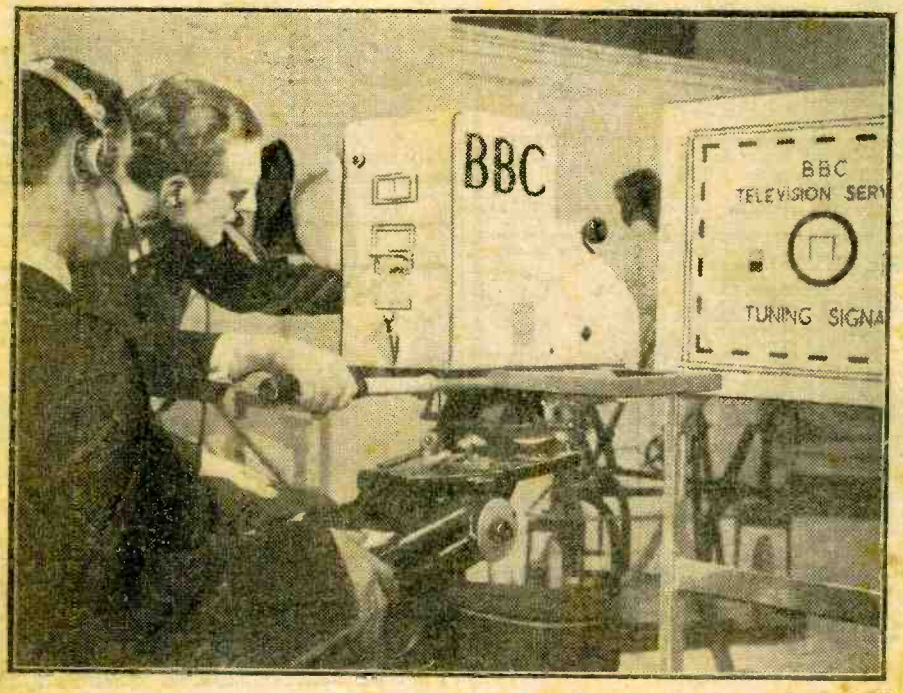
AUTOMATIC TWO-VALVER

Practical Wireless

9D EVERY MONTH

Vol. 24. No. 503. || Editor: F. J. CAMM || JUNE, 1948



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Measuring Meter Resistance

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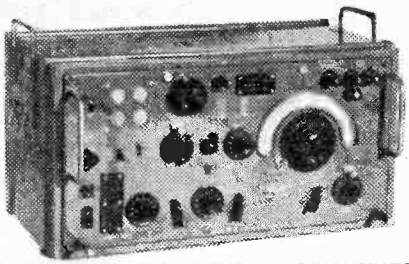
6F8	—	10/6	VU134	(HVR2)	10/-
6V6	—	8/6	VU39	(R3)	9/-
CV6	—	5/-	VR137	(EC52)	5/-
VR65	(SP41, 6.3 v.)	5/-	VR136	(EF54)	7/6
VR92	(EA50)	5/-	VS70	(7475)	7/6
VR56	(EF36)	6/-	VT60A	(807 Ceramic)	10/-
VT52	(EL32)	6/-	717A	—	7/6
VR55	(EBC33)	5/-	12SH7	—	7/6
VT86	(6K7 met)	10/6	12SL7	—	10/-
VR503	(KT33C)	10/-	12A6	—	7/6
VR53	(EF39)	5/-	VR91	(EF50)	6/6
VR57	(EF32)	7/6	RL18	—	12/6



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SP.250B.	250-0-250 v. 60 m/a. 4 v. 1-2 a., 4 v. 3-5 a.	25/-
SP.300A.	300-0-300 v. 60 m/a. 6.3 v. 2-3 a., 4 v. 2 a.	25/-
SP.300B.	300-0-300 v. 60 m/a 4 v. 2-3 a., 4 v. 3-5 a., 4 v. 1-2 a.	25/-
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SP.301B.	300-0-300 v. 120 m/a. 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 3-5 a.	28/-
SP.350A.	350-0-350 v. 100 m/a. 5 v. 2-3 a., 6.3 v. 2-3 a.	29/-
SP.350B.	350-0-350 v. 100 m/a. 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 3-5 a.	29/-
SP.352.	350-0-350 v. 150 m/a. 4 v. 2-3 a., 6.3 v. 2-3 a., 6.3 v. 2-3 a.	36/-
SP.501A.	500-0-500 v. 150 m/a. 5 v. 2-3 a., 6.3 v. 2-3 a., 6.3 v. 2-3 a.	50/-

METERS. All meters are by the best makers and are contained in bakelite cases. Prices are about one-quarter the original cost.

