THE PERMA-TUNED TWO—See page 140

Practical Wireless
and
PRACTICAL TELEVISION

Contents

Amateur Receiver Design
New Ideas for the Constructor
Thermion's Commentary
Negative Feedback
Factory Production Methods
Making Simple Superhets
Three-range S.W. Coil
Noise Suppression
Readers' Letters
Permeability Tuning

—Radio Engineers are at a premium to-day! Equip yourself for a good job by studying:

PRACTICAL WIRELESS SERVICE MANUAL

By F. J. CAMM.

A Complete, Practical and Up-to-date Work on the Testing of all Types of Wireless Receivers. 288 PAGES and OVER 220 PHOTOGRAPHS, DIAGRAMS and PLANS.

From all Booksellers 6/6 or by post 6/6 direct from the Publishers, George Newnes, Ltd. (Book Dept.), Tower House, Southampton Street, London, W.C.2.
The Universal Avomioir and the D.C. Avomior put within the reach of the serious amateur a means of rapid precision testing of an accuracy unobtainable with other instruments in their class. Their simplicity and versatility make short work of all the normal trouble-tracking problems. They are worthy members of a range of "AVO" Instruments renowned for their high standard of workmanship and efficiency.

**THE UNIVERSAL AVOMINOR**

**ELECTRICAL MEASURING INSTRUMENT**

- 23 Ranges of Direct Readings
- D.C. Volts, A.C. Volts, Milliamperes

<table>
<thead>
<tr>
<th>D.C. Voltages</th>
<th>A.C. Voltages</th>
<th>Milliamperes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 volts</td>
<td>0-5 volts</td>
<td>0-25</td>
</tr>
<tr>
<td>0-25</td>
<td>0-100</td>
<td>0-5</td>
</tr>
<tr>
<td>0-500</td>
<td>0-500</td>
<td>0-100</td>
</tr>
<tr>
<td>0-500</td>
<td>0-500</td>
<td>0-500</td>
</tr>
</tbody>
</table>

**The Universal Avomioir**

- 23 Meters in ONE

<table>
<thead>
<tr>
<th>Current</th>
<th>Voltage</th>
<th>Resistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milliamperes</td>
<td>ohms</td>
<td>ohms</td>
</tr>
<tr>
<td>0-30</td>
<td>0-18</td>
<td>0-10,000</td>
</tr>
<tr>
<td>0-500</td>
<td>0-12</td>
<td>0-100</td>
</tr>
<tr>
<td>0-1,200</td>
<td>0-1,500</td>
<td>0-1,200,000</td>
</tr>
<tr>
<td>0-2,400</td>
<td>0-3,000</td>
<td>0-3,000</td>
</tr>
<tr>
<td>0-6,000</td>
<td>0-6,000</td>
<td>0-6,000</td>
</tr>
</tbody>
</table>

**The D.C. Avomioir**

- Complete with instruction booklet, leads, interchangeable crocodile clips and testing prods.

**Please send details of Trophy Instruments**

Name: ____________________________

Address: __________________________

---

ROAMING THE WORLD WITH AN ALL-BRITISH TROPHY

WORLD LISTENING PROVIDES A NEVER ENDING SOURCE OF INTEREST AND ENTERTAINMENT IN THESE HISTORIC TIMES

THE TROPHY IS

SPECIALLY DESIGNED FOR

ALL-WORLD RECEPTION.

EXTREMELY SIMPLE TO OPERATE.

BOTH MODELS CAN BE ADAPTED TO OPERATE FROM BATTERY CURRENT.

SEND FOR DETAILS.

**TROPHY 8-VALVE A.C.**

A Super Receiver With Amazing Range.

- 7-550 metres continuous.
- 5 Wavebands.
- Solo Knob Bandspread Tuning.
- Attractive Cabinet.

**£18 : 3 : 11**

Matched Cabinet Speaker. £2/16/6

PETO SCOTT CO. LTD. (Dept. P8) 77, CITY ROAD, LONDON, E.C.

PHONE: CLERKENWELL 5911.

---

**TROPHY 6-VALVE A.C.**

Represents Unbeatable Value.

- 10-545 metres continuous.
- 4 Wavebands.
- Independent Bandspread Dial.
- Pitch Control

**£14 : 0 : 8**

Including Built-in Speaker

---

**TROUBLED TRACKING SIMPLIFIED**

**Avo**

Reg. Trade Mark

**ELECTRICAL MEASURING INSTRUMENTS**

The Universal Avomioir and the D.C. Avomioir put within the reach of the serious amateur a means of rapid precision testing of an accuracy unobtainable with other instruments in their class. Their simplicity and versatility make short work of all the normal trouble-tracking problems. They are worthy members of a range of "AVO" Instruments renowned for their high standard of workmanship and efficiency.

---

ROAMING THE WORLD WITH AN ALL-BRITISH TROPHY

WORLD LISTENING PROVIDES A NEVER ENDING SOURCE OF INTEREST AND ENTERTAINMENT IN THESE HISTORIC TIMES

THE TROPHY IS

SPECIALLY DESIGNED FOR

ALL-WORLD RECEPTION.

EXTREMELY SIMPLE TO OPERATE.

BOTH MODELS CAN BE ADAPTED TO OPERATE FROM BATTERY CURRENT.

SEND FOR DETAILS.

**TROPHY 8-VALVE A.C.**

A Super Receiver With Amazing Range.

- 7-550 metres continuous.
- 5 Wavebands.
- Solo Knob Bandspread Tuning.
- Attractive Cabinet.

**£18 : 3 : 11**

Matched Cabinet Speaker. £2/16/6

PETO SCOTT CO. LTD. (Dept. P8) 77, CITY ROAD, LONDON, E.C.

PHONE: CLERKENWELL 5911.
The "Fluxite Quins" at Work.

"There's a mouse in the wireless." "Oh, pleaded. "It's squealing!" "Do you hear that?" -'d LADIES. "See that FLUXITE is Explained OH "and It's squealing!" -to her aid the lads speeded. "There's a mouse in the wireless." "Write for Free Book on the art of "soft" soldering and ask for the "Fluxite Gun." The FLUXITE GUN is always ready to put Fluxite on the soldering job instantly. A little flux has to be found in the right spot and one charging lasts for ages. Price 1/6, or filled 2/6.

Write for Free Book on the art of "soft" soldering and ask for leaflet on "Flexicore" for TV and radio work; and ask for "FLUXITE" but IMPORTANT.

Details of our range of products are contained in 128 pp. Catalogue No. 163, price 6d. post free. (stamps accepted). Which is the best selection in the United Kingdom from which to choose.

THANK YOU!

Full details of our range of products are contained in 128 pp. Catalogue No. 163, price 6d. post free. (stamps accepted). Which is the best selection in the United Kingdom from which to choose.

DOMESTIC ELECTRICAL GOODS

MORPHY RICHARDS FROM, Auto-...control Safety Model, post 1/6...MORPHY RICHARDS FRIES—Tubular Major, 1 kW...Tubular Twin Beam, 1 or 2 kW...Crest Twin Beam, 1 or 2 kW...Sealer Twin Beam, 1 or 2 kW...ORMOND HAIR DRYER...STUART-TURNER AC/DC CENTRIFUGAL PUMPS—A first-class job made for continuous running. (As used on the Queen Mary.) Ideal for A.R.P. Shelters...No. 10, 100 gals. per hour...No. 11, 250 gals. per hour...No. 12, 500 gals. per hour...Foot valve and strainer 12/6 and 15/6 extra. (When water has to be heated.

CLOCKS, WATCHES, &c.

ACURATE TIMEKEEPERS WITH TUNEFUL CHIMES

These 9-day clocks, with movements of heavy gauge steel, chosen the quarters, half, three-quarters and hour. The Triple Chime Models have three distinct and separate sets of chimes. Westminster—Rolls Razors, Ltd., London. (Write for complete watch and clock list.)

TRIPPLE CHIMES—A few only are available at &c.

GENTS' HIGH-GRADE 15-JEWELL CHROME WATCHES, Swiss movement...LADIES' HIGH-GRADE 15-JEWELL Watch Movement WRIST WATCHES, Swiss movement...LADIES' MINIATURE, same movement as above quality, Chrome...VICEROY NON-ELECTRIC SHAVERS (made by Rolls-Royce, Ltd.), a welcome present for the Services...REMINGTON RAND AC ELECTRIC SHAVERS...REJUVENATE YOUR SHAVEMASTER by filling in form &c. to order...LONDON RADIO SUPPLY CO., Established 1918.

Advent of A. F. BULGIN & Co., Ltd., BYE PASS ROAD, BARKING. Tel. RIPLEY 3474 (4 lines)
**PREMIER HIGH FIDELITY AMPLIFIER KITS**

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

- **Kit of Parts and Wired Chassis with Valves Tested**
  - 4-watt A.C. Amplifier
  - 4-watt A.C.I.D.C.
  - 4-watt A.C.L.D.C.
  - 8-watt A.C.I.D.C.
  - 15-watt A.C.L.D.C.

- **Black Crackle Steel Cabinets** 176 extra.

**PREMIER SMOOTHING CHOKE**

<table>
<thead>
<tr>
<th>Type</th>
<th>Current</th>
<th>Henrys</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.40/50</td>
<td>40 m.A.</td>
<td>20 H.</td>
<td>£0.50</td>
</tr>
<tr>
<td>C.40/180</td>
<td>40 m.A.</td>
<td>8 H.</td>
<td>£0.50/</td>
</tr>
<tr>
<td>C.40/600</td>
<td>40 m.A.</td>
<td>2-3 H.</td>
<td>£0.10/</td>
</tr>
<tr>
<td>C.60/150</td>
<td>60 m.A.</td>
<td>20 H.</td>
<td>£0.10/</td>
</tr>
<tr>
<td>C.60/180</td>
<td>60 m.A.</td>
<td>20-34 H.</td>
<td>£0.30/</td>
</tr>
<tr>
<td>C.60/500</td>
<td>60 m.A.</td>
<td>20 H.</td>
<td>£0.12/</td>
</tr>
<tr>
<td>C.60/500</td>
<td>60 m.A.</td>
<td>25 H.</td>
<td>£0.15/</td>
</tr>
</tbody>
</table>

- **Speaker Field Replacement** 25,000 7/6.

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

- **Premier Morse Practice Key on Bakelite Base and Brass Movements** 3/3
- **General Purpose Morse Key** 5/10
- **Heavy Duty TX Key on Cast Base** 7/0
- **Bakelite Buzzers** 2/-
- **3 Henry Chokes** 7/6

**MATCHED UNIVERSE OUTPUT TRANSFORMERS**

- **Auto Transformers.** Step up or down, 100-125 v. to 200, 230 or 250 v. A.C., 60 watts, 911; 125 watts, 1,816.
- **L.T. Transformers.** All C.T.
- **4 v. 2-3 a.** 9/11 6.3 v. 2-3 a.
- **25 v. 1-2 a.** 9/11 7.5 v. 1-2 a.
- **5 v. 1-2 a.** 9/11 12 v. 1-2 a.
- **Push-Pull Transformer Drivers** 1/6

**EMERGED MODELS**

- Flexo 8 in., 175 ohm field, 7/16 G. 12 energised, 2,500 field, 63/-; 100 B.T.H. 1,600 ohm field, less transformer, 11/6.

**MOBILE COIL SPEAKERS**

- **All complete with transformers.** Rola 6-in., 18/-; 8-in. P.M.A., 17/6; 10-in. P.M.A., 22/6.

**PREMIER SHORT-WAVE KITS**

- Incorporating the Premier 3-Band S.W. Coil, 11-16 Meters without coil changing. Each kit is complete with all components, diagrams and 2 Valve Kits. 3-Band S.W. 2-Valve Kit, 14/9.

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

- In response to many requests we have now produced an A.C. version of the popular Premier Short Wave SG 3 Kit. Circuit: Pentode H.F. Stage, Pentode Detector, Beam Power Output, and F.W. Rectifier, 100-250 v. A.C. Operation, Bulit-in Power Pack, Humfree operation. For use with Phones or P.M. Speaker.
- Complete Kit of Parts with drilled chassis all components. Plug-in Coils covering 12-170 metres, 4 valves and full instructions and circuits.

**MATCHMAKER UNIVERSAL**

- **6.3 v. 2 a.** 6.3 v. 2 a...
- **350-350 v. 150 m.a.** 350-350 v. 100 m.a., 5 v. 2 a, 151...
- **350-350 v. 100 m.a.** 350-350 v. 100 m.a., 5 v. 2 a, 151...
- **350-350 v. 50 m.a.** 350-350 v. 50 m.a., 2 v. 2 a, 151...
- **350-350 v. 100 m.a.** 350-350 v. 100 m.a., 5 v. 2 a, 151...
- **350-350 v. 50 m.a.** 350-350 v. 50 m.a., 2 v. 2 a, 151...

- **Speaker Placement** 22-47, 41-94, 73-170 metres, 2/- each, with circuit. 3-Band 3-Watt Receiver. £4 each, 513.

- **4-or 6-pin Coil Formers.** Plain or Thready, 7/6 each.

**AMERICAN VALVES**

- We hold stocks of all types at competitive prices.

**SHORT-WAVE CONDENSERS**

- Trolitoll Insulation. Certified superior to ceramic. All-brass construction. Easily gained.

**MULTIPLEX SHORT-WAVE KITS**

- **2613 151-** 631- ;
- **291 -** 631- ;
- **22-47, 41-94, 73-170 metres, 2/- each, with circuit. 3-Band S.W. Coil, 11-25, 19-43, 38-86 metres. Suitable any type circuits, 21/1.

**REPLACEMENT VALVES**

- **ALL SETS**

**WRITE FOR LATEST LISTS.**

- **ALL TYPES OF BATTERY VALVES**
  - **AT COMPETITIVE PRICES.**
Colour Television Demonstration

We recently witnessed a demonstration, given by Mr. R. L. Baird, of colour television. He rightly points out that the television industry will give employment to thousands when television broadcasting is started at the critical period which will follow the cessation of war. Television was first achieved in this country, which has maintained the leadership, a leadership which must be retained.

Reports which have recently appeared in the Press have dealt with colour television demonstrations in America. Wide claims have been made for them, but further investigation shows that only coloured lantern slides have been radiated. It is clear that America has not solved the difficulty of radiating studio scenes in colour. Moreover, the pictures transmitted are of relatively low number of lines, namely, 343, and the system employed appears to be on the same principle as that demonstrated to the Press by Mr. Baird 20 months ago.

The system demonstrated by Mr. Baird in December employed 600 lines, and artists in an outdoor studio enacted a scene which was transmitted to a receiving set in an adjoining house. This transmission was in colour and the results were good. The transmitter used was based on Mr. Baird's original spot light system, consisting of a cathode-ray tube, in front of which revolved a disc fitted with blue-green and red filters. After passing through the disc the light spot on the cathode-ray tube is projected on to the scene to be transmitted by means of a lens. The person who has been televised is thus scanned by blue-green and red light beams in succession. The light from the coloured light spots traversing the scene operates three large photo electric cells, and the current is amplified and sent by land line or wireless to the receiver.

In the demonstration a land line was used owing to the war, for the use of transmitters is prohibited by the Government.

Large Screen Colour Tele-Radiogram

At the receiver the transmitted pictures corresponding to blue, green and red are superimposed, as in the well-known colour printing process, to form a complete television picture in colour. Apparatus similar to that employed at the transmitter is used, and the picture is produced first in black and white on a cathode-ray tube. In front of this is the colour disc similar to that used at the transmitter end and revolving exactly in step with it. This is achieved by controlling the motor driving the disc, from an impulse incorporated in the transmitted picture.

The black-and-white pictures, by passing through the colour discs, are coloured blue, green and red, and then projected on to the screen by means of a lens. On the screen they blend to give a television picture in colours. The screen is 2ft. 6in. by 2ft.—the largest screen ever produced for the home—and shows 600-line pictures, which is 50 per cent. increase in the lines used by the B.B.C. In addition to colour the new television will receive the B.B.C. black-and-white pictures on the same screen by merely pressing a button.

Four push-buttons are provided, and these bring into action an all-wave radio set, an automatic record changing radiogram, B.B.C. television, and colour television.

