to the invention a very thin layer of metal is incorporated with the fluorescent material of which the screen is made, and this acts as a conductor. The layer must obviously be made extremely thin; otherwise it will not be transparent, and some of the fluorescent light will be lost. Actually, a wire of molybdenum is volatilized by heat, and a coating of metal, approximately two atoms thick, is deposited from the vapour upon a sheet of glass, which is then used as a "carrier" for the fluorescent materials forming the screen.

N. V. Philips' Gloeilampen-Fabrieken. Convention date (Germany) August 4th, 1934. No. 441813.

## MAGNETRON CIRCUITS

THE split-anode type of magnetron valve has recently come into prominence as a generator of ultra-short waves.



Magnetic field controlled by a shorting bar or—

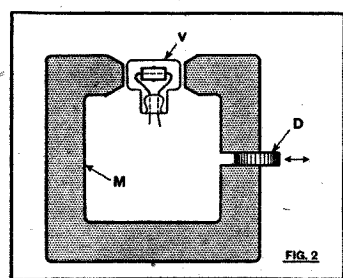
In operation the valve is located in a strong magnetic field, which controls the passage of the electron stream across the electrodes. The production of the field requires a fairly heavy consumption

## Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section.

of power, and is therefore generally drawn from the mains.

For a portable outfit a permanent magnet can be used, but it is then necessary to be able to adjust the strength of the control field, since this is a critical factor in the production of oscillations of a given wavelength.

As shown in Fig. 1, a magnetron valve V is located between the pole-pieces of a permanent magnet M, and the field across the gap is controlled by means of an iron bar B, which is pivoted at P, so that it can be swung up or down to form a variable shunt. Fig. 2 shows an alternative arrangement in which a disc D of iron is moved



—by a variable reluctance.

in or out of a gap formed in one of the limbs of the magnet so as to act as a variable reluctance in series with the main magnetic circuit.

Telefunken Ges. für drahtlose Telegraphie m.b.h. Convention dates (Germany) February 23rd and July 5th, 1934. No. 441740.

## FREQUENCY-MODULATED SIGNALS

FREQUENCY - MODULATED signals are received on an input circuit which comprises, first, a substantially pure resistance having constant impedance but a rapidly varying phase-angle, over the frequency range involved. In series with this is a parallel-tuned circuit of inductance and capacity having constant impedance and phase-angle over the same range of frequencies. The frequency modulations are thus converted into amplitude modulations, and are fed in this form to a rectifying valve.

Marconi's Wireless Telegraph Co., Ltd. (Assignees of J. W. Conklin). Convention date (U.S.A.) March 23rd, 1934. No. 441591.

## TELEVISION

THE synchronising impulses are transmitted on the same carrier-wave as the picture signals. At the transmitter a constant positive bias is applied to the modulator during the whole of the time that picture signals are present, but as soon as the synchronising impulses are formed the bias is lowered to a constant and definite value. The process is repeated for each line and frame. The method ensures a "dark

fly-back" for the spot on the fluorescent screen, and also lends itself to the control of fading.

Radio-Akt D. S. Loewe. Convention date (Germany) May 19th, 1933. No. 441761.

## TRANSMITTING AERIALS

THE aerial is a self-supporting tower structure which acts as a radiator and is insulated at the base. In order to increase its radiating efficiency, and to reduce ground losses, a wire screen is inserted between the mast structure and the supporting insulators. This operates with a second screen which is placed below the insulators and earthed, so as to form a large condenser. This is stated to prevent the formation of an intense electrostatic field on the surface of the ground.

C. E. Schuler (assignor to International-Stacey Corporation). No. 2008931 (U.S.A.).

## CRYSTAL-CONTROLLED VALVES

WHEN a piezo-electric crystal is used to stabilise the frequency of a valve used, say, as the master oscillator of a wireless transmitter, the natural or fundamental frequency of the crystal is to some extent vitiated by the effect of the inherent capacity across the crystal electrodes. In order to overcome this difficulty, and to identify the crystal frequency more exactly with that of the valve oscillator, a small inductance is inserted in series with the crystal of a valve such as to resonate with the electrode capacity.

J. K. Clapp (assignor to General Radio Co.) No. 2012497 (U.S.A.).

## SELENIUM CELL AMPLIFIERS

THE response of a selenium cell used to reproduce sound records tends to fall off at the higher frequencies. In order to offset this the coupling transformer in a subsequent stage of valve amplification is made of relatively low inductance and with a rising frequency characteristic. In addition the primary winding is shunted by a series circuit which attenuates the middle frequencies. The combination gives a substantially flat response curve over practically the whole of the audible range.

H. G. Tasker (Assignor to United Research Corporation). No. 2004253 (U.S.A.).

## PRE-SELECTOR COUPLINGS

WHEN a highly selective circuit is inserted between the aerial and the first HF stage of a wireless receiver, the effective resistance of the coupling generally rises as the signal frequency increases, and this militates against its efficiency in cutting-out undesired signals.

According to the invention the difficulty is overcome by using a screened-grid input valve, which is so connected that it acts as a negative resistance, by dynatron action. The valve is adjusted just short of the oscillating point, and, being in shunt with the tuned coupling, it tends to reduce the damping resistance at high frequencies.

W. F. Curtis. No. 2013650 (U.S.A.).

## SHORT-WAVE SIGNALLING

ULTRA-SHORT wave oscillations are produced by the Barkhausen-Kurz method of applying a high positive voltage to the grid of a triode valve, the anode of which is kept substantially at the same potential as the cathode. Signals are then superposed by causing low-frequency currents to vary either the strength or direction of a magnetic field produced in the interior of the valve by windings mounted outside the glass bulb.

W. Weihe (Assignor to Telefunken Ges. für drahtlose Telegraphie m.b.h.). No. 2013773 (U.S.A.).

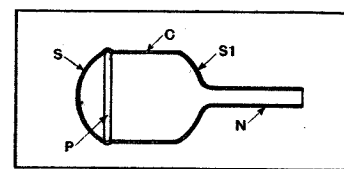
## MUTING CIRCUITS

A SERIES resistance is inserted in the anode circuit of a high-frequency pentode so that its amplification factor first rises rapidly, and then falls off. The rising part of the curve is used, through the resistance, to mute the valve automatically. This cuts out inter-station noise, when tuning, until a worth-while signal arrives to trigger the valve back into action.

L. E. Barton (Assignor to Radio Corporation of America). No. 2010252 (U.S.A.).

## CATHODE-RAY TUBES

A DEFECT of the ordinary cathode-ray tube is that the glass bulb is subjected to severe tensile strains, both at the centre



Reinforced bulb for cathode-ray tube.

as well as along the line of connection between the bottom of the bulb and the main body. This weakness is particularly noticeable in large tubes built for receiving television pictures.

According to the invention the bulb is shaped, as shown in the drawing, so that there is a neck portion N containing the electrode system, joined to a cylindrical portion C with spherical ends S, S<sub>1</sub>. The fluorescent screen is held in position by means of a pressing P. This construction is stated to distribute the strains, so that there is no risk of tube collapse or "implosion."

Radio-Akt D. S. Loewe. Convention date (Germany) July 10th, 1933. No. 442519.