Range	Ext. Diam.	Type	Price
500 ma.	3in.	M.C.	12/6
40 v.	2in.	M.C.	5/9
2½ a.	2in.	Thermo	5/-
20 a.	2in.	M.C.	7/6
40 a.	2in.	M.C.	7/6
25 a.	3½in.	M.C.	7/6
25 a.	3½in.	M.C.	7/6
500 ua.	3½in.	M.I.	2/11
5 ma.	2½in.	M.C.	5/-
1 ma.	2½in.	M.C.	5/-
500 ua.	3½in.	M.C.	15/11
20 v.	3½in.	M.C.	19/6
15 v.	2½in.	M.C.	5/9
150 ma.	3½in.	M.I.	7/6
200 ma.	2½in.	M.C.	8/-
5,000 v.	3½in.	M.C.	12/6
3,000 v.	4½in.	Electrostatic	50/-
	3½in.	Electrostatic	35/-

SPECIAL OFFER OF ELECTRIC GRAMOPHONE MOTORS. British made, Rim driven, with 8in. Turntables. Fixed speed (78 r.p.m.) for 200-250 volts **A.C.** only. **£4/19/6.**

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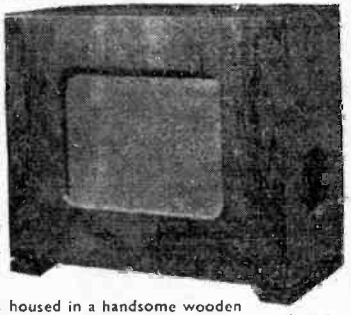

No set is complete without at least one Stentorian speaker to allow you to enjoy the luxury of radio away from the receiver — in the kitchen or bedroom, for instance. And the quality of the most magnificent set will be matched without fault, for each Stentorian provides a high level of output with distortion-free reproduction—and is housed in a handsome wooden cabinet of perfect acoustical construction. Ask your local dealer about them. Prices from **39/6d.** with 5in. speaker, to **£5 15s. 6d.** with 9in. speaker and matching transformer.

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—the finest extra SPEAKER for any set

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DENCO.—R.F. Chokes: USW **1/6** ; SW 2/3 ; All-wave 3/6 and 4/-. Polystyrene Feedthrough insulators, 1½in. **1/4** ; 1¾in. **1/8** ; 2¼in. 3/3 ; 3¼in. **3/9**. Polystyrene standoffs, ¾in. **1/-** ; 1¼in. **1/1** ; 2¼in. **1/2** ; 3¼in. **1/4** ; 3¼in. **1/4**.

EDDYSTONE.—Transmitting condensers, 60-60pF split stator, air-gap .068in. 54 **6.** Preset air dielectric trimmer condenser for aerial series tuning, **6/6.** Split-stator SW condenser, 34+34pF (Butterfly type), **8/4.** Short-wave variable condensers with extension spindle for ganging : 20pF **7/-** ; 40pF **7/9** ; 60pF **8/3** ; 100pF **9/3** ; 160pF **9/6.** Bandset, 150pF **8/6.** Flexible couplers for ¼in. spindles, **3/-** ; midget type for 5/32in. spindles, **2/3.** Flexible driving shafts, **6/-.** Adjustable insulated brackets, **2/6.** Moulded insulators in red and black, can be used as standoff, terminal post or feed-through, 1¼in. high, 1,000v. working, **1/6.** Bechive type standoffs (ideal for supporting light beam elements), **1/6.** Ceramic aerial strain insulators (low loss), **2/6.** Rack equipment (details on request). "640" amateur communications receiver, **£39/10/-.** Eddystone Short Wave Manual No. 6, **2/7.**

Q-MAX.—All-dry 4-valve short-wave battery receiver complete with valves and coils, covering 11-200 metres, **£17/15/-.**