Previous Demonstration

Colour television was first shown in 1928, when Mr. Baird demonstrated television pictures in colour to the British Association. Ten years later he showed coloured television on a screen 12ft. by 8ft., at the Dominion Theatre in London, to an audience of 3,000 people, the transmission being by wireless from the Crystal Palace, nine miles away. In 1939 he again showed coloured television, this time with a cathode-ray receiver, but experimental apparatus was used in these demonstrations. To-day Mr. Baird has developed coloured television to the commercial stage.

The Reserved Age

Mr. Bevin, the Minister of Labour, is appealing for more skilled labour, and is conducting the experiment in the electrical trades of sharing out the skilled men available. The age of reservation of 17 years of electrical workers will be raised to 20 on January 8th, and one grade will be raised to 35; two grades will be open for the first time to men of 18 to 35 years of age.

To-day Mr. Bevin is endeavouring to find out what each electrical worker is doing, and if it is proved that he is not doing a job of vital National importance he will remain where he is.
The Perma-tuned Two
A Compact Receiver Designed for Immediate Use on a Pre-selected Wavelength, thus Eliminating All Tuning Adjustments

By L. O. SPARKS

This set was designed to satisfy the demand for a simple yet efficient receiver capable of receiving the Home Service or Forces programmes with the minimum of adjustment. It was intended for use in an air-raid shelter where it was possible to employ an external aerial of reasonable efficiency, and during the many months it has been in service it has proved very efficient, and economical as regards H.T. and L.T. consumption.

Circuit
The theoretical circuit is shown below. To obtain the utmost gain, a Cossor 210SPT is used as a leaky-grid detector, reaction being secured by the usual capacity controlled method. For the aerial-grid circuit, a Bulgin Type 0.6 coil was selected, as tests revealed that it gave a satisfactory degree of selectivity, bearing in mind the single-tuned circuit, and the probable use of a short aerial. The L.F. output of the 210SPT is fed into an L.F. transformer, having a ratio of 3.5:1, by the parallel-feed method. This is indicated in the circuit by the resistance R.2 and the fixed condenser C.3, the latter preventing any direct current from reaching the primary of the transformer, thus allowing its maximum inductance to be obtained. In view of this, it is permissible to use a midget component, or one of a cheap type from the spares-box.

Across the secondary of the transformer is connected an Erie potentiometer, R.3, having a value of 0.25 megohms, the moving arm of which is connected directly to the grid of the output valve, a Cossor 220HPT. This is in the steep-slope economy pentode class, and gives ample output for loudspeaker work when the local transmission is being received. An external grid-bias battery has been eliminated by using an automatic grid-bias arrangement. The resistance R.4, connected between the H.T. and L.T. negatives, produces a D.C. voltage drop according to the values of the total current (H.T.) consumed by the receiver and the resistance R.4. The condenser C.4, connected across R.4, is essential for by-passing purposes, and on no account should it be omitted.

If valves other than those specified are used, the value of R.4 must be adjusted to suit the new current conditions. The output of V.2 is taken direct to the speaker transformer, and in the original model this was a W.B. Junior, and no tone corrector was found necessary. As this may not apply in all instances, owing to possible variations in speakers and cabinet, a suitable tone corrector is shown by the condenser C.5 and fixed resistance R.5, the connections being indicated by the broken lines.

Construction
The layout and wiring of the components are shown opposite, the baseboard being

---

LIST OF COMPONENTS

Valves, Cossor 210SPT, 220HPT.
Tuning condenser, J.B. Dilecon, .0005 mfd.
Reaction condenser, J.B. Dilecon, .0005 mfd.
Valve-holders, Clix, two (one four-pin, one five-pin).
L.F. transformer, B.T.S., Varley, Bulgin.
Volume control, Erie, .25 megohm (with switch).
Coil, Bulgin, Type 0.6.
Resistances: 1 watt, one 2 megohm, one 100,000, one 750 ohms.
Condensers: Dubilier, one .0001 mfd., type 4600/5; one .05 mfd., type 4602/S; one .1 mfd., type 4602/S; one 2 mfd., 3016.
Component brackets, two.
Speaker, W.B. Junior.
Batteries, one 2 volt accumulator, one 120-volt H.T. Exide.
cut from 5-ply to the size 6fin. by 5fin. On the top are mounted the coil, L.F. transformer, tuning condenser and the two valve-holders (one four-pin and one five-pin), the latter being for the output pentode. Two 1in. diameter holes have to be drilled for the valve-holders, and one 1fin. in diameter for the coil connecting tags. The two holders and transformer should be screwed into position first. This will allow much of the wiring to be completed before mounting the other components. The tuning condenser is held in position by an ordinary component mounting bracket, but for the reaction condenser it is necessary to bend a bracket into the shape shown, or make one from a strip of metal 2fin. by 1fin. in width, the thickness being approximately 0.005 fin. The spindle of the reaction condenser passes up through the chassis, a suitable clearance hole, 0.005 fin. in diameter, having been previously drilled. As it is not possible to fit a knob to the spindle, a saw-cut, 0.005 fin. deep, should be made across the latter to allow adjustment to be made with a small screwdriver or trimming tool. It will be noted that no wave-change switch has been incorporated.

This was omitted as the set was not intended for use on the long waves, therefore the coil tags Nos. 2, 3, 5, and 6 can be connected together before the coil is mounted in position, a length of wire, about 5fin. in length, being left on for connection to the negative-earth side of the filament. The red flexible lead from the coil is brought down through the centre hole in its base, instead of being left through the top of the caming-can.

The potentiometer is provided with an on-off switch, and this is wired in series with the L.T. negative supply so that the circuit is broken when the potentiometer is turned to its minimum position. Care should be taken to see that the metallised screening covering of the lead which goes to the top cap (anode) of the SPT is properly connected to the earth line, and that the ends are bound or protected from making contact with the internal conductor.

Housing the Set

A suggested design for a cabinet is given in Fig. 3, but, owing to the compactness of the set, it lends itself to many arrangements, according to individual requirements. When considering this part of the constructional work, it must be appreciated that the back edge of the baseboard is that to which the two variable condensers are fitted. The potentiometer, i.e., L.F. volume control, is intended to be in the front, as it is the only control necessary once the set has been tuned to the desired station. The idea is clearly indicated in Fig. 3. The housing of the batteries depends on space available; the writer made a separate box to hold these.

Operation

The operation of the set follows normal procedure. After connecting batteries, aerial and earth and loudspeaker, the circuit is brought into operation by turning the volume control in a clockwise direction. Reaction should be set near its minimum; volume control at maximum, and tuning then carried out by rotating the tuning condenser. When a signal has been received, strength can be increased by careful adjustment of the reaction condenser. Once the best settings have been found for the transmission concerned, the variable condensers need not be touched, as the set can be switched on and off, and the volume of the output controlled, by the single potentiometer control.

For best results, 120 volts H.T. is advisable at H.T. positive 1 and, approximately, 36 volts for H.T. positive 2, the latter is the screening-grid voltage. As this varies according to individual valves, the best value must be determined by experiment, but do not assume that higher voltages are always the best. When used as a detector, the SPT is invariably more efficient with a surprisingly low voltage.

Wiring Diagram of the Perma-tuned Two
Problems of Amateur Receiver Design—6

The Choice and Use of Different Types of Coil

By FRANK PRESTON

Because of the great variety of coil types it is often difficult to decide which is most suitable for any particular circuit arrangement. In many cases it is possible to replace one coil by two or more other types without affecting results, but on the other hand it may be found that one pattern is better than all others when, for example, selectivity is the most important factor.

We can first discuss types of aerial coil used in a Det.-L.F. receiver. One very good type is that shown in Fig. 1, where it will be seen that the aerial lead-in is connected to a tapping on either M.W. or L.W. winding, according to the setting of the two-pole change-over wavechange switch. By making careful choice of the tapping points it is possible to obtain an approximately equal degree of selectivity on both wavebands. At the same time, a high degree of efficiency can be obtained. In the case of ready-made coils it can be taken for granted that the makers have found the most suitable tapping points; with home-made coils it is generally found best to tap the windings about two-fifths of the way down. It is, however, worth while to make a few tests to determine the best tapping points.

Multiple Aerial Tappings

Another type of coil which is excellent for an experimental type of receiver, or for DX use, is that represented diagrammatically in Fig. 2. It will be seen that in this case there are four tappings on the M.W. winding and one on the L.W. section.

If the windings are brought out to sockets, the aerial terminal can be connected, through the series condenser, to a flexible lead fitted with a wander plug. The plug can then be moved until the required degree of selectivity is obtained for any particular use. The M.W. tappings can be equally spaced from the "grid" end of the winding down to a point about one-third of the distance from the "earth" end of the winding.

The type of aerial coil with separate aperiodic (untuned) aerial winding is widely used, and one arrangement of windings is shown in Fig. 3. In this case, the aerial winding is coupled to the medium- and long-wave windings and is connected to a centre tap on the long-wave winding.

H.F. Couplings

There are, of course, many other types of aerial coil, but those referred to are typical, and others are, in most cases, variants of them. When we come to consider coils suitable for coupling an H.F. valve to a detector or to a second H.F. valve, we find that most aerial coils can be used in this position. Fig. 5, for example, shows the connections for a coil of the type represented by Fig. 2. It is connected on the tuned-grid principle, and an additional grid tapping is shown. The latter is of considerable help in minimising grid-circuit damping and, hence, in improving selectivity. In practice, it would probably be found most convenient to use the first or second of the aerial tappings.

Fig. 6 shows a modified form of the coil shown in Fig. 1 used in a tuned-anode circuit, whilst Fig. 7 shows a tuned-transformer arrangement where a coil of the general type, shown in Fig. 3 (but with completely separate primary winding), used in a tuned-transformer arrangement.

By this means selectivity is slightly increased on long waves, and the aerial winding can be comparatively small so that the coupling between it and the grid winding is "loose." By using an aerial winding with about three-fifths of the number of turns used on the medium-wave winding it will be found that selectivity and efficiency are good.

In Fig. 3 the reaction winding is also shown, and the connections for it would be precisely the same in the coils represented by Figs. 1 and 2. It will be seen that the reaction condenser is included between one end of the winding and earth. Instead, it could be placed between the other end of the winding and the detector anode, but hand-capacity effects would probably be more noticeable in that case.

Aperiodic Aerial Windings

A modified form of the arrangement shown in Fig. 3 is given in Fig. 4. In this case there are two aperiodic aerial windings in series, the lower of which is short-circuited along with the long-wave tuning winding when the wavechange switch is moved to the medium-wave position. This type of coil is very satisfactory indeed, if well designed, since there is no compromise on either waveband. One little difficulty arises when the wavechange switch is not built in, however, due to the large number of terminals required. To keep the number down to seven, one end of the reaction winding is generally connected, inside the coil, to the earth terminal. Because of this, the reaction condenser must be on the "anode" side of the winding. Where an eighth terminal can easily be accommodated it is worth while to provide two separate terminals for the reaction winding.

Ensuring Stability

In the case of a two-H.F. "straight" circuit it is often found that stability can most easily be ensured by mixing the
couplings; that is by, say, using tuned-anode coupling between the first and second valves, and tuned-grid between the second and third. It could be argued that if difficulty is found in obtaining stability without resorting to this method the design is bad. But the fact remains that the “mixing” simplifies design, and the method can therefore be justified.

**Band-pass Tuners**

Band-pass tuning is less widely used to-day than it was a few years ago, largely because selectivity is better obtained by using a superhet. When considering a single-H.F. “straight” circuit, however, band-pass tuning is a definite advantage if a good degree of selectivity is required along with quality of reproduction. There are two schools of thought concerning the position of the band-pass filter; one prefers it between the aerial and the first valve; the other, between the H.F. and detector valves.

The advantage of the former position is that there is no danger of the tuning of the filter being “unbalanced” by reaction control—since reaction would be applied to the other tuning circuit. On the other hand, it does seem rather illogical to provide, say, a 9 kc/s band-width, and then to cut it by means of the single-circuit coil with reaction. For my own part, therefore, I prefer to place the filter between the H.F. and detector valves, and to take special care with the reaction circuit. This consists of using the lowest capacity of reaction condenser with which oscillation can be obtained over the whole of both wavebands and, where convenient, using a differential reaction condenser. It also pays to take care to apply the optimum H.T. voltage to the anode and (in the case of an H.F. pentode) to the screening grid, so that only a very small variation of reaction-condenser capacity is required with variations of tuning.

No mention has so far been made of the tuning and oscillator coils of a superhet, or with the I.F. transformers, but these questions can be dealt with in a later article.

**Fig. 6.** Tuned-anode coupling, with a simple type of coil which gives good selectivity. The reaction winding is omitted for simplicity; as it is from Figs. 5 and 7.

**Fig. 7.** A tuned-transformer circuit, using a double-wound coil.

---

**ITEMS OF INTEREST**

**Developments in B.B.C. European Service**

NEW programmes for France and Luxembourg, and an additional bulletin in Polish are included in recent developments made in the B.B.C.'s European Service. A Sunday programme for French listeners entitled, “Une demi-heure du Dimanche,” which is now broadcast from 3.0 to 3.30 p.m. B.S.T., includes a review of the week's events and talks on general interest and religious subjects. It is transmitted on the wavelengths 49.59 metres and 25.29 metres.

The new programme for Luxembourg is broadcast on the last day of the month between 8.0 and 8.30 p.m. B.S.T., includes a review of the week's events and talks on general interest and religious subjects. It is transmitted on the wavelengths 49.59 metres and 25.29 metres.

The new programme for Luxembourg is broadcast on the last day of the month between 8.0 and 8.30 p.m. B.S.T., includes a review of the week's events and talks on general interest and religious subjects. It is transmitted on the wavelengths 49.59 metres and 25.29 metres.

**New Appointment for Overseas Service**

NEWLY arrived in this country from Australia is Mr. R. C. McCall, who has been appointed to the B.B.C. staff to organise the new Pacific transmission of the B.B.C.'s Overseas Service. This provides a further example of the close co-operation between Dominion broadcasting organisations and the B.B.C.—other similar examples have been the appointment of Mr. E. L. Bushnell, Controller of Programmes for the Canadian Broadcasting Corporation, to the position of North American Programme Organiser of the B.B.C. Overseas Service, and the work in this country of the Canadian Broadcasting unit, which includes Mr. Bob Bowman, Mr. Gerry Wilmot and Mr. Rooney Pelletier.

Mr. McCall was for many years on the staff of the Australian Broadcasting Commission and has had wide experience of musical activity in Australia. He was Federal Programme Editor of the Broadcasting Commission at one time and later became Manager of the Commission's Victorian branch.

**B.B.C. Diary for 1941**

THE B.B.C. Diary for 1941 is now available. It contains 22 sections of interesting information about the B.B.C., including many details about the work of the B.B.C. under war conditions. The section, B.B.C. Personnel, containing biographies of some B.B.C. officials, has been brought up to date. Prices, including postage and purchase tax, range from 2s. 4d. to 7s. 7d. The Diaries may be obtained direct from the B.B.C. Publications Department, Searle Road, Wembley, Middlesex, or from any B.B.C. Regional Office.

**Troops are now being trained in a wide range of technical subjects, including many branches of engineering and wireless, at a London Technical Institute. In the illustration, three N.C.O.s are seen examining a wireless chassis.**
New Ideas for the Constructor

Get Your Constructional Ideas Out of the Rut. Break Away from Stereotyped Designs and Develop Your Own

By THE TECHNICAL STAFF

THE design of the simpler "straight" type of short-wave receivers has made very little progress. Circuits built around arrangements of two, three and four valves still hold the widest appeal, and the short-wave enthusiast is content to carry on with standardized equipment, components and circuits. This procedure is the wisest one for beginners to adopt, but with the more experienced amateur S.W. apparatus offered the constructor, before the war, an extensive range of components, but now, there has been an opportunity to the amateur to develop his own ideas and constructional abilities.

Circuits

Although an untuned H.F. stage can be useful, a tuned stage is likely to be better, and two tuned H.F. amplifiers will indicate how many transmissions are absent from the log book. Few amateurs use a 2-v-2 receiver; a number experiment with a single stage, but do not reach the second stage of H.F. amplification, fearing trouble due to instability and the consequent lack of signal strength. The adoption of the following suggestions will help to overcome the snags. Commence by getting a 1-v-1 receiver to work really well, the H.F. section being tuned and coupled to the detector by an efficient H.F. transformer. Stability in all stages is essential, and the detector should be fitted (when such are needed) to the coil former, although if sufficient adjustment of the inductances can be obtained by varying the spacing of the turns, that is preferable to the use of trimming condensers. All the constructional work must be rigid and careful consideration given to circuit details before use is made of metalised screening for screening individual conductors.

Single-signal and diversity receivers are two fields rich in experimental possibilities, whilst the incorporation of "R" strength indicators, noise limiter and I.F. limiter circuits, pre-H.F. amplifiers and regenerative I.F. stages in superhet all form valuable additions to a receiver.

Constructional Suggestions

An examination of catalogues of S.W. communication type receivers reveals many items not usually embodied in amateur-built sets. While it is not possible to incorporate all the ideas revealed in home-constructed sets, it is feasible to make use of many or devise an idea from the information contained in the specifications. For example, dials, coil units, panel layout, screening and switching arrangements are all items which provide scope for ingenuity.

Dials

A large-diameter dial, having clearly defined sections for different frequency bands, and giving a good length of pointer travel for each band, is desired by most S.W. operators. Such devices are not now cheap, nor easy to obtain, but as slow-motion units do not suffer from the same restrictions, the construction of a satisfactory dial should not present difficulty. The slow-motion units or mechanism can be purchased for from 2s. 9d. to 3s. 6d. from many of the advertisers in PRACTICAL WIRELESS, and they give a reasonable reduction ratio. In addition to these, various types of slow-motion drive can be made from three or four pulleys, a spring or two and a few odd pieces of metal. The dial can be marked out on Bristol board, a diameter of 6ins. to 9ins. will be generous, and after it is ruled off, horizontally, through its centre point, concentric lines can be drawn in and the sections marked off for the various frequency bands as shown in Fig. 1.

If a dial of this type is used for the band spreader control, it will be possible, provided that the tank control can be set to a definite setting, like the Eddystone ten-position tank tuning-condenser, to utilise one of the semi-circular spaces for the band-width covered by the complete movement of the 1-s condenser for each setting of the tank condenser.

Coil Units

Most S.W. enthusiasts will be familiar with the well-made coil units which are included in certain types of communication receiver. They add a professional appearance to the outfit, eliminate plugging in individual coils and, as they are assembled as a rigid unit, they enable the inductance values to be adjusted to a remarkable degree to ensure perfect tuning. Simple types could be made for the simple 1-v-1 receivers, and with a little skill and ingenuity, the whole appearance and efficiency of the set could be improved. Ordinary commercially produced plug-in coils could form the basis of the construction on the lines suggested by Fig. 2. Other arrangements will suggest themselves, according to individual requirements; for example, locating the coils in a horizontal position and having wiping contacts; providing any necessary screening as part of the unit assembly and, finally, selecting the most suitable point for insertion of the unit, i.e., through the panel, the chassis or top side of cabinet.
The Southern Accent

I READ that a schoolmaster recently informed his pupils that they were attending a Northern school that he intended to teach the Southern accent, because that was the accent adopted by the B.B.C. and represented the National accent. I am glad of this, because, quite frankly, I do not like the Northern accent, and moreover, whether it is the less I like it. I suppose that Northerners dislike the Southern accent just as much, and we must, therefore, fall back upon our lexicon to support the contention as to which is right, and which is wrong. The Northerner will retort that their accent is better than Cockney, but then the Cockney is a purely local dialect, and not general to the South. The Northern accent is, however, general to the district, and they cannot find support for it in a dictionary. We pronounce book as buk, but the Northerner pronounces it as book, and similarly look. The Northern accent is, indeed, terribly bad and a grave reflection upon Northern school-teachers, who should be taught to pronounce the language they are supposed to teach. The Northern accent does, however, mildly represent the English language, whereas the Scottish accent is some sort of hybrid concoction of Gaelic, English, and Norse, which is used in the North, but not in the South. It means "to work for profit, or lucratively," and I do not like the word, especially when the B.B.C. use it in the sense of "usefully." Another word I dislike intensely which is used in the North, and particularly in Lancashire, where the word was born. The Lancashire people like picturesque naming of the hedges, and it really is a piece of slang. Let us forget it.

Colour Television

Mr. BAILD recently gave a demonstration of colour television, to disprove statements that have appeared recently to the effect that Hitler's activities have stopped all television progress in this country. It was apparent from the demonstration that, as I have so often mentioned in these pages, experiments continue. The television industry will give employment to thousands when television broadcasting recommences, at the critical period after the war. The reports which have appeared of colour television demonstrations in the U.S.A. deal with experiments only. Coloured lantern slides and coloured films only have been used. The Americans have not yet overcome the difficulty of radiating—studio scenes in colour. The pictures are of comparatively low quality, and have been described as "mediocre," and the aspects they use seem to be on the same principle as that demonstrated to the Press by Mr. Baird 18 months ago.

By Thermion

Those German Spies

SEVERAL readers have written to me asking for full details with wiring diagram of the transmitting outfit carried by the three German spies recently executed. We had, of course, immediately taken the matter up with the Authorities asking them to place one of the receivers at our disposal for purpose of description in this journal. However, such a receiver must make use of a standard circuit, and the only point of interest would rest in the composition of the design. I do not know at the moment of going to press whether the Authorities will permit us to publish the details. We must remember that Neville Chamberlain, who was guilty of so many crassly ignorant mistakes, allowed 70,000 German refugees to enter this country when Hitler purged his country of the Jews. There can be no doubt that Hitler saw in the hospitality which we extended to these refugees an easy method of giving spies and Fifth Columnists Jewish passports so that they could obtain easy entry into this country. As far as I have been able to trace there was not a thorough investigation into the bona fides of these refugees. The fact that some of them could carry portable transmitters which were not discovered until after they had landed is a somewhat disquieting factor. The present Cabinet are much more alert and alive to the possibilities, and it may be that they will refuse us permission to publish the details because it would put information in the hands of enemy agents in this country—technical information which would enable them to build their own transmitters. As amateur transmitting is illegal and all transmitters have been confiscated in this country the publication of such information would not be of great interest. We do not wish to encourage our enemies to build transmitters. Happily the Authorities have transmitted the official point of view I will again refer to the subject.

Prizes Awarded

I HAVE awarded book prizes to the following in connection with the competition which was set for the best essays on ‘How the War Has Affected my Radio Hobby’: W. Austin, 77, Sidney Street, Brightlingsea, Nr. Colchester, Essex; Lawrence McCooey, 202A, Worm’s Road, Clifton, Bristol; H. T. Beveridge, 9, Eveson Road, Norton, STourbridge, Worcs.; A. F. Light, Penrith, Pulhelin, N. Wales; Arthur McCooey, Myrbeck Drive, By Gloucester; C. R. Neville, 2, Sisters Cottages, Diamond Terrace, Greenwich, S.E.10; and G. N. Green, 13, Green Walk, Reading, Madix. A selection of the essays will be published next month.

Readers on Active Service

I AM delighted to receive so many letters from readers on Active Service. Most of them are from readers who have corresponded with me for the past 10 years, and their letters take me back to the heyday of home construction when we were forgetting the last war and not anticipating the present one. Some of them saw Active Service in the last war and are now placing their valuable knowledge at the service of the country as instructors, operating technicians, and servicemen. In spite of the difficulties of service life they still maintain their interest in radio. When peace returns we shall open up our columns to them so that they can record their experiences in greater detail than is possible under a censorship. Much of what they will have to say will not appear in this country when Hitler purged his country of the Jews. All that, thank goodness, is now altered, though why it could not have been done before the war I shall never understand. The latest figures of the export of electrical and radio apparatus from this country speak eloquently of the work done by our readers. As far as I know the figures for September, 1940, were £134,908 which show an increase of £67,490 over September, 1939.

Our Roll of Merit

Our Readers on Active Service—Eleventh List.

C. E. Myers (Gnr., R.A.), Aldershot.
N. Shirley (Pte., R.A.O.C.), Aldershot.
B. C. Caville (Lt., R.A.O.C.), Oswestry.
A. T. Dudding (Gar., R.A.), Leeds.
C. Sloper (Cpl., R.A.F.), Suffolk.

Delivering the Goods

Too often in the past have I received letters from readers overselling complaining about the apparent indifference of the British radio manufacturers to their requirements, and the way in which more enterprising foreign firms were literally wiping up the markets. So many British firms adopted the ridiculous policy of supplying standard equipment, either through crass ignorance of the true conditions or the sublime attitude of "take it or leave it," with the result that other countries secured the orders. All that, thank goodness, is now altered, though why it could not have been done before the war I shall never understand. The latest figures of the export of electrical and radio apparatus from this country speak eloquently of the work done by our readers. As far as I know the figures for September, 1940, were £134,908 which show an increase of £67,490 over September, 1939.
Details of an Amplifier Embodying a Tapped Potentiometer and Making Use of Negative Feedback

Most listeners have noticed that when the volume control of a receiver is adjusted so that the volume is below normal, the quality of the reproduction is strained and lacking in depth. This effect has been explained satisfactorily by physiologists, and many attempts have been made to provide volume controls which compensate for this apparent distortion. In the usual type of compensated volume control a potentiometer is employed with a tapping near the middle, and a condenser and resistor in series are connected between the tapping and the earthed end of the potentiometer.

In the circuit diagram (Fig. 1), a two-stage audio-frequency amplifier which may be employed in a radio receiver or gramophone amplifier is shown, and comprises an audio-frequency input signal circuit 5, an audio-frequency output circuit 6, and a control grid 18 of a suitable biasing meter resistor permits the application to the control grid 18 of a suitable biasing meter resistor 16 is connected to the high signal potential earth 19, and to the low signal potential indicated by the series-connected resistor 12 of a loudspeaker 13.

Inverse Feedback

By properly polarising the connections with the output secondary 11 of the transformer 10, and earthing one terminal of the grid electrode at 22, inverse feedback potential may be derived from the amplifier output circuit 6, through an inverse feedback circuit, comprising the cathode circuit of the valve 7, and a second-or output-amplifier 8, including an inter-stage coupling network 9 of the resistance-capacitance and a suitable output transformer 10, the secondary 11 of which is connected to the output circuit 6, which includes the speaker coil 12 of a loudspeaker 13.

The resistance of the input circuit 5 is indicated by the series-connected resistor 14, and this circuit is coupled through a suitable coupling condenser 15 to an attenuator or a volume control potentiometer 16. In accordance with usual practice, a volume control contact 17 is movable over the resistor 16 past the taps as the variable volume control contact 17 is moved along the resistor 16 past the taps supplying the feedback voltage. Furthermore, it is evident that the frequency characteristic of the feedback voltage varies at the same time. This in turn causes the frequency characteristic of the amplifier to vary with variations in the signal attenuation in a predetermined relationship.

L.F. Compensation

The size or capacity of the condensers 27 determines the amount of low frequency compensation which is provided at the several taps. For aural compensation, it is desirable to increase the low audio-frequency response of the system at low output levels by making the network one which gives more negative or inverse feedback at high frequencies than at low frequencies as the attenuation is increased; that is, as the voltage control contact 17 is moved to reduce the input signal voltage applied to the first amplifier stage 7, the relative low-frequency response is increased. The range of high-frequency signals which are fed back to reduce the gain is determined by the impedance of the feedback circuit, which is, upon the controlling elements included in the lead 24, and such elements may include inductive or capacitive reactance elements, or both as required, together with suitable resistance means. Thus, in the circuit shown in Fig. 1, as the amplifier output or volume is reduced, the high-frequency attenuation is increased, because of the fact that inverse feedback is provided at the higher frequency end of the audio-frequency range, with a corresponding additional reduction in gain in the high-frequency ranges, while the feedback at the lower frequency end of the audio-frequency range is substantially prevented because of the relatively high impedance of the condensers 27 to low audio-frequencies.

If low-frequency attenuation is desired, the circuit may be modified or combined with the circuit of Fig. 1 in the manner indicated in Fig. 2.

Alternative Arrangement

In this circuit the feedback branch...
Modern Factory Production Methods—5

Various Tests which Pre-production Models have to Undergo Before they are Approved for Full Production

By "SERVICE"

The conclusion of the last article in this series dealt with the trial production of about 50 instruments of the new model after a few "hand-made" samples had been vetted by various production, design, sales and service departments. The trial production is necessary in order to make sure that the operatives can carry out the process of wiring and assembly of a component on the test chassis, in the way arranged for by the process engineer who laid out the instructions. Despite his careful forethought it may be found that under fast working conditions a girl cannot effectively make a certain soldered joint, because the lack of the joint is obscured by work carried out by the previous girl in the production line. Difficulties connected with the wiring of the circuit which affect sensitivity, instability, calibration, etc., must be examined and changes made if necessary.

It may be impossible to maintain the original high sensitivity of a chassis due to actual production troubles or to the fact that the valves arriving in quantities from the valve manufacturers may not all be up to the original sample with which the set was designed and first tried out. If the sensitivity cannot be maintained, then the test gears at the final stage of the production line must be altered to pass the chassis through at an agreed lower level.

Wiring of the Chassis

Another problem concerns the wiring of the chassis. Circuit wiring if incorrectly dressed may give rise to a large coil, thus causing trimmer condensers to be set at a lower value. These "padders," as they are familiarly termed, are small fixed condensers of about half the value of the trimmers and their purpose is to enable the trimmers to be finally set at a point about half-way between maximum and minimum, at which position they are more likely to remain steady.

The reference above to Co refers to the capacity of the wiring in the circuit, which in its rotative position to earth (or chassis) capacity of the component to be built up across the tuning coils, and may therefore be regarded as a condenser. In circuit diagrams condenser capacity is sometimes referred to as Co, etc., so that design engineers have acquired the habit of referring to the inter-capacity of wiring as Co.

When the 50 preliminary instruments have been made up they will be carefully scrutinised by the various engineers and departments mentioned previously. If any modifications have had to be made which affect sensitivity, quality, etc., the sales department will most certainly have something to say about it, and they may insist that the production is improved.

Test Specifications

The designs engineer, together with the service department, will see what type of fault is most commonly made upon production, and will arrange that special inspection is given to the processes which lead up to that fault. There will, of course, be inspectors at various stages along the production line, and these men have definite wiring to cut to the correct length, and component leads are shortened, when required, at a place away from the assembly line, so that there is no danger of extraneous matter getting into the chassis. Sometimes, however, it is necessary for wire trimming to be carried out on the chassis itself, and then the inspection mentioned above has to be instituted.

The matter of inspection, however, will be dealt with at length in a later article in this series, and we will revert now to our consideration of the 50 chassis which have been made up along production lines.

"Soak Test"

About 25 of these models will be put on what is termed a "soak test." During this test the sets will be run all day with the

Wiring of the chassis continued...
MODERN FACTORY PRODUCTION METHODS (Continued from the preceding page)

surges, and if a breakdown occurs it is more quickly detected at a period of the day which leaves plenty of time for investigation.

When carrying out a "soak test" it is a good thing to arrange that the sets are operating at good volume, just as they would when in use by the public. In many cases this is not done, and the receiver is either operated with the volume control turned well back, or the loudspeaker is disconnected, and the output from the instrument is fed into a dummy load.

Faults that Develop

This is not entirely satisfactory because, although the loudspeaker is a separate component, and may have been given a long test, and the chassis also given a longer test, often to the weight or disconnection of the speaker unit, the magnet assembly may be disconnected, and the output from the instrument fed into a dummy load.

For example, microphones may develop and disappear, loudspeaker buzz, etc., would only become apparent when the receiver performance is extended to a fair degree. Just because the fault is not immediately obvious, it cannot be taken for granted that such faults will not develop under production conditions. A change of material may have been made in the construction of the scale and wavelength pointer assembly, causing it to be more flexible and therefore more inclined to rattle on certain notes; the leads from the sound coil for the loudspeaker may not have been properly dressed by the operative assembling the loudspeaker unit so that they buzz under conditions in the receiver.