RAYMART.—CT6 6-pin threaded coil formers, **2/6** ; ceramic base for same, **1/6.** Ceramic standoffs, 3¼in. **2/-.** Ceramic valveholders, English type—4 and 5-pin **1/-** ; glazed **1/3** ; 7-pin **1/6** ; Mazda Octal **1/6** ; 9-pin (EF50 type) **2/-.** American type : 4-pin **1/3**, glazed **1/6** ; 7-pin **1/3**, glazed **1/6.** Acorn **2/6**, international octal **1/6**, 50-watt 4-pin Jumbo, **4/6.** Speed-key 9/6. High-note buzzer, **3/6.**

W.B.E.—All-wave superhet tuning unit, 3 waveband, with tuning condenser, slow-motion drive, coloured dial with station names, coils, trimmers and padders. One hole fixing. For 465 kc/s I.F. Complete with circuit of frequency changer stage, **59/6.**

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WODEN.—Push-pull output transformers for high quality amplifiers. For 6L6's, 30 watt, for 3, 7½ and 15 ohms speech coils, **42/6.** For 807's, 60 watt, for 7½ and 15 ohm speech coils and 200 ohm line, **67/6.**

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Practical Wireless and PRACTICAL TELEVISION

16th YEAR OF ISSUE

EVERY MONTH VOL. XXIV. No. 503 JUNE, 1948.

Editor F.J.CAMM

COMMENTS OF THE MONTH BY THE EDITOR

A Crippling Tax

A RADIO set is such a necessary part of the life of every citizen that we express grave concern at the Chancellor of the Exchequer's imposition of a 66-2/3rds. purchase tax on radio and television receivers. This concern is, indeed, felt throughout the industry, which has recently, through the Radio Industry Council, sent a memorandum to Members of Parliament. It is a serious matter that whilst tax rates on so many items of lesser importance have been reduced that on radio and television receivers should be increased.

The purchase tax on radio receivers is now double that prevailing last August. It was then 33-1/3 per cent., which was increased to 50 per cent. in the emergency budget. The radio industry served the country well during the war and practically discontinued the manufacture of receivers for civilian use. With all the difficulties with which it has been beset during the past three years it has exported some millions of pounds' worth of receivers and was rapidly getting back to normality.

This latest blow is undeserved and, in view of the facts, unjustifiable. This comparatively new industry does not need to be hamstrung by crippling taxation at a time when America and other countries are intensifying their competition in the overseas markets. An adequate home market is absolutely essential in order to maintain a good export market, and we feel that this new tax will adversely affect our exports. It may be many years before the radio industry recovers from its effects.

It must be remembered, too, that a healthy radio industry, in view of the advance of electronics, is necessary to national defence. We think that many firms may go out of existence unless the tax is considerably reduced.

The Chancellor of the Exchequer seems to be of the opinion that there is no tax limit which an industry cannot stand. The industry at present is spending at least £3,000,000 a year on research. This cannot be maintained under the present system of taxation. It is particularly unfortunate that the industry has embarked upon a campaign to enhance our export trade in television equipment—unfortunate because the new tax will seriously hamper the effort. The industry is already committed to the expense.

The sales of radio receivers since last August have shown a steady decline and as the Chancellor must have been aware of this it would appear that the new tax is part of a policy of killing home sales. A radio set is not a luxury, but evidently Sir Stafford Cripps thinks otherwise.

The tax also applies to valves. The industry is finding it difficult enough to service radio and television receivers in over 11,000,000 homes. A valve should not be subject to any tax at all. There is to be no Radiolympia this year and the industry, bereft of this annual sales-promoting exhibition, will have to devise other means of convincing the public that in spite of the new taxes it is wise to purchase a radio receiver. If they do so they will be running counter to Government policy, because the purchase tax was originally imposed to discourage sales.

We hope that by the time this is in print the Chancellor will have listened to wiser counsels.

Electrical Interference with Television

The Radio Industry Council is planning a campaign to eliminate electrical interference with television reception in the Home Counties and the London area. Representations have already been made to the Society of Motor Manufacturers and Traders, to the National Road Transport Federation, the G.P.O., Railways, L.P.T.B., police, and the motoring organisations. Interference takes the form of momentary distortion of the picture on the screen, and of accompanying sounds.

Television receiver manufacturers, by suitable modifications of the circuit of their models, have already reduced interference to a low level, but suppression is easiest at the source of the interference and not at the receiving end.