Drop Test

Another test which is essential at this stage of production is the drop test, although it can be made at an earlier stage if no drastic modifications have been made. The receiver is brought together in one cabinet, with the back of the cabinet in position, that certain troubles develop. For example, microphones may develop and disappear, loudspeaker buzz, etc., would only become apparent when the receiver performance is extended to a fair degree. Just because the fault is not immediately obvious, it cannot be taken for granted that such faults will not develop under production conditions. A change of material may have been made in the construction of the scale and wavelength pointer assembly, causing it to be more flexible and therefore more inclined to rattle on certain notes; the leads from the sound coil for the loudspeaker may not have been properly dressed by the operative assembling the loudspeaker unit so that they buzz under conditions in the receiver.

Vibration Test

A vibration test is sometimes substituted for the shock tests which is not so drastic as to apply a shock test, but which is often just as destructive to certain parts of the instrument. Under these conditions continued shaking, knobs may come adrift, cord drives become divided, bolts unscrew, and other such-like faults develop.

For this test the model is bolted to a small platform, which is supported by a constant state of violent motion. Beneath the middle of the platform, and in contact with it, is an elliptical cam connected to an an electric motor. When the latter is switched on, it raises the cam to a uniform height of about three feet, and this test must be repeated, and the chassis also given a long test, often to the weight or disconnection of the speaker unit, the magnet assembly may be very heavy, and if the cone wedge which supports it is not quite strong enough for the job it will become distorted so that the speech on the cone no longer moves parallel in the air and distortion will occur when it fouls the loudspeaker during reproduction.

The test or anchorage points for all heavy components such as mains transformers, the loudspeaker, the receiver chassis, etc., must be examined for all possible damage. The test is so that the carton arrives at the depot they are not opened, or perhaps a dealer who co-operates with the production committee, and they have arrived at the depot they are not opened, but are re-addressed back to the manufacturer. It can be well imagined what the receiver goes through to the manufacturer is fortunate enough to have someone in the north of Scotland to assist him in this test.

LATEST PATENT NEWS

Group Abridgments can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, either sheet by sheet as issued on payment of a subscription of 3s. per Group Volume or in bound volumes price 2s. each.

NEW PATENTS

These particulars of New Patents of interest to readers have been selected from the Official Journal of the Patent Office of March 1st, 1941, with the permission of the Controller of H.M. Stationery Office. The Official Journal of the Patent Office is published by the Patent Office, 25, Southampton Buildings, London, W.C.2, price Is. 2d. per sheet (annual subscription, £2 10s.).

Specifications Published

528090.—General Electric Co., Ltd., and Tingle, L. C.—Apparatus for transmitting or receiving colour television.
528179.—Perceval, W. S.—Thermionic valve capacitance coupled television apparatus or the like.
528192.—Kolster Brands, Ltd., and Bratty, W. A.—Discriminating circuits for television and the like.
528184.—Jackson, D.; Pye, Ltd.—Mounting of the chassis of radio and television apparatus or the like.

Printed copies of the full published Specifications may be obtained from the Secretary, 25, Southampton Buildings, London, W.C.2, at the uniform price of 1s. each.

February, 1941

PRACTICAL WIRELESS
Practical Hints

Converting 4-Pin Coils

HAVING recently erected a doublet, I decided to convert my 4-pin coils (2 windings) to three winding coils without changing the formers. First, I roughly wound on the primary winding till I obtained a position and length which gave the required coupling, then I drilled the former and passed the ends of the winding through the holes. These wires were soldered to two pins of a 4-pin chassis valveholder, which was then glued to the top of the former. The ends of the doublet feeder were connected to the two corresponding pins of an old valve-base. This method can also be used to connect an ordinary valveholder, which was then glued to the top of the former. The ends of the doublet were connected to the two corresponding pins of an old valve-base. This method can also be used to connect an ordinary valveholder, which was then glued to the top of the former. The ends of the doublet were connected to the two corresponding pins of an old valve-base. This method can also be used to connect an ordinary valveholder, which was then glued to the top of the former.

That Dodge of Yours!

Every reader of "Practical Wireless" must have originated some little dodge which would interest other readers. Why not pass it on to us. Every year we reserve 41-100 for the best hint submitted, and for every other item published on this page we will pay half-a-crown. Turn that idea of yours to account by sending it in to us addressed to the Editor, "Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every motion sent in must be original. Mark envelopes "Practical Hints." Do NOT enclose Questions with your hints.

A Slow-Motion Drive

THE accompanying sketch shows a slow-motion drive which can be fitted to most condensers. Two similar brackets (B) made from stout aluminium, have holes 3 in. in diameter drilled near the top for the condenser bushes. The rubber tyred wheel F was taken from a mechanical toy, the driving hole being enlarged to 1 in. diameter. The rubber tyre is a friction fit against the brass tube A, which is soldered on the driving spindle. The scale held by bush C can be of any type, but I find an opaque plastic disc (or painted white at back) makes a good substitute. The grub screw of the bush C was replaced by a long screw which when filed to a point forms the pointer. With a circular scale and double pointer it is possible to mark S.W., L.W., M.W., degrees or stations, using part of the paper. The motion is smooth and free from backlash.—J. G. HARKNESS (Barry, Glam.).

Shock-proof Mounting for Radios

AS many radio receivers are now installed in shetlers, it is advisable that some precautions should be taken to protect them from rough usage, or weather. The shock-proof mounting arrangement, shown in the illustration, is made as follows: A simple frame is constructed from 1 in. thick plywood and strengthened in the corners with plywood, as indicated. Dimensions will vary according to the particular receiver to be housed. Eight 1 in. diameter holes are then cut in the positions shown, and plywood discs 2 in. diameter cut to cover each hole. The bottom four screws are screwed in position and four soft 1 in. diameter rubber balls placed in the recesses now formed, after which the set is placed in position, and the side and top bulbs put in place; the cover discs are then placed over, screwed and glued down. As an added precaution Sorbo strips can be glued to the underside of the framework as shown. In order to give a finish a cost of varnish or paint can be applied to the woodwork.—T. J. SANDERS (Masthead).
MAKING SIMPLE SUPERHETS

How an Efficient Superhet Receiver can be Made by Using Standard Components and a Number of Old-type Valves

Details were given in a recent issue of a "Spare-box Superhet," and they evoked a good deal of interest. There are no doubt many readers, however, who would like to build a receiver of rather more ambitious type than that described, but who are normally prevented from doing so because of the frequency-changer, H.F. pentode and double-diode valves required. It is to meet the requirements of this type of reader that we give on this page a circuit for a five-valve superhet, of fairly simple pattern, despite the number of valves, which can be built around existing valves of the screen-grid and small-triode types.

Five Standard Valves

The more critical reader will probably point out that the circuit is a "reversion" to an arrangement which was employed some years ago and which is now dead. We do not admit that, although it is granted that the general circuit layout does not differ very greatly from that employed in certain earlier receivers. But in drawing up the circuit—and we have recently used a set built round this circuit with satisfactory results—we have attempted to incorporate many of the best features of modern design with the best of earlier design. It might also be argued that the set has far too many valves; although only five are shown at least one L.F. or output set has far too many valves; although only one L.F. or output set is needed to operate a speaker. Obviously, the number of valves is greater than we have often expressed our preference for the system of using a greater number of valves, none of which is "stressed to the limit." By following this arrangement there is far less trouble due to instability and difficulty of operation, and at the same time the overall efficiency obtained with the five valves shown is probably as high as that obtained by using three valves of more modern type—pentagrid, H.F. pentode and diode, for example.

It should be mentioned here that although screen-grid valves have been referred to, and are suggested as suitable for first, second and fourth positions, H.F. pentodes or tetrodes could be used if they are on hand. Alternatively, there is no great objection to employing a combination of valve types so that use can be made of valves which are to be found in the spares box. Suitable types of valves, of comparatively old type, are indicated, and it will be observed that a small power valve is suggested for the oscillator stage and an L.F. or general-purpose valve for the second detector.

Tuning Arrangements

It will be seen that the sequence of stages is: preliminary H.F.; first detector; oscillator; I.F.; second detector. A simple arrangement of tuning circuits is shown, but the actual coils to be employed will depend upon what is available from the spares box. The aerial coil has an aperiodic winding, whilst that used to couple together the H.F. and first-detector valve is wired in a tuned-anode circuit. Since it will be desired to tune both of these by the same two-gang condenser, it will be clear that the coils should be similar and at least approximately matched. The oscillator coil may be of any ordinary broadcast type with reaction and separate aerial windings if a few turns are removed from the two tuning windings. Actually, it is not essential to modify the coil, although if this is not done the available waveband will be somewhat narrowed.

The number of turns to be removed will be dependent upon the intermediate frequency to be employed. That in turn will depend upon the I.F. transformers available. Since use is to be made of comparatively old components it is probable that the I.F. will be somewhere between 110 and 200 kc/s. In the case of our own experimental receiver we used a pair of I.F.'s nominally rated as tuned to 165 kc/s (they were from an old commercial receiver), and an L.F. in this region proved very satisfactory. After completing the receiver a little experiment was carried out in connection with the optimum setting of the trimmers, and it was found eventually that in setting by trial and error, the I.F. was slightly above 170 kc/s.

The Oscillator Coil

With regard to the modification of a standard broadcast coil for use in the oscillator circuit, we found that the removal of about one-tenth of the total number of turns from the medium-wave winding, and about one-sixth from the long-wave winding, proved satisfactory. In addition, we inserted a .001-mfd. fixed condenser.
in series with the long-wave winding in the position shown. It will be seen that the condenser was wired between the lower end of the winding and one terminal of the wave-change switch. Since the switch was built as a self-assembly one lead to it was cut, the two ends being joined to the fixed condenser, which was wedged inside the coil base for neatness.

It is best to consider the use of ganged tuning for the oscillator, as well as the H.F. and first-detector circuits, unless a set of superhet coils is used, and then they were made use of a single mfd. condenser for tuning the oscillator circuit. This setting of this is generally fairly critical, so we looked out a condenser with dual-motion drive; that is, fitted with a dial which can be turned bodily (and moving the condenser spindle at the same rate), or which can be turned slowly by means of a built-in friction drive. The dial on the gang condenser was of the geared-down type, but the gearing was high so that the scale could be moved fairly quickly.

Since tuning is not normally extremely critical on this condenser it was not found necessary to employ a very slow-motion drive.

In some instances it will be found that slow-motion drives, or two-speed drives, are not to be found. An alternative method is to fit two direct drives and to fit a .00005 mfd. variable condenser as vernier in parallel with the oscillator tuning condenser. The advantage of this method is that the condensers are good ones with a high-grade condenser and having a rotor which is stiff at some points and which just "flops" round at others is practically useless in a set of this kind.

Method of Tuning

A little difficulty will be experienced at first in operating both tuning condensers at the same time, but after a few stations have been logged and notes made of the condenser settings, the difficulty should vanish. It will be found that both condensers follow a different "law." In other words, if the aerial condenser has to be turned through, say, 120 degrees to alter the tuning from 200 to 400 degrees, the oscillator condenser may have to be turned through only 90 degrees to cover the same waveband. These figures, incidentally, are purely arbitrary, and should not be taken as any indication of the tuning positions to be expected.

But once this "law" has been established it will not prove very difficult to move both condensers knobs at the same time and to keep the tuning circuits fairly well "in step." The relative movements will be slightly different on the two wave-length ranges, but that should not be the cause of trouble.

Wavebands Covered

It has been taken for granted up to now that the receiver would be used for only medium and long waves. If other wavebands are required use can be made of multi-range tuners, modifying the medium- and long-wave windings of that used for the oscillator; it will not be found necessary to make any alteration to the short-wave windings when using the comparatively low L.F. mentioned above. A much better method is to employ six-pin plug-in coils. When that is done it will usually be found that the next smaller coil to that used for the first two valves can be used in the oscillator circuit without any alteration being necessary. It is preferable that the coils should be screened, and this can be arranged in one of many ways. Probably the best is to make use of ordinary coil screening cans taken from old coils. The base or "reversed lid" will be screwed to the receiver chassis and drilled, along with the chassis, to allow the coil-holder sockets to pass through. The holes must, of course, provide reasonable clearance to prevent any possibility of short-circuit.

If this method is not convenient, a rectangular screening box, divided into three equal sections, can be made from copper or aluminium (zinc is a moderate substitute if neither of the other metals can be obtained) and fitted with a lid. The coil holder sockets will then be mounted in the bottom of each of the compartments. In following this arrangement, great care is necessary to ensure that all joints in the screening box are sound electrically; in most cases this is ensured by taking care to make them mechanically sound. If this point is overlooked the screening will be inefficient and the screens may actually serve to couple the coils together. The whole screen must, naturally, be well earthed to the chassis and to the earth terminal.

H.T. Supply

The question of H.T. current consumption cannot be overlooked in a receiver of this type, for if 120 volts H.T. is used the consumption of the five valves shown might easily amount to between 10 and 12 mA. And to that must be added the consumption of the L.F. amplifier used.

From this it is evident that, for maximum efficiency, and when working on 120 volts, an eliminator, H.T. accumulator or Milnes-unit is desirable. The alternative is to use a super-capacity H.T. battery, or two smaller batteries in parallel (not good practice) and to cut down H.T. to about 100 volts.

**NOTES AND NEWS**

**Spies’ Radio**

A RADIO transmitter formed the communicating link between the three spies who were recently executed and their Nazi masters in Germany. The apparatus with which they communicated possessed consisted of a transmitter which fitted into a leather case measuring 8in. by 8in., and another case, 14in. by 6in., which housed the batteries. To outward appearances the two cases looked very much like those used for cameras, but when connected and worked in conjunction with the special aerial, the power radiated was sufficient to make contact with the receiving station in Germany. It would appear that the circuit was intended for telegraphy, a compact Morse key forming part of the equipment, a good idea of which can be obtained from the accompanying illustration.

**R.A.F. Selection Board and Secondary Schools**

So successful have been the visits of the Royal Air Force Selection Board of the R.A.F. to the various public schools throughout the country that the scheme has now been extended to include the larger secondary schools.

Under the scheme, experienced personnel of the R.A.F. visit schools by arrangement with the schools’ authorities and interview senior boys who have an interest in the air. They give helpful advice on the methods of entry into the Royal Air Force, explain something of the different courses of training for pilots and air crews, and discuss with the boys their prospects of gaining a commission.

Nearly 300 secondary schools have already been included in the scheme, and the visiting officers will call personally on as many as possible of these during the current term.

During the first six weeks of the Michaelmas term, about 90 public schools have been visited, including many with famous names. Over 250 senior boys have been recommended for entry at a later date as pilots, observers or wireless operator-air gunners, 160 as officers. Apart from the actual results achieved, the Selection Board scheme is enthusiastically received by many headmasters as being one of the best ways in which the boys about to leave school can get to know of the opportunities offered by the R.A.F.
O ut usual monthly analysis of readers' requests reveals that during the past month the outstanding demand is for a low-powered A.C.-operated amplifier, suitable for record reproduction and output experimental work. We have, therefore, produced the unit described in these pages, and although we have had to modify what might be termed the average specification submitted by those readers who wrote to us, we hope that the design will appeal not only to them, but to many others who are requiring an amplifier having good response characteristics.

It is difficult to combine in one unit an amplifying circuit capable of satisfying those who require a simple piece of apparatus to reproduce records faithfully, with the circuit and constructional modifications essential to make the ideal for general experimental work. The only alternative, and it is the one we have taken, is to compromise by producing an amplifier having good tonal qualities, and so constructed that its general utility value makes it an asset to the experimenter.

Circuit

We have assumed that the input will be provided by a modern type of electromagnetic pick-up, but allowances have been made so that satisfactory loading of the output valve will be obtained from smaller inputs. The input is isolated, so far as D.C. is concerned, from the grid of V1 by means of the fixed condenser C1, but the grid receives its bias via the potentiometer R1, by virtue of the resistance R2 in the cathode circuit. The proportion of the input signal passing at the grid of V1 is governed by the potentiometer which forms a smooth and effective volume control. The output from V1 is fed to the grid of V2 by means of a resistance.

The amplifier in its finished state, neat, sturdy and pleasing in appearance.

Capacity coupling, this method being chosen, in preference to the use of an L.F. transformer, through considerations of space, layout, possible introduction of hum, cost and overall gain requirements. The anode load is provided by R3, the value of which directly affects the amplification obtainable from V1 and allowing for, say, 70 per cent. of the calculated gain being obtained, the resistance value specified gives reasonable tolerances.

Double-Anode Decoupling

It is essential, in circuits of the type under consideration, to take every precaution against hum being introduced by the L.T. line, especially in those stages giving appreciable amplification. For this reason, double-anode decoupling has been incorporated in the first stage: the use of two resistances and their associated by-passing condensers, R4 and R5 and C2 and C3, provides a much higher degree of decoupling than a single resistance having a larger value, without the disadvantage of causing a greater voltage drop.

The coupling condenser C4 provides the link between the anode of V1 and the grid of V2 and, owing to the high conductance of the latter, grid and anode stoppers or stabilising resistances have been fitted, these being indicated by R6 and R7. It will be noted that a tride power-supply valve has been selected for the output stage, thus ensuring most satisfactory tonal response, complete absence of pentode "pitch" and a wattage output in keeping with the purpose for which the amplifier is primarily designed. For monitoring purposes, "personal" listening, and to make the application of the unit as wide as possible, provision has been made for headphones to be connected across the output of V1. For this purpose a separate condenser C5 is taken from the anode to one side of the two socket strips fitted to the centre of the front runner of the chassis. The other socket is connected to the common negative-earth line, i.e., chassis, thus completing the intermediate output circuit when the phones are in use. It will be appreciated that by using this method, no H.T. voltage (D.C.) is across the phone windings. Therefore there need be no fear of causing harm to them or the user.

Fig. 1.—The simplicity of the circuit is shown by this theoretical diagram. Refer to it when reading the text.

Metal chassis. See text (Premier or Petro State). Resistance, 1 watt—650,000, one 10,000, one 30,000, one 50,000, one 100, one 250,000, one 1,000 ohms; 1 watt—one 300 ohms (Eric). Potentiometer, 0.5 milliamperes (Eric). Condenser fitted, type 307 (two 0.05 mfd.; type 4021 (two 0.1 mfd.; type 4605/S (one 0.1 mfd.; type 4605/S (one 0.05 mfd.; type 3010; one 50 mfd., type 3004 (Doulasing). Valve holders. one 4-pin type 9-pin (Amplimetal).
-VALVE AMPLIFIER

A Unit for Pick-up

Overall dimensions of 11 ins. x 10 ins. will be required. We know that it is not now easy to obtain sheet metal, but it is quite possible that a suitable piece could be cut from an old chassis or panel. It will be seen from the illustrations that the chassis is of the open ends type and should, therefore, be difficult to make. When bent to the required shape, the following dimensions should be obtained, 10 ins. in length, 6 ins. wide and 3 ins. high, these being made measurements. It will be noted that the spare inch in length has been used to make jin folds to the sides of the top and the back and front runners. These are membering to place the small circular scale under the fixing nut of the potentiometer.

The remainder of the wiring is very straightforward and calls for no comment other than our usual request for particular attention to be paid to all connections to ensure that they are satisfactory.

Mains Unit

The actual output required will be governed by the valves used for V.1 and V.2, but, as the original model utilised, and was designed round, the Cossor 41 MHP and 41 MXP, the details given for the mains unit are those which will provide sufficient operating potentials for these two valves.

The 41 MXP requires an anode voltage of 200 volts and a grid bias of 12.5 volts, and under these conditions consumes 40 mAs. The 41 MHP also needs an anode voltage of 200 volts, with a bias of 2 volts, its anode current being 2.5 mAs. From these details, the most satisfactory rectifier will be one in the 200 volts 60 mAs class, and the Cossor 506 BU satisfies all requirements. The mains transformer, therefore, will need an H.T. secondary giving 250-2-290 volts at 60 mAs, one L.T. winding having an output of 4 volts at 1 amp, centre tapped, and another giving a total of 2.5 volts, also centre tapped. The first L.T. supply is for the rectifier, and the second for the 41 MHP, and the 41 MXP. It should be noted that both of these are indirectly heated type and are able, therefore, to obtain their bias through the usual resistance in cathode method. This point is

Wiring Plan of the Amplifier

![Wiring diagram of the amplifier](image-url)

The theoretical diagram of the unit is shown in Fig. 2. The H.T. and L.T. leads should terminate at a four-pin plug, such as the Bulgin model P.9 or, failing this, the valve base from a defunct 4-pin valve. Note should be made of the connections; the H.T. positive lead is taken to the anode pin, the H.T. negative to the grid pin, and the leads from the 4 volt 2 amp. section of the mains transformer to the two filament pins.

As the mains unit forms the power supply, no switching has been provided in this instance on the amplifier section, so provision should be made for a suitable switch—Bulgin type S.128, which is a double pole toggle Q.M.B.—to be incorporated in the mains unit assembly.

COMPONENTS

- Socket strips, two L.S., type X388; two insulated sockets, type X350 (Cox).
- Connecting plug, type P.9 (Bulgin).
- D.C. type L.P.7 (Bulgin).
- Valves, one 41MHP, one 41MXP (Cossor).

MAIN\NS UNIT

Mains transformer (Premier).
- Smoothing choke, type L.E.14 (Bulgin).
- Smoothing condenser, type 0288 (Dubliner).
- Valve holder, 4-pin (Amphenol).
- Valve, 506 BU (Cossor).
ROUND THE WORLD OF WIRELESS

Radio in Shelters

REPLYING to a question in the House of Commons recently, Mr. Herbert Morrison said that the use of wireless in shelters had the approval of the Government in principle, but no subsidy from Government funds was contemplated.

When it was suggested that the provision of wireless on the relay system would be necessary in connection with airplanes, he replied that considering the number of persons who used the shelters, they should be able to get together and provide wireless receivers themselves.

Station WLWO, Cincinnati

LESS than a week after its formal dedication, station WLWO, Cincinnati, becomes the only international short-wave station in the United States authorized to operate on each of the six international wavelength groups with unlimited frequencies and with unlimited time.

The Federal Communications Commission has granted WLWO's application to operate on the 9, 11 and 16 mega-cycle bands, with exclusive frequencies.

The complete list of WLWO's frequencies in kilocycles now is as follows: 6,080, 9,590, 11,710, 15,250, 17,800 and 21,650.

A.R.P. Radio Link

IT is reported that an important step is being taken in a certain town to make it independent of the regional wireless station which, for two or three years, has been run by the neighbouring city police.

The basic idea of this installation is to be prepared for any grave contingency that might disorganize ordinary electrical communication.

The scheme is believed to be the first in the country. Two-way communication is provided for by means of a main 100 W. radio transmitter. All the police, fire, ambulance and A.R.P. services can be linked with quick action if needed. The outlay will be several hundred pounds. The Watch Committee has just approved the project, and details have been sent to the Home Office for confirmation.

Automatic S.O.S.

A NOther interesting "find" in one of the shot-down Nazi planes is a complete radio transmitter mounted in a waterproof metal container. The container holds a small transmitter, the necessary batteries and a motor which automatically keys the Morse signal, "S.O.S., S.O.S.", when the transmitter is switched on.

The transmitter can be used in conjunction with a form of "umbrella" aerial, filled on a long, thin mast, or with a kite aerial, the line for which is carried on a reel inside the container.

It is presumed that this transmitter is intended for use in the rubber dinghy used by pilots who have had to leave their machines when over the sea. This transmitter does not appear to be a regular part of the equipment of the Nazi planes, but is probably carried only when an important Nazi official is being flown.

Radio Training Scholarships

FIFTEEN scholarships in radio training in the radio department of the Cincinnati College of Music were awarded recently by station WLW in co-operation with the College. The scholarships, first of their type, are each valued at $100 dollars, and cut the winners to a year's tuition in residence at the College. The courses offered resemble those of announcing, production and sound effects.

Women Radio Operators for R.A.F.

BRITAIN'S air offensive, demanding more and more operational and training units of the R.A.F., is reflected in a new call for W.A.A.F. recruits. Young women, and therefore not so anxious to do the sort of job they know, or to learn a new one. Clerks, cooks, telephonists, women operators, sick quarter attendants—there is a job for every woman from 18 to 43.

Specially interesting is the work of women radio operators—"announcers," so to speak, of the R.A.F. For this post a high degree of intelligence is needed, and especially the capacity to keep cool and unruffled under any conditions. Younger women only are wanted—age 18-35.

Valves for German Aircraft Radio

AN interesting fact concerning the standard receiving equipment fitted to meet the German planes is that H.F. pentode valves are used exclusively; every valve in the set is interchangeable with any of the others. The valves have side contact bases and top cap; they are fitted in an inverted position and are held firmly in place. To withdraw them a small knob is screwed into a tapped hole in the plastic material base. The valves are very small and have some resemblance to 'acorns,' although being somewhat larger.

A Pilotless Plane

ACCORDING to an American inventor, Dr. Lee de Forrest, a pilotless "television torpedo" plane may be completed within a year. He states that the plane could be made from inexpensive plastics and would require no armour, so it would be a robot machine. The flight could be directed by radio from a mother ship ten miles or more away.

Television cameras could be placed in the nose of the plane, and a television transmitter could send pictures of the terrain below to a ground base or to the mother ship, where operators would be able to manipulate the 'plane. The Army authorities who are at present testing the plane say that it could also act as a robot bomber. It is estimated that the 'plane would cost between £250 and £300.

R.A.F. Require Radio Mechanics

RIGHT young men now have a chance to learn the expert trade of radio mechanic—"in the R.A.F. Formally, entry into this trade was reserved for skilled men; now a special course of training will be given to the right sort of candidate. The age limits are 18-30, and the standard for entry is fairly high. A school-leaving certificate or its equivalent is desirable, and applicants must be physically fit and mentally alert. It is a chance for the young man who is perhaps just below the standard for air crew duty.

A Canadian wireless operator at work receiving instructions for the gun crews when Canadian soldiers of the artillery recently carried out practice shooting "somewhere in England."

Selectivity!

A CUSTOMER of a Kent trader, who has a lodger who insists on listening to German broadcasts, wrote in asking that her set should be fixed so that she could tune in to the B.B.C. wavelengths, but could not get German stations. The trader commented that it might be simpler to get rid of the lodger.

Mansfield's War Weapons Week

IT is gratifying to learn of the effort made by the little town of Mansfield in connection with their War Weapons Week. Aising at a total of £200,000 the grand sum of £388,955 was finally received. The staff of Whitley Electrical Radio Co., Ltd., contributed £606 3s. 8d.
Noise Suppression

The Requirements of Noise-suppressing Devices Including Scratch Filters, and Their Application to Radiograms

In order to obtain satisfactory reproduction from gramophone records, it is necessary to provide means for controlling the frequency output from the pick-up. Just as it is essential to regulate the voltage output to compensate for the variations in the recording, so it is equally desirable to correct the frequency range to suit the amplifier and loudspeaker characteristics. The volume of sound will naturally be regulated by the usual control, which will be either incorporated on the base of the pick-up itself, or on the motor-board, or even in the radiogram, where it might be made double duty for both radio and gramophone reproduction.

On the majority of commercial sets no further provision is made for the pick-up, although, if the receiver includes a volume control, 'this will sometimes act to restrict the higher audio-frequencies, which in the region of about 3,000 cycles coincide with the scratch noises. For a number of technical reasons later explained, such tone controls are apt to spoil reproduction rather than improve it. The main reason is that the 'tone control' merely consists of a by-passing scheme for high notes, and since it is a desired frequency within its scope it seriously attenuates all adjacent lower high notes, due to the broad tuning effect.

High-note Loss

Consequently, in attempting the suppression of scratch, the user, unless very careful in selecting the control, is likely to rob the recording of its 'brilliance' imparted to the reproduction by those frequencies immediately below 3,500 cycles. A tone-control transformer included as an L.F. coupling will offer somewhat greater scope, but even so, in attempting the suppression of scratch noises, the response curve will be tilted to the base end, these latter frequencies then becoming more prominent.

Due to the limited bass notes in a modern electrical recording, this overemphasis by the tone control is a good fault and will lead the output up, provided, of course, in correcting the incorrectness not overdone. These remarks are tantamount to putting the cart before the horse, in that it is necessary to discover the causes of background noises in a pick-up before one is in a position to cure them.

Nearly all pick-ups operating on the electro-magnetic mechanical principle give rise to harmonics at the upper end of the frequency response curve. Modern versions possess substantially uniform characteristics, with a peak, due to the mechanical resonance of the armature, between 3,000 and 5,000 cycles, as shown by a falling response up to about 7,000 cycles. Owing also to the movement of the needle point on the record, a further needle scratch resonant circuit will be formed, and when the needle point is placed over the problem, the following interesting conclusions have been reached. (1) When, needle scratch is superimposed on the resonance noise, the resultant background is loud because of the increase in amplification which is incident to the resonant circuit. (2) As the noise is thus at its loudest at the armature resonance-point, reducing the amplification at the frequency of the armature will substantially reduce the background. (3) An asymmetrical condition of the pick-up armature—that is, when it does not affect the magnetic field uniformly due to being slightly out of mechanical centre or unequal magnetic pull—will result in the scratch varying in pitch with all high notes reproduced. A trace of noise from a gramophone record, due to it extending over a large range of frequencies, will quickly stimulate the pick-up armature into a natural resonance.

A Practical Scheme

It is obvious from the above that the removal of the natural resonance at the frequency of which it occurs offers the best solution, to pick-up noises, rather than the entire removal of all frequencies on and above the resonant point, such as would occur with so-called tone-controls. The use of a scratch filter, therefore, imposes the limitation that it must only suppress at the resonant frequency, leaving frequencies above that point unattenuated. A scheme as shown in Fig. 1 or in Fig. 2 will be found to fulfill these conditions, as both circuits are fundamentally the same. In each case, the variable controls provided on either device, it is possible to find the resonance point of the particular pick-up in use, as the action of the filter is a trough in the frequency response by acting as a short-circuit to alternating currents of the frequency to which it is tuned. This loss in the filter network can be made to cancel out the resonance gain, the nett result being a more level overall output. Prescriptive users of these filters should note that the inclusion of the series resistance restricts the voltage output of the pick-up and, therefore, the output valve must possess sufficient overall gain to load the output valve from a pick-up input about half that stated by the makers.

Surface Noise

The loss of output is unavoidable, as the filter circuit must of necessity include the series resistance to maintain a correct impedance ratio to the pick-up. On the other hand, any noticeable effect on the reproduction. Noises due to the friction of the needle on the surface of the record are unlikely to be restricted by the use of these filters except at the point of resonance, and short circuits of all frequencies between the middle and top note register (which would naturally ruin reproduction completely) there does not appear to be any possibility of restricting them. A similar trouble was experienced with the sound-track on films during their early days, and it was not until a system of making the silent part of the sound track came into being that the fault was overcome.

Radio Traffic Control in America

A Novel plan to bring traffic signals into cars in the form of distinctive tones corresponding to the "stop" and "go" lights, may in time make a car-radio a legal requirement on every car in America. In its present form, this traffic-control system uses the existing car radio tuned to 600 k.c., thus making the system immaterial to the radio owner. The use of this traffic-control system deals with the 0,000,000 cars now equipped with auto-radios, though eventually a special small set would be employed with fixed tuning to the highway safety signal frequencies.

By the use of this system, the driver, instead of letting his attention wander from the roadway in his search for traffic signals in unfamiliar territory, would hear a pleasant low tone as long as the lights ahead were green. When "red" comes on, in all cars on that section of the roadway an interrupted high note would be heard, like a crossing signal.

Recorded Messages

The small highway transmitting unit, which may be mounted on a telephone pole or a traffic light stanchion, makes use of a magnetic tape sounding recording device by which continuous repetition of a traffic bulletin or a safety message may be broadcast. A distinctive sign placed on the street in advance of a given radio zone calls attention of motorists to the radio system, which they are approaching, and tells them the frequency to which to tune their set.