In the case of cars it is estimated that 85 to 95 per cent. freedom from interference can be provided—without detracting from the engine's performance—by fitting a 10,000 to 15,000 ohm resistor in the high-tension lead between the ignition coil and the distributor. F.J.C.

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The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Wireless." Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, "Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

ROUND THE WORLD OF WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year, ending 29th February, 1948.

Region	*Number*
London Postal	2,107,000
Home Counties	1,465,000
Midland	1,598,000
North Eastern	1,731,000
North Western	1,482,000
South Western	963,000
Welsh & Border	646,000
Total England & Wales ..	9,992,000
Scotland	1,060,000
Northern Ireland	181,000
Grand Total..	11,233,000

The above total includes 43,500 television licences, an increase of 4,500 over the previous month.

Prosecutions in February for operating wireless receiving apparatus without a licence numbered 429.

Set owners are asked to renew their licences promptly, and to produce the reminder card sent to them when purchasing the new licence at a Post Office.

V.H.F. for Norwich

THE extension of overhead power lines to some of the remotest outskirts of rural England while bringing the boon and blessing of electricity to many, is at the same time introducing additional maintenance problems. One of the most difficult the need for speedy communication between field engineers and headquarters, has been overcome by Mr. J. A. Sumner, M.I.E.E., M.I.Mech.E., F.I.I.A., the City Electrical Engineer for Norwich, who has recently installed in his area F.M. radio and telephone equipment manufactured by the G.E.C.

The Fixed Station transmitter-receiver is in the Tower of the City Hall, some 250ft. high, and uses a folded radiator aerial with counterpoise earth on a special arrestor spike on the dome of the tower.

Fig. 1 (above).—Mr. Sumner at the control unit in his office, from which he can communicate with any engineer in his area.

Fellow A.I.E.E.

MR. ROBERT CHARLES GOODING WILLIAMS, M.I.E.E., M.I.Mech.E., Chief Engineer of Philips Electrical, Ltd., has been elected a Fellow of the American Institute of Electrical Engineers.

Dr. Williams recently rejoined Philips Electrical Ltd. (England), after a stay of just under two years with the North American Philips Company of New York, where he acted as an Executive Engineer.

Radar Controlled R.I.A.F. Planes

A MODERN type of radar, able to locate the height and the direction of an approaching aircraft at a distance of over 150 miles, is in use in the Royal Indian Air Force.

In the event of hostilities, with the aid of this equipment, the controller can easily snap on a television screen an exact view of the raiders, and through his radio telephone he can pass on the information to his camp or direct to the R.I.A.F. fighter aircraft to intercept the raiders.

Sutton Coldfield Television Station

A SITE for a television station to serve the Midlands has been acquired at Sutton Coldfield, near Birmingham. Work on the construction of the station has already begun.

The power of the vision transmitter will be 35 kW. and that of the sound transmitter, 12 kW. This constitutes twice and four times the powers of the respective transmitters at the Alexandra Palace station. Contracts for the two transmitters have already been placed with Electric and Musical Industries, Ltd., and Marconi's Wireless Telegraph Co., Ltd., respectively. The range of the station is expected to be about 50 miles, covering a population of some six million. It is not yet possible to say when the new station will be in service, but the work is being pressed on as fast as present conditions permit.

The station will transmit the same programme as that radiated by the London Television Station at Alexandra Palace. The programme will be conveyed to the new station by means of a special cable or by a radio link. These are being installed by the General Post Office.

E. K. Cole's B.I.F. Contribution

E. K. COLE, LTD., have three stands at the British Industries Fair this month, and in addition many of their products, particularly plastics, will appear in other exhibitors displays. At Birmingham they will occupy stand C.310, with a show of Ekco-Ensign Electric Lighting and Thermovent Heating; in London they have taken stand Q.55, at Earls Court, to display their Plastics development for many trades and industries; and at Olympia, stand H.44, will be devoted to Ekco Radio, Car Radio and Television. E. K. Cole, will, therefore, be offering to oversea buyers in all parts of the world, the products of four distinct industries within their organisation—Radio, Lighting, Heating and Plastics. This is a unique versatility for one Company, representing a high export target.

First Television "Oscar"

AT the twenty-first anniversary dinner of the Television Society, recently, the first television "Oscar" ever presented was awarded to Mr. George More O'Ferrall. The award took the form of a silver medal and was for the most artistic television production of the year. It will be presented annually.

Mr. O'Ferrall, who is a senior drama producer, at Alexandra Palace, received it for his work on Hamlet, televised last December.

Mr. Tony Bridgewater received the Mervyn Premium for his paper on the Television Outside Broadcasts Service.

Mr. Norman Collins and members of the Television Service were present at the dinner.

The Television Society was founded in 1927, for the furtherance of study and research in television and allied problems.

Mullard Staff Changes

TWO new appointments in the valve sales department of the Mullard Wireless Service Co., Ltd., were recently announced.

Mr. H. N. Miller, new valve sales manager for Mullard.

Henry Nicholas Miller becomes sales supervisor, and George William Morris becomes London area manager.

H. N. ("Dusty") Miller needs very little introduction to the radio trade. For 20 years he has had a varied and colourful career with the Mullard company, beginning in 1928 when he travelled the Eastern Counties.

The new, neat "Princess" portable just released by Ekco.

Companies Act, 1947, Commencement

THE Board of Trade have made an Order appointing July 1st, 1948, as the date on which all the provisions of the Companies Act, 1947, not then in force, will come into force.

The same Order has brought into force Section 120 (2) of the Act which empowers the Board of Trade to make regulations altering or adding to the provisions of certain schedules to the Companies Act, 1929. Under these powers, regulations have been made with effect also from July 1st next, amending Table A and the form of annual return.

The Companies (Articles of Association and Annual Return) Regulations, 1948 (S.I., 1948, No. 434) comes into force on July 1st, 1948. Copies now obtainable price 9d.

Wrotham Frequency Modulation Station

A SITE has been acquired near Wrotham, Kent, for the construction of a frequency modulation transmitter station. Work on the construction of the station has already begun.

An order has been placed with Marconi's Wireless Telegraph Co., Ltd., for a 25 kW. F.M. transmitter for this station which, it is anticipated, will be the first of a number of F.M. transmitter stations to be erected throughout the country, and which will operate on about three metres. The present intention is that these transmitters will be used to improve the coverage of the Third Programme, and later the Light Programme, but both these services would be additional to long and medium wavelength transmissions.

Experimental V.H.F. Receiver

Further Constructional Details of the Novel Receiver for Battery Operation Which was Described Last Month.

By G. ELLIOTT

THE quench coil (Fig. 7) is constructed after the manner described in Newnes' "Short Wave Manual." The special low-resistance chokes, RFC1 and RFC2, are home-made and are shown in Fig. 8. With regard to the R.F. chokes RFC3, 4, 5, 7 and 8 the Eddystone type 1011 is recommended, and Eddystone type 1,010 is recommended for RFC6. For the tuning condensers, any type of midget 20pF. ceramic variable can be used. The type used by the author were made by Cyldon. A small 5 : 1 reduction drive is suitable on the R.F. tuning control, while a "Utility" 100 : 1 ratio micro-dial was employed on the detector tuning. C14 is supported on an insulated bracket.

A metal panel is desirable, to help eliminate hand-capacity effects. A wooden chassis was originally used, but there is no reason why a chassis of aluminium could not be employed, as all wires carrying R.F. currents are held well away from the chassis. Constructors will no doubt wish to make use of the materials which they have on hand, but the make of the majority of materials used in this receiver was given in the parts list in last month's issue.

Operation

Coil 1 will cover approximately 60-90 Mc/s; coil 2, 50-75 Mc/s; coil 3, 35-55 Mc/s; coil 4, 27-40 Mc/s. Reaction will be found to be perfectly smooth on all ranges, although the strength of reaction will tend to fall away at the high frequency end of coil 1. The oscillation limit of the 1Q5GT in this circuit is about 100 Mc/s. The use of a 5 : 1 reduction drive on the reaction potentiometer R2 will be a great assistance in giving perfect adjustment, which is needed on weak signals.