Preventing Traffic Jams

By means of this device, traffic can be re-routed to a secondary thoroughfare from crowded highways, preventing jams before cars have a chance to pile up, and drivers can be warned of speed limits or of emergency in case of fire or accident.
A Three-range Short-wave Coil

Constructional Details of a Triple-range Coil
Unit for Experimental Receivers

In the past a short-wave set has been looked upon by many as rather a special instrument intended only for the more advanced experimenter. As a result, sets of this type were made in somewhat ' rakish ' form and were fitted with numerous ' gadgets ' and controls which, in themselves, were sufficient to scare the average listener away from short waves. But these things have changed, and a short-wave receiver now had the appearance of an ordinary broadcast set. Partly as a result of this, and partly because there are many S.W. stations giving out important programmes, the ordinary constructor is giving more attention to short-wave work. This is all to the good and the change will lead to greater simplicity of design and operation. The use of plug-in coils is becoming a thing of the past just as it did in respect to broadcast receivers a few years ago.

12-70 Metres

The three-range tuner of which particulars are given in Fig. 1 will cover the wavelengths from approximately 12 to 70 metres when tuned by a .0002 mfd. condenser. This range is a very wide one, of course, representing a frequency range of from 25,000 kilocycles to 4,250 kilocycles, and it is divided into three portions which give approximately 12 to 20, 18 to 38, and 35 to 70 metres respectively. It will be seen that the bands overlap slightly and so it is divided into three portions giving a very wide one of .0002 mfd. and .0003 mfd.

The change-over from one wavelength to another is effected by means of two ordinary push-pull switches which each short-circuit another is effected by means of two ordinary push-pull switches which each short-circuit one of the tuned windings. This is all to the good and the change will lead to greater simplicity of design and operation. The use of plug-in coils is becoming a thing of the past just as it did in respect to broadcast receivers a few years ago.

Parts Required

The few materials required to make the tuner are:

- One 3 fin. length of six-ribbed ebonite coil former, 1 fin. diameter. (The dimensions are measured outside the ribs.)

Six 8BA terminals.
Six feet 18-gauge enamelled wire.
Six feet 26-gauge enamelled wire.

Construction

First of all, drill six 1/4 in. holes around one end of the ebonite former and securely fix the terminals into them. Next make a pair of 3/16 in. holes about 1/2 in. away from the terminal end of the former, and anchor one end of the thinner wire in these, leaving a couple of inches of wire projecting inside the tube for later connections. The method of anchoring the wire is to pass the end through one hole, back through the other and back to the inside again through the first. Now wind on four turns, cut off the wire and secure the end by passing it through another pair of holes made in a suitable position.

Leave a space of about 3/16 in. and then make another pair of holes (about 3/16 in. this time) for securing the end of the thicker wire. Wind the end of the 18-gauge wire in these and wind on two turns before making a looped tapping as shown in detail on Fig. 1. Pass the loop through a 1/4 in. hole in the former and continue to wind on another three turns; make another loop and then put on the remaining seven turns. Terminate the winding by passing the wire through another pair of holes at the beginning. It will be seen from Fig. 1 that all the turns of the thicker wire are spaced about by the thickness of the wire; the spacing increases the tuner's efficiency by lowering its self capacity.

To prevent the turns from slipping, a good tension should be kept on the wire whilst winding. Lastly, put on the other portion (seven turns) of the reaction winding, leaving a space of 3/16 in. between it and the lower end of the tuned winding. To fix the turns more securely in position they should be given a coat of shellac varnish.

Using the Tuner

The tuner is very suitable for use in the aerial circuit of any short-wave set, adaptor or converter, and in each case the connections will be shown in Fig. 2. Suitable values for the more important components are also shown in the latter figure, and these will be adhered to with fair accuracy. The .0001 mfd. pre-set series aerial condenser is a necessity and prevents damping upon the length and capacity of the aerial employed as well as the wavelength range in use.

Both wavechange switches are of the normal two-spring push-pull type, but it is important that good ones should be used because if the contacts are not perfect they will give rise to cracking sounds. When both switch knobs are pushed in the highest wavelength range (35 to 70) is obtained; by pulling out switch " A " the range is from 18 to 38 metres, and by pushing " B " the range is from 12 to 20 metres. The capacities of tuning and reaction condensers are shown to be .002 mfd. and .00015 mfd. respectively. These values are most suitable, but they might be increased to .003 mfd. and .0002 mfd., or reduced to .001 mfd. and .0001 mfd. without affecting efficiency to any marked extent.

Both condensers should be good ones designed especially for short-wave work, and it is desirable (from the point of view of easy tuning) that the tuning condenser at least should be provided with a vernier control. The H.F. choke should, of course, be a special short-wave one and not of the ordinary type intended for a broadcast receiver.
THE conventional diode detector, a capacity is usually connected in shunt with the load resistance. The presence of this capacity frequency gives rise to difficulty because it may cause attenuation of the upper modulation frequencies, particularly if some of them are within the audio frequency range. As a result, in television receivers this difficulty is largely overcome in a new detector circuit originated in the laboratories of the Radio Corporation of America. This circuit is shown in the accompanying diagram. The R.F. input is fed to the diode 15 via the transformer 11, and the rectified direct current flows from the carrier frequency components by means of the neutralising winding 16 which is coupled from the grid and, connected in series with the grid of the amplifier valve 17.

NEW DETECTOR CIRCUIT
A Reader's Equipment

Sir,—The enclosed photographs of my gear may interest other readers.

In one photograph can be seen a three-valve (H.F. Pen.-v.-Pen.) short-wave receiver; while to the right is a five-valve A.C. superhet. Under this there are two gas-mack box receivers. The switches on the wall control all of the receivers solely from the operating position. The output from either short-wave receiver can be switched through to the 'phones, which are left permanently connected to a terminal block. On the other hand, the receivers can be switched through to the P.U. sockets of the 'phones if loudspeaker reception is desired. An audio oscillator can also be brought into operation for morse practice.

How do readers receive the Forces programme on the 40-metre band? I find that this station is badly "swamped" during the evening by some of the "local" Europeans. I often visit Eastbourne, Sussex, in connection with my work, and spend a few days there each time. I should like to meet any readers in that town (during the evenings) who are interested in amateur radio. Perhaps they would drop me a line giving their QRA, etc.

On the other hand, any readers in this district (especially those in the Services) will find a welcome at this address. It would be as well, though, if intending visitors would let me know by some means when to expect them.—S. E. Janes (72, Kimberley Road, Croydon, Surrey).

Matching Coils

Sir,—The article on a Spares-box Superhet in the December, 1940, issue mentions the difficulty of matching coils in order to use a ganged condenser in a home-made frequency changer. But this is not impossible, even without special appliances.

Twelve months ago, having decided to construct my own mains H.F., Det., and L.F. receivers into a superhet, I determined from the beginning to use a ganged condenser in the frequency changer stage. I will not say that it is easy for one who has not done it before, but it certainly can be done, and, with some care, accuracy of ganging can be evolved, and this was done, with the result that I now have a three-valve-band superhet, satisfactory on each waveband, and as easily tuned as any manufacturer's product. It differs from the superhet described in that it is fitted with a single F.C. valve, but this does not affect the question of ganging.—A. O. Griffiths (Wrexham).

[Bearing in mind that our remarks were intended for the average constructor, we think that A. O. G. proves that it is not an easy matter to obtain perfect ganging, or in other words, that it is practically impossible, for the man who would wish to build a set of the type under discussion, to secure ganging without some form of testing equipment. A.O.G. insists that he had to devise a system, and we feel sure that other readers would welcome more details of the procedure he found it necessary to adopt. —"The Experiments."]

Tuning-up

Sir,—I was rather pleased to note the advice the writer of the article, "Tuning-up Your S.W. Receiver" in the January issue, gave concerning aerials. For a long time I have been using an indoor arrange-
Get Busy

I t is not possible to generalise, owing to
the widely varying conditions in different
parts of the country and in our occu-
pations and hours of freedom, but all
members should make every effort to act
namely, my colleagues on the Technical
Station, and we hope that it will prove
useful DX, some of the best cards I received
being from K7FBE, K6NQZ, OQ6, many
VK's, VR6AY, V82AR, V8BA, and 41
VK states, all on telephony. All amateur
bands from 10 to 160 metres were covered
by means of plug-in coils of the four-pin
receiver date from early 1936, when I
constructed one, and I must admit I was
amazed at the DX capabilities of the
'toy' as I had thought. I had this receiver
in use in its original form for about two
months, and my log included all the more
usual DX, some of the best cards I received
being from K7FBE, K6NQZ, OQ6, many
VK's, VR6AY, V82AR, V8BA, and 41
VK states, all on telephony. All amateur
bands from 10 to 160 metres were covered
by means of plug-in coils of the four-pin
slow-motion reaction conditioner. I used a
3 megohm leak, .0001 mfd. grid-condenser,
and a 4500 ohm 'phones (V.A.M.) of the P.T.S.
100:1 airplane S.M. dial and their coils.
Great care was taken to prevent losses in
the tuned circuit; wiring was done of the
minimum, and all H.F. wires mounted
well clear of the metal baseboard. I
do agree with Mr. Yeates when he stresses
the importance of 'how you listen.' I
believe that almost any one-valver, which
has been reasonably well put together,
using good components, a suitable valve,
and also very important, efficient head-
phones, is capable of giving highly satis-
factory DX results, provided that the
operator is also up to his job. Reaction must
be carried out slowly and delicately, and one
must be prepared to hang on like grim death
to a certain frequency on the air, or
abandon the attempt, and try another
station, the widely varying conditions in
different parts of the country and in our occu-
pations.

Station Lay-out

O UR very active member, No. 6,773,
of Rotherham, certainly knows how
to pull in the DX transmissions, make
a decent station lay-out, and keep logs
which are legs in the true sense. We
reproduce below a plan sketch of his
station, and we hope that it will prove
of some guidance to others. He tells us
that his aerial systems include a 40ft.
high inverted ‘L,’ running due N.-S.
and another 50ft. high E.-W., and a directional
beam, 40ft. high, glow thanks, 6,773, for the great interest shown.
Can't you rope in a few more members
in your area, and form a local section?
Let's hear from you again.

Contact Required

A NEW young member (14k years),
living at 17, Runnymede Rd., Hall
Green, Birmingham, wishes to contact
someone about his own age.

0-V-0s

SOME very interesting remarks, concern-
ing super 0-1-0 rig, come from
Camm, in a letter from Member 6,320.
After the usual greetings he opens up with:
I have been following with great interest
the widely varying conditions in different
parts of the country and in our occu-
pations.

A rather unusual view of a den but, neverthe-
less, it shows that
member, 6,773 made
good use of his ex-
tensive equipment.

This illustration indicates the
handy size of
"The Radio
Engineer's Vest
Pocket Book,' which costs 3/6, or 3/9 by post.
It contains 160 pages of facts, figures
and formula, and easily slips into
the waistcoat or uniform pocket.
Send postal orders to The Publisher,
Book Department, George Newnes,
Ltd., Tower House, Strand, W.C.2.
Outline of Musical History 16

Landmarks in the Development of Modern Music
By our Music Critic, MAURICE REEVE

ACH, Beethoven and Wagner, they are the three great landmarks in the history and development of modern music. We are not denied effective names that all others covet. It is they who gave the cue as to what should be done; their laws and decrees have been almost immutable and, for better or for worse, to-day as they fashioned it—that is, so far as the classic forms are concerned. Other great critics they have been, of course, and the individuality of such masters as Mozart, Schubert, Liszt, Debussy and many others, are indisputable and unchallengeable. But the point I wish to drive home is this: that, with few exceptions, these incomparable masters didn't make music; they made their own dishes based on the recipes of the three great chefs named above.

Wagnerian Epoch

The death of Wagner, and of Brahms a few years later, marked the end of a truly memorable epoch. We can, perhaps, best realise the astounding progress and the amazing achievement, I think, when we recollect that less than fifty years earlier, between the writing of the "Unfinished Symphony" and "Tristan and Isolde," an age that half century seems to cover. Not an attempt to cover a good half of all the music we know, and it certainly does when we include in it, as we are entitled to, all the later masterpieces of Beethoven himself.

Russian School

The Wagnerian epoch ended in the hey-day of the great Russian school, composed of Tchaikovsky, Rimsky-Korsakov, Balakirew, Moussorgsky, Borodin, Khrennikow, and the several other lesser lights. They were, one might say, a transference eastward of the great romantic movement founded by Schumann, Beda and the others. Marvellous were some of the things they accomplished, and works like Tchaikovsky's symphonies, Rimsky's "Picerie Ruse," and "Coq d'or," Moussorgsky's "Cheremushka," "Ais Godonov," and Glina's "Une Vie pour le Czar," with many others, are among the most notable achievements of the century.

The music of these masters is like Wagner's, though born of entirely different motives, of a colour the vividity of which is frequently blinding, and of a passion the intensity of which is often overwhelming. It is music that goes right to the head, intoxicating and emotionally stimulating by turns. They are displayed in its writing is astounding, and many new orchestral effects of the most bizarre character were found.

Its most notable contribution was the founding of the great school of Russian opera, which has worthy taken its place beside that of Germany, France and Italy.

Bax

In England there was no outstanding musician to leave masterpieces to posterity or who could beat out new paths and find new formule for music to flow down to future glories. But in England there was an excellent school of scholarly minds, and of those, like Parry, Stanford, Sullivan, and MacKenzie, Bennett, and others, whose chief activities were in the realm of church music. Sullivan, of course, was the founder of the English light opera school.

Edward Elgar

But, whilst these men were keeping the torch of music alight in England, a giant was rising on his armour and was starting on the creation of a series of master works, which, apart from being incomparably the finest works in English music, stand worthy by the side of the myriads from the Continent. Edward Elgar, whose chief work is the fruit of the present century, wrote music in strict conformity with classical tradition, but his individuality and typically English outlook, coupled with a nobility and a sincerity, give his work a stature that few would care to deny or dispute. He was very like Brahms before him and that he followed hard in the footsteps of his great predecessors with-out striking many new paths for himself. But he was alone inasmuch as he had no native school of masters below, which was to achieve his principal work after 1900. This was the founder of the English light opera school.

Debussy

The modern Spanish school is a remarkable offshoot from the parent stem. Glittering, bizarre and intensely nationalistic, it has contributed a notable list of writer and works to the musical catalogues, particularly in the realm of ballet and piano solos. De Falla, Granados, Albéniz, Tárrega, Nin, are among the leaders.

Dvorak and Sibelius

We can only pass very rapidly over the scene, but in our brief glance the names of Grieg, Dvorak, Smetana, Sibelius, Scriabin, Faure, Ravel and de Falla cannot fail of recognition. Dvorak and Sibelius are both in the direct line of succession of the great symphonists. And in our own day men like Prokoviev, Bartok, Berg, etc., are struggling to make music say something new and finding the effort very difficult. But, whilst these men were keeping the opement of which the less said here the better. The only remark I would care to make would be to offer up a prayer of thanks that the English music since the death of Elgar, wrapped in the mist of having to deal in them, at least until such a time as they are curred with the invention of a piano with a keyboard that will stretch far down the corridor.

Bax

In England the rise of Elgar marked the evolution of a school of contemporaries which more than favourably compared with any on the Continent, but which was also as illustrious a band as in our own. Bax is a master of tone colour, and his palette has a variation of musical prints which are not only brilliant and daringly modern, but which, when wrapped in the unanswerably live and influence the future. Vaughan Williams, though sometimes extremely modern in his treatment of material, frequently turns to our collections of folk tunes for his inspiration. His "London" Symphony is a beautiful and moving picture of our now sadly harassed capital. There are also such as Ireland, Quilter, Walter, and many others.

What has music in store for us; what is its message? Has it said its say, or are they only the prelude to a new and incomparable to the St. Matthew Passion, the Seventh Symphony, and "Tristan and Isolde"! I shall hope to consider these questions in a future article.
Impressions on the Wax

A REVIEW OF THE LATEST GRAMOPHONE RECORDS

TUCKED away in the new Decca list is a most unusual record. Unusual in that it contains a duet by two outstanding stars of light music. They are Mantovani and Sidney Torch. The recording took place at the State Cinema, Kilburn, where Torch is the resident organist. The recording is of the lovely "Intermezzo" from the film "Escape to Happiness," while on the other side is Eric Coates' "The Sleepy Lagoon." The two stars are also to be heard separately this month. Torch has a new swing medley—"Piping Hot." Mantovani leads his famous orchestra through two tangos, "Jealousy" and "La Campanulita," on Decca F 7571.

Songs of Hawaii

This month the Decca Company devote a whole album to genuine "Songs of Hawaii" played by a real native orchestra—Ray Kinney and His Hawaiians. The traditional native songs of the islands were inspired, strangely enough, by hymn tunes introduced by missionaries years ago. Not that we can hear a very close connection between any well-known hymn and the songs in this album. This new album contains ten ballads, love songs and bulas written by such popular musicians as Charles King, James Kanake, Matilda Kauwe, Johnny Almeida and Johnny Noble (The Jazz King of Hawaii). Ray Kinney, whose orchestra and singers are all natives of the islands, is himself a delightful singer and he is ably abetted by the high falsetto singing of George Kaimo and other vocal work by Henry Paul and Trio. This album is strongly recommended to all who want the real thing—but a word of warning, the titles in the original language are the most unpronounceable thing we know. (Decca Album No. 23: F 7373-7377)

Musicians in the R.A.F.

DANCERS and variety-goers who miss the old faces on the stand and on the stage will be glad to know that musicians who have joined the Services are still making records. Under the name of the R.A.F. Squadronaires a number of musical stars from such famous bands as those directed by Ambrose, Bing Crosby, Billy Cotton and Jack Payne have banded themselves together as a new dance band. This month, Decca releases their record of "By the Waters of Minnetonka," and "The Song is Ended." (Continued on page 163)

Variant

No subject is quite so fascinating as the study of current song titles. This month has produced a very good crop that ranges from "Get Your Boots Laced Papa," which, played by Woody Herman and his orchestra, takes up two sides of Brunswick 03033, to "Little Orly Hair on a High Chair," by Jimmy Dorsey's Orchestra on Brunswick 03027. Between these two there is the odd title, "Honky Tonk Train Blues," by Milt Berth, on Brunswick 03026.

The Casa Loma Orchestra make four sides from the new Bing Crosby film "If I Had My Way." Best seller of the four should be "Pessimistic Character," on Brunswick 03030. Ambrose has a hit in "Cassy On," on Decca F 7580, and Robert Ashley sings on the Jack Payne record of "I'll Be Waiting For You," on Decca F 7561.

Bing Crosby leads the new vocal records with the hits from his new film, "April Played the Fiddle" and "I Haven't Time to be a Millionaire," on Brunswick 03031.

**CONSIDER THE FOLLOWING FACTS!**

- Exclusive Celestion-Amphenol Moulded-in Plates ensure maximum strength, rigidity and a high degree of efficiency.
- The sturdy plates keyed into the body cannot rattle loose.
- UNIFORM CONTACT ! INSULATION !
- Ceaestion-Amphenol Contacts pressed from specially treated phosphor bronze are engineered to ensure uniform contact on all prongs.
- There will be no "fatigue" even after constant use.
- Exceptional insulation is assured by the special properties of the moulding powder.

**CELESTION-AMPHENOL VALVEHOLDERS**

are specified for The A.C. Two-valve Amplifier described in this issue.

**ALL STANDARD BRITISH AND AMERICAN TYPES IN STOCK.**

**CELESTION LIMITED**

ENGINEERS,

KINGSTON-UPON-THAMES, SURREY

Telephone: Kingston 5456-7-8
Columbia


On the vocal side we have Nelson Eddy singing "The Magic of Your Love" and "Ride Cossack, Ride" on Columbia DB 1911; Walter Midgeley has recorded "The Mountain of Happiness," which he couples with "So Deep is the Night" on Columbia DB 1934; and Turner Layton makes yet another record success with "We'll Go Smiling Along" and "Stay in My Heart," on Columbia FB 2486.

If you want to enjoy a good laugh then you should hear Stanley Holloway telling "your" joke about "The Lion and Albert," and "Albert Comes Back" on Columbia FB 2482. Jack (Blue Pencil) Warner is also in cheerful vein with " Claude and His Sword" and " Alouette," a traditional Canadian song on Columbia FB 2484.

His Master's Voice

I NTERESTING sets of records which have recently been released by the H.M.V. Company contain recorded speeches broadcast by the Prime Minister, the Rt. Hon. Winston Churchill, M.P., on the progress of the war. They cover a period from May to September, 1940. Among the vocalists who appear in this month's list are Webster Booth, singing "The Star of Bethlehem," "The Holy City" on H.M.V. C3190; John McCormack, the Irish tenor, who also sings two religious songs—"Still Night," "Holy Night," and "Legend—Cape of Good Hope" on H.M.V. DA1755, and finally the well-known Australian baritone, Peter Dawson, revive two old Irish songs—"The Mountains of Mourne" and "Phil the Fluter's Ball" on H.M.V. B9114.

"Max Miller with the Forces," which are recordings of an actual performance, give us eighteen minutes of "The Cheeky Chappie" on three records—H.M.V. BDS85-5, which are sold complete in a portfolio for 6s. 6d. The other records containing recordings of favourite scenes, songs and music from "Peter Pan" are also supplied in a delightfully decorated portfolio for 10s. 6d. The owners of the talking part are Jean Robertson as Peter Pan, Dinah Sheridan as Wendy, and Gordon Harker as Captain Hook. Profits from these records—H.M.V. DX 981-7—are being paid to the Hospital for Sick Children.

WINTER IS CREATING A BOOM IN EXTENSION SPEAKER LISTENING . . .

Thousands discovering the joy of a Stentorian . . .

This winter is introducing a rapidly increasing number of listeners to a new radio pleasure: "music where they want it!" Free from the restrictions of one-room radio, they are enjoying their favourite programmes in the Shelter, whilst working in the kitchen, or wherever it is convenient to listen; and all by the simple connection of a Stentorian Extension speaker to their existing radio. What's more, these handsome but moderately priced speakers offer an appreciable improvement in reproduction over most built-in speakers. Why not make full use of your radio this winter by installing a Stentorian? Cabinet models from 21s. 6d.

Illustrated literature on request.
New Circuits for Permeability Tuning

Variation of Core Permeability with Signal Current, and Some Applications

In conventional tuned circuits of the type having inductance with ferromagnetic or magnetic cores the change in permeability of the cores in operation is relatively small, and usually is not measurable because of the low flux density and relatively large volume of the cores ordinarily provided. It has been found, however, that with magnetite core tuning inductances, the permeability may be varied appreciably as the flux density in the core is increased to a relatively high value.

The flux density may be increased by the presence of strong signals, in an I.F. amplifier, which increase the signal current flow through the inductance, or the core volume may be decreased to a relatively small percentage of a normal core volume. As a result of a relatively high flux density, it is possible to shift or vary the resonant frequency of a tuned circuit embodying such an inductance, over a relatively wide frequency range with a relatively narrow range of variation in the strength of the applied signal or signal voltage, because of the change in permeability, and that, for maximum change of flux density with relatively small voltage change, a low L.C. ratio in the tuning inductance is necessary.

As shown in Fig. 2 by the curve 12, it has been found to be possible to shift the resonant frequency of the tuned circuit 5 by 460 kcs, for example, to 430 kcs, with an R.F. voltage change from zero to substantially 10 volts. This is with a low L.C. ratio in the tuned circuit 5. With a higher L.C. ratio, the response curve may be as indicated at 13 in Fig. 2, requiring a wider variation of voltage E across the tuned circuit to obtain the same shift of the resonance point.

The value of the capacitor 7 or the value of C in the circuit 5 was 400 μmf, for obtaining the curve 13, while for obtaining the curve 12, a capacity of 4,000 μmf was employed across the tuning inductance. The lower L.C. ratio provides a higher current through and a lower voltage across the tuning inductance. With a higher value of tuning capacity, it is obvious that for the same frequency or frequency range the value of the inductance 6 and the number of turns on the winding must be lower. However, it has been found that with a lower number of turns, the flux through the core is increased appreciably because of the fact that the flux varies as the square of the current, and only as the first power of the inductance.

The ratio of the reactance of the inductance 6 to its high-frequency resistance, or the Q of the coil, is reduced with increase in the strength of the signal applied through the circuit 8 to the circuit 5, because of the increase in the permeability, and this results in a decrease in the gain of any amplifier stage in which the circuit is employed. A higher value is a desirable feature since it reduces the gain or stabilizes the Q and permits increased gain automatically for weak signals.

As will be seen from the curves of Fig. 2, the voltage E required to change the resonant point or tuning of the circuit 5 through a relatively wide frequency range may be varied over a relatively wide range or a relatively narrow range, depending upon the L.C. ratio of the tuning elements in the circuit. This permits considerable latitude in the design of the circuit.

In any case, however, the range of frequency variation and the variation of the Q of the coil is relatively high only when the flux density is increased to a relatively high value, and this is accomplished not only by providing an inductance winding having a magnetite core of relatively low volume or cross-section whereby the flux density is high per unit volume of the core, but is also made possible at a lower input voltage E, by providing the tuned circuit with a high Q of the coil.

In any tuned circuit, it is unnecessary to depart from the desirable features of magnetite core tuning to obtain a shifting of the resonant point or a frequency variation in the tuned circuit, since to obtain this characteristic, it is merely necessary to decrease the length and diameter of the coil and core assembly in such a manner that the flux density per unit volume of the core is increased, and for a maximum change in frequency with low voltage change, a low L.C. ratio is used in the tuned circuit.

I.F. Amplifier Circuit

Referring now to Fig. 3, an intermediate-frequency amplifier circuit is shown in which a valve 15 is provided as the last intermediate-frequency amplifier stage preceding a second detector valve 16 in the shunt tuned or cross-tuned receiver. The detector is of the diode rectifier type comprising a pair of diode electrodes 17, connected to the secondary 18 of I.F. coupling transformer 19, which is coupled in series with a coupling coil 20, and is shunted by an adjustable capacitor 21.

The output circuit 22 of the I.F. amplifier valve 15 is connected with the tuned...
primary winding 23 also provided with a shunt tuning capacitor 24, so that the two tuned circuits may respond to the same frequency

The secondary circuit 18-20 is connected at its low potential end through a diode output resistor 51 to the cathode 26, and to the filter capacitor 53.

Audio-frequency signals output is derived from the resistor 25 through an output diode output resistor 25 to the cathode 26. Associated with the grid 28, tuned circuit 45 carries through signals for, further amplification and utilisation from the resistor 25 through an output diode output resistor 25 to the cathode 26.

Tuned Input Circuit

The I.F. amplifier valve 18 is provided with a tuned input circuit comprising a tuning inductance 35, and a shunt tuning capacitor 36, the tuning the tuned primary of which is indicated at 35. The secondary 30 is tuned by the shunt capacitor 36 and also by a core 39 the tuned primary of which is indicated at 40 on the controlling circuit by an amount at least sufficient to increase in negative bias the inductance 35 with a source of A.V.C.

The secondary 45 may be connected across the tuned circuit 45 will. The frequency being decreased with in

The secondary circuit 18-20 is connected at its low potential end through a diode output resistor 51 to the cathode 26, and to the filter capacitor 53.

Audio-frequency signals output is derived from the resistor 25 through an output diode output resistor 25 to the cathode 26. Associated with the grid 28, tuned circuit 45 carries through signals for, further amplification and utilisation from the resistor 25 through an output diode output resistor 25 to the cathode 26.

Tuned Input Circuit

The I.F. amplifier valve 18 is provided with a tuned input circuit comprising a tuning inductance 35, and a shunt tuning capacitor 36, the tuning the tuned primary of which is indicated at 35. The secondary 30 is tuned by the shunt capacitor 36 and also by a core 39 the tuned primary of which is indicated at 40 on the controlling circuit by an amount at least sufficient to increase in negative bias the inductance 35 with a source of A.V.C.

The secondary 45 may be connected across the tuned circuit 45 will. The frequency being decreased with in

The secondary circuit 18-20 is connected at its low potential end through a diode output resistor 51 to the cathode 26, and to the filter capacitor 53.

Audio-frequency signals output is derived from the resistor 25 through an output diode output resistor 25 to the cathode 26. Associated with the grid 28, tuned circuit 45 carries through signals for, further amplification and utilisation from the resistor 25 through an output diode output resistor 25 to the cathode 26.

Tuned Input Circuit

The I.F. amplifier valve 18 is provided with a tuned input circuit comprising a tuning inductance 35, and a shunt tuning capacitor 36, the tuning the tuned primary of which is indicated at 35. The secondary 30 is tuned by the shunt capacitor 36 and also by a core 39 the tuned primary of which is indicated at 40 on the controlling circuit by an amount at least sufficient to increase in negative bias the inductance 35 with a source of A.V.C.

The secondary 45 may be connected across the tuned circuit 45 will. The frequency being decreased with in

The secondary circuit 18-20 is connected at its low potential end through a diode output resistor 51 to the cathode 26, and to the filter capacitor 53.

Audio-frequency signals output is derived from the resistor 25 through an output diode output resistor 25 to the cathode 26. Associated with the grid 28, tuned circuit 45 carries through signals for, further amplification and utilisation from the resistor 25 through an output diode output resistor 25 to the cathode 26.

Tuned Input Circuit

The I.F. amplifier valve 18 is provided with a tuned input circuit comprising a tuning inductance 35, and a shunt tuning capacitor 36, the tuning the tuned primary of which is indicated at 35. The secondary 30 is tuned by the shunt capacitor 36 and also by a core 39 the tuned primary of which is indicated at 40 on the controlling circuit by an amount at least sufficient to increase in negative bias the inductance 35 with a source of A.V.C.

The secondary 45 may be connected across the tuned circuit 45 will. The frequency being decreased with in

The secondary circuit 18-20 is connected at its low potential end through a diode output resistor 51 to the cathode 26, and to the filter capacitor 53.

Audio-frequency signals output is derived from the resistor 25 through an output diode output resistor 25 to the cathode 26. Associated with the grid 28, tuned circuit 45 carries through signals for, further amplification and utilisation from the resistor 25 through an output diode output resistor 25 to the cathode 26.

Tuned Input Circuit

The I.F. amplifier valve 18 is provided with a tuned input circuit comprising a tuning inductance 35, and a shunt tuning capacitor 36, the tuning the tuned primary of which is indicated at 35. The secondary 30 is tuned by the shunt capacitor 36 and also by a core 39 the tuned primary of which is indicated at 40 on the controlling circuit by an amount at least sufficient to increase in negative bias the inductance 35 with a source of A.V.C.

The secondary 45 may be connected across the tuned circuit 45 will. The frequency being decreased with in

The secondary circuit 18-20 is connected at its low potential end through a diode output resistor 51 to the cathode 26, and to the filter capacitor 53.

Audio-frequency signals output is derived from the resistor 25 through an output diode output resistor 25 to the cathode 26. Associated with the grid 28, tuned circuit 45 carries through signals for, further amplification and utilisation from the resistor 25 through an output diode output resistor 25 to the cathode 26.

Tuned Input Circuit

The I.F. amplifier valve 18 is provided with a tuned input circuit comprising a tuning inductance 35, and a shunt tuning capacitor 36, the tuning the tuned primary of which is indicated at 35. The secondary 30 is tuned by the shunt capacitor 36 and also by a core 39 the tuned primary of which is indicated at 40 on the controlling circuit by an amount at least sufficient to increase in negative bias the inductance 35 with a source of A.V.C.

The secondary 45 may be connected across the tuned circuit 45 will. The frequency being decreased with in

The secondary circuit 18-20 is connected at its low potential end through a diode output resistor 51 to the cathode 26, and to the filter capacitor 53.

Audio-frequency signals output is derived from the resistor 25 through an output diode output resistor 25 to the cathode 26. Associated with the grid 28, tuned circuit 45 carries through signals for, further amplification and utilisation from the resistor 25 through an output diode output resistor 25 to the cathode 26.

Tuned Input Circuit

The I.F. amplifier valve 18 is provided with a tuned input circuit comprising a tuning inductance 35, and a shunt tuning capacitor 36, the tuning the tuned primary of which is indicated at 35. The secondary 30 is tuned by the shunt capacitor 36 and also by a core 39 the tuned primary of which is indicated at 40 on the controlling circuit by an amount at least sufficient to increase in negative bias the inductance 35 with a source of A.V.C.