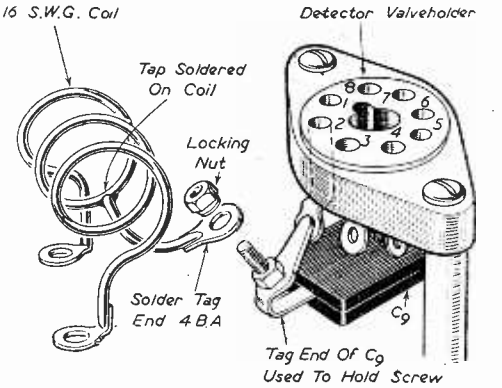
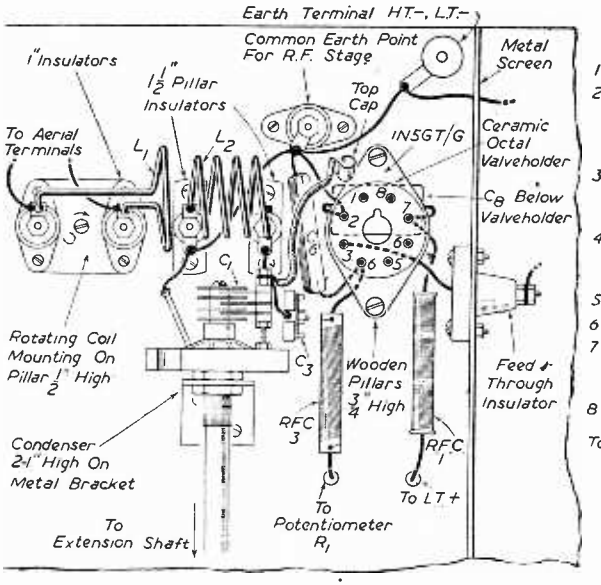


Fig. 5.—Details of the coil-mounting for the detector stage, showing the soldered cathode tap and method of connecting the tap direct to the valveholder.



Valve Base Connections

1 ——
2 Filament.— To C8 & Earth Or Tapping On L2
3 Anode. To Detector Stage & L3
4 Screen. To C6 & R.F.C.3
5 ——
6 ——
7 Filament. + To C8 & R.F.C.1
8 ——
Top Cap. Control Grid To Terminal Of C1

Note:- When R.F. Stage Is Regenerative, Pin No 2 On Valve Goes To The Tapping On L_2 And Not To Earth. Valve Pins Viewed From Top.

Fig. 4.—Plan of the upper part of the chassis, showing the wiring of the R.F. stage.

The R.F. tuning control should be kept in step with the detector tuning, although its adjustment is not critical. The resonant position is indicated by a rise in the background noise and a slight increase in the reaction strength, requiring a slightly lower position of the control R2. To operate as a quench receiver, SW2 is turned to position 1, and the quench control R3 is rotated to switch on SW3. R2 is set to approximately the same position as to give normal reaction, or a little lower, and then R3 is rotated until the quench noise becomes audible. In this position the receiver is most sensitive to weak signals—experience will show the best settings of the controls. The quenching

voltage can be increased on strong signals to bring up the strength. The detector will act as a self-quenching valve by sufficiently advancing the reaction control, but this method of operation is less satisfactory and is not so sensitive on weak signals. With SW2 in position 1, output can be taken to an

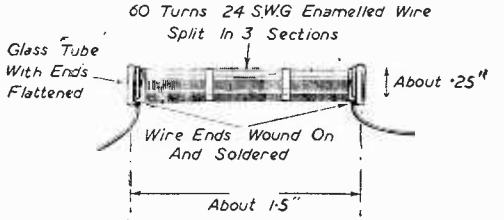


Fig. 8.—Constructional details of the low-resistance filament chokes.

amplifier from terminal 2 of the output socket, with the receiver working quenched or as a straight (quench control switched off and SW3 open).

Much criticism has been levelled at the quench receiver, due to the local interference it can cause on other receivers, but the use of an R.F. stage here practically eliminates radiation. There is no doubt that super-regeneration is very useful in holding signals where trouble is experienced from frequency drift in the transmitter, or an unstable carrier, swaying aerial systems, etc. However, for the reception of very weak long-distance signals, the receiver is best operated in the straight condition, preferably listening on C.W., as super-regeneration is too noisy.

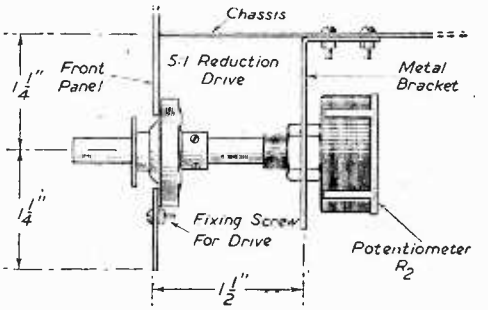