The secondary 45 may be connected across the tuned circuit 45 will. The frequency being decreased with in

The secondary circuit 18-20 is connected at its low potential end through a diode output resistor 51 to the cathode 26, and to the filter capacitor 53.

Audio-frequency signals output is derived from the resistor 25 through an output diode output resistor 25 to the cathode 26. Associated with the grid 28, tuned circuit 45 carries through signals for, further amplification and utilisation from the resistor 25 through an output diode output resistor 25 to the cathode 26.

Tuned Input Circuit

The I.F. amplifier valve 18 is provided with a tuned input circuit comprising a tuning inductance 35, and a shunt tuning capacitor 36, the tuning the tuned primary of which is indicated at 35. The secondary 30 is tuned by the shunt capacitor 36 and also by a core 39 the tuned primary of which is indicated at 40 on the controlling circuit by an amount at least sufficient to increase in negative bias the inductance 35 with a source of A.V.C.

The secondary 45 may be connected across the tuned circuit 45 will. The frequency being decreased with in

The secondary circuit 18-20 is connected at its low potential end through a diode output resistor 51 to the cathode 26, and to the filter capacitor 53.

Audio-frequency signals output is derived from the resistor 25 through an output diode output resistor 25 to the cathode 26. Associated with the grid 28, tuned circuit 45 carries through signals for, further amplification and utilisation from the resistor 25 through an output diode output resistor 25 to the cathode 26.

Tuned Input Circuit

The I.F. amplifier valve 18 is provided with a tuned input circuit comprising a tuning inductance 35, and a shunt tuning capacitor 36, the tuning the tuned primary of which is indicated at 35. The secondary 30 is tuned by the shunt capacitor 36 and also by a core 39 the tuned primary of which is indicated at 40 on the controlling circuit by an amount at least sufficient to increase in negative bias the inductance 35 with a source of A.V.C.

The secondary 45 may be connected across the tuned circuit 45 will. The frequency being decreased with in

The secondary circuit 18-20 is connected at its low potential end through a diode output resistor 51 to the cathode 26, and to the filter capacitor 53.

Audio-frequency signals output is derived from the resistor 25 through an output diode output resistor 25 to the cathode 26. Associated with the grid 28, tuned circuit 45 carries through signals for, further amplification and utilisation from the resistor 25 through an output diode output resistor 25 to the cathode 26.
American Valve Details

"I am using a receiver which employs valves of the American types having 6.3 volt heaters. I have now been given a new valve marked 6N7, but as I am without any information concerning its characteristics, I am at a loss to know how to use it. Can I obtain information about it in my present set? Could you oblige by giving me the chief details?"—F. B. (Brighton).

We cannot say whether you can use it or not, as we are without any information of the circuit, therefore we hope that the details given below will enable you to determine for yourself.

According to the R.C.A. Manual, the 6N7 is a Class B twin triode. It is of the all-metal type and consists of two high mu triodes designed for Class B operation, contained in one casing. The triode unit has separate external connections for all electrodes except the heaters and cathodes. Heaters work at 6.3 volts; 8 amperes. Maximum anode voltages 300 volts. Peak anode current, 125 mA. Average anode dissipation, 10 watts. Typical operating conditions: 45 volts plate, 50 volt signal, 0.4 miliampere grid-current, anode to anode load of 8,000 ohms and a power output of approximately 8 watts. It is fitted with an octal base, the connections being 2 and 7 heaters; 8, cathode; 4, grid No. 2; 5, grid No. 3, anode No. 2; and 6, anode No. 1. Fin No. 1 is blank.

Argon Charger

"I have been using this very efficient L.T. charger ever since you published its constructional details. Wishing to secure a spare rectifying valve, I found that the one specified is now no longer obtainable. Can you suggest an alternative which will not necessitate any modification of the wiring or assembly?"—T. R. T. (Wimbledon).

As the original valve is no longer being produced by the makers, it will be quite necessary, in order to use one made by Messrs. Philips, to utilise a condenser number, as the price, before the Purchase Tax came into force, was 1s. 6d. The address of the firm is, Messrs. Philips Lamps, Ltd., Philips, Strand, London, W.C.2.

Meter Range

"I have become interested in making a multi-range test meter, but I notice that in my present set there is a shortage of skilled workmanship and the cost of the meter is prohibitive. Can you suggest an alternative which will enable you to determine this for yourself. Without any information of the circuit, therefore I am at a loss to know how to proceed.;—T. P. (Chester).

To reply formally to an inquiry of this sort, it is essential for all work to be carried out at the nearest office. The usual forms of business correspondence are to be handled as under-mentioned.

1. Forward your query to the Editor, PRACTICAL WIRELESS, Money Newton, Tower House, Southampton Street, London, W.C.2. The coupon on page 168 must be enclosed with every query.

2. For answers or explanations, the coupon must be attached to the reply. These forms are dealt with by a department of general interest.

3. Apply current and voltage tests to the receiver; tune in the normal frequency and not the number of hours it is in use and the conditions prevailing in the particular part of the country concerned. At the present time there is a shortage of skilled service engineers, and it would seem that now is the opportunity for anyone entering the sphere of the radio industry, provided that they have sufficient practical and theoretical knowledge and are familiar with modern commercial receivers. To make a success of a commercial business, it is essential for all work to be carried out quickly, efficiently and in a thorough manner, giving attention to all details. The usual form of business correspondence should be used and it is best to keep within the specified limits. The actual capacity of the cell, one be as high as 2 volts. Therefore, you must adjust the sensitivity to the number of hours you put the cells on charge, or because the point raised is not of general interest.

4. If you are prepared to experiment with any of the devices described, the answer will be given to you, and it will be sent to you, together with the reply, along with the information which you require.

Crystal Set Selectivity

"I am using a crystal set for headphone work on my 20 S.W.G. tin wire, whilst I am using a low end of valves with the strength and quality of its reproduction, its lack of selectivity allows very annoying interference to be experienced. Is it possible, without using valves, to make the circuit more selective and not lose any of its power?"—H. N. A. (Wembley).

If you are prepared to experiment with the crystal set, you will be able to make the circuit more selective and not lose any of its power. You will be able to do this by connecting a flexible wire to the free end of the crystal and using a small battery. The battery should be connected to the crystal through a resistor. This resistor should be of the same value as that used in the circuit described."—F. B. (Brighton).

We have not published a blue-print of this circuit, but it will be found that the device described allows very powerful interference to be experienced. You will be able to do this by connecting a flexible wire to the free end of the crystal and using a small battery. The battery should be connected to the crystal through a resistor. This resistor should be of the same value as that used in the circuit described. Of course, you will be able to do this by connecting a flexible wire to the free end of the crystal and using a small battery. The battery should be connected to the crystal through a resistor. This resistor should be of the same value as that used in the circuit described.
OUTPUT WATTAGE.

ESTIMATING the actual output of a power or pentode valve, especially when one attempts to do so by ear, is a matter which so often produces very inaccurate figures. Quite a number of constructors confuse the anode dissipation of a valve with its A.C. output. The first is obtained by multiplying the anode current by the anode high-tension voltage, i.e., direct-current wattage, but it must be appreciated that the figure thus obtained does not denote the wattage of the output so far as the loudspeaker and the signal is concerned. The efficiency of a valve is low, and it is quite feasible to assume that, say, only 25 to 50 per cent. of the anode dissipation wattage can be considered as being the amount delivered to the speaker. For example, supposing a power valve of the battery-operated type has an anode current of 10 mA's at a certain grid-bias. This current will be flowing the whole time the valve is in operation, and in view of its D.C. nature, will not produce variations in the speaker. A signal, however, on being applied to the grid, varies the grid potential above and below its standing value supplied by the G.B. battery. This effect, in turn, causes similar variations above and below the 10 mA's anode current, and it is these variations which cause the loudspeaker to operate in sympathy with the signal.

One has to be very experienced to estimate A.C. wattage output by ear. For instance, supposing the output from an amplifier was reduced or increased until the average person estimated that it was half or double as loud as the original, it would be found, and this fact has been proved by extensive tests, that the actual ratios of the power (the original to the new) were in the neighbourhood of 6.3:1 or, in other words, an output of one watt would only sound half as loud as one rated at 6.3 watts. It is very difficult for a normal person to distinguish a variation in output of 50 per cent., but, as strange as this may seem, it is an actual fact, and only goes to prove how careful one has to be when attempting to judge the output by sound alone.

PERSONAL PARAGRAPHS

G. A. Marriott, manager of the Osram valve department of the G.E.C., has been elected as the new chairman of the British Radio Valve Manufacturers' Association.

Two brothers, E. G. Baker and H. C. Baker, who have served the G.E.C. for a period, between them, of 104 years, have just retired. The former has been associated with the wires and cables department, and the latter with the order department, both at Magnet House.

Wright and Weaire, Ltd., recently attained their majority, the firm having been engaged in the radio industry for 21 years. Both J. G. Wright and T. G. Weaire have been associated in the business during the whole of this period.

We regret to record the death, early in December, of Mr. Charles Oliver, founder of the firm bearing his name, at Woolwich, and one of the pioneers of the electrical industry.

It is now some forty-three years since Mr. Oliver started a small factory under the name of Oliver and Company to manufacture arc lamps. He was later joined by the late Mr. W. M. D. Pell, son of Mr. Pell, of Brookie-Pell fame, and Mr. Oliver then designed and produced in 1914 the longest burning magazine-frame lamp then known, and these lamps, installed in the City of London as long ago as 1914, are still in service.

Among the designs and developments he fostered, his system of distance control, or switchgear by mains ripple, the initiation and development of the Varley Magnet Coin-winding Company, now one of the largest in the country for this work, and the manufacture of Varley Wireless Sets and components well-known for their quality, stand out as pre-eminent. In recent years, the developments of the Varley Driy Accumulator, and storage battery with no free acid, occupied much of his time, and now appears to hold excellent future prospects.

His close personal linking of technical and managerial problems in the business have, during his lifetime, resulted in the steady expansion of the original factory, until now, Oliver Pell Control Limited and its subsidiaries, employing some nine hundred men and women, will remain a monument to one of the old pioneers.

A FINE BOOK FOR THE BEGINNER!
EVERYMAN'S WIRELESS BOOK
By F. J. CAMM
5/- or 5½ by post from George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

TRAINED MEN URGENTLY NEEDED

NEVER before has there been such an urgent demand for trained radio men. There's a job waiting for you; or you can earn good money in your spare time.

Are you liable for military service? The R.A.F. is appealing for radio men, and many of our students have already been accepted as Radio Mechanics, Operators and Instructors. They like the work and the pay is good.

You can study at home in your spare time and become a qualified Radio Engineer. Even if you know nothing about radio, we can train you.

Hundreds of our students who had no previous knowledge or experience of radio have secured well-paid employment or spare-time work as a result of our training.

Our Home-Study Courses are praised and recommended by leading Radio Authorities. Our fees are reasonable and can be paid by easy monthly instalments.

Wherever you live you can study at home without interfering with your ordinary occupation. Do not delay, but post coupon now for full details of our Courses.

We have moved from London and Ealing; our new address is:

T. & C. RADIO COLLEGE
29, Market Place, READING.

ADVERTISEMENTS

Keep that happy expression

In good times or bad, wherever you are, keep to that happy expression "Player's Please." The cigarette which makes happy expressions everywhere.

PLAYER'S PLEAS Please

PLAYER'S NAVY CUT CIGARETTES. MEDIUM OR MILD. PLAIN OR CORK TIPS.

Please send me free details of your Home-Study Radio Courses.

NAME
ADDRESS
P. 12.
MILES IN FRONT!

A Candler trained operator now serving in the R.A.F. says:-

"...I should like to thank both yourself and the company for the great start which was obtained through taking your Junior Code Course. The experience which I gained from that, has kept me 'in front' of others who relied on obsolete methods of learning code."

CANDLER CODE COURSE

There are Candler Code Courses for beginners and also for those who desire to increase their "v.p.m." speeds.

There's no royal road to learning—but there IS a quick way to genuine CODE skill. Thousands of Candler Trained Operators, including many in the Services, have proved the value of this truly remarkable system of Code instruction.

In the "BOOK OF FACTS," which will be sent FREE on request, full information is given concerning the subjects covered by the complete Candler System.

Terms: cash or weekly layoffs.

COUPON

Please send me a Free Copy of Candler "Book of Facts."

NAME:

ADDRESS:

Post in 1d. unsealed envelope to London Manager, CANDLER SYSTEM CO., 121, Kingsway, W.C.2.

TAYLOR-METER

32 RANGE UNIVERSAL METER

Sensitivity 1,000 ohms per volt, A.C. and D.C.

set testing functions of A.C. and D.C. precision instruments, covering ranges essential for carrying out accurate measurement for radio and general test work.

Model 90, PRICE £9.9.0 (No purchase tax payable)

Complete with leads, test prods and comprehensive book of operating instructions. Delivery 4 to 6 weeks.

STUDY THESE FEATURES:

METCAL, 41 square type Taylor moving coil meter.

Sensitivity of 500 microamperes. SCALERS. The large dial has 3 clearly engraved scales for measurement of resistance, A.C. and D.C. volts and amperes. RANGES. The 32 ranges include:-(7) D.C. Volts 0-0.05 up to 1,000. (6) A.C. Volts 0.05 up to 1,000. (5) D.C. Current 0-1 mA. up to 2.5 amps. (4) A.C. Current 0-1 mA. up to 2.5 amps. SOCKETS and PLUGS on the front panel. "Common", "Test", "1,000V" and "Output". ACCURACY. A high degree of accuracy is assured, as every instrument is carefully self-calibrated to British Standards. MODEL 95, 17 RANGE D.C. Meter. £7.17.0 (Free postage free on request). BRITISH MADE. GUARANTEED 6 MONTHS.

TAYLOR

CHALLENGER RADIO CORPORATION

announce their new War Time policy, "One Super-Effective Receiver a Year." Send for details and a Powerfully illustrated War-Time Catalogue. also available, valves at competitive prices, and P.A. Speakers.


PRACTICAL WIRELESS

February, 1941

READERS' BARGAINS

TRANSFORMERS, Valves, Speakers, Coils, etc.

SOUTHERN Radio's Bargains.

5-15" Candler System, Volume Controls, Wire, Circuits, etc. Value £25.00, 5/- .

15- service Man's Component Kit, Electrolytic Condensers, Volume Controls, Wire, Circuits, etc. Value £35.00, 10/-.

SOUTHERN Radio, 14 to 18, Holborn, London, EC.1.

EXCHANGE Motor Speaker, Four Maina Valves, Minna Transformer, Dual Range Coil, Ultraformer.-A. Stevens, 10, Everest Close, Welling, Kent.

RECEIVERS AND COMPONENTS

SOUTHERN Radio, 14 to 18, Holborn, London, EC.1.

FREE advice bureau coupon

This coupon is available until February 1st, 1941, and must accompany all Queries and Hints.

PRACTICAL WIRELESS, February, 1941.
Radio Clearance, Ltd.

Radio Clearance, Ltd.

FRED'S RADIO CABIN

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.

Radio Clearance, Ltd.
This IMPORTANT GUIDE to SUCCESSFUL ENGINEERING CAREERS

After months of intensive effort and research we are pleased to announce that the new edition of our handbook, "ENGINEERING OPPORTUNITIES," is now out of the publishers' hands and ready for free distribution. Containing 208 pages of practical guidance, this book is, beyond argument, the finest and most complete handbook on Successful Engineering Careers ever compiled. It is a book that should be on the bookshelf of every person interested in engineering whatever his age, position or experience.


WE DEFINITELY GUARANTEE "NO PASS—NO FEE"

If you are earning less than £10 per week you cannot afford to miss reading "ENGINEERING OPPORTUNITIES."

In your own interests, we advise you to write (or forward the coupon) for your copy of this enlightening guide to well-paid posts NOW. There is no cost or obligation of any kind.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY
Principal: Professor A. M. Low
409a, SHAKESPEARE HOUSE, 17, 18 & 19, STRATFORD PLACE, LONDON, W.I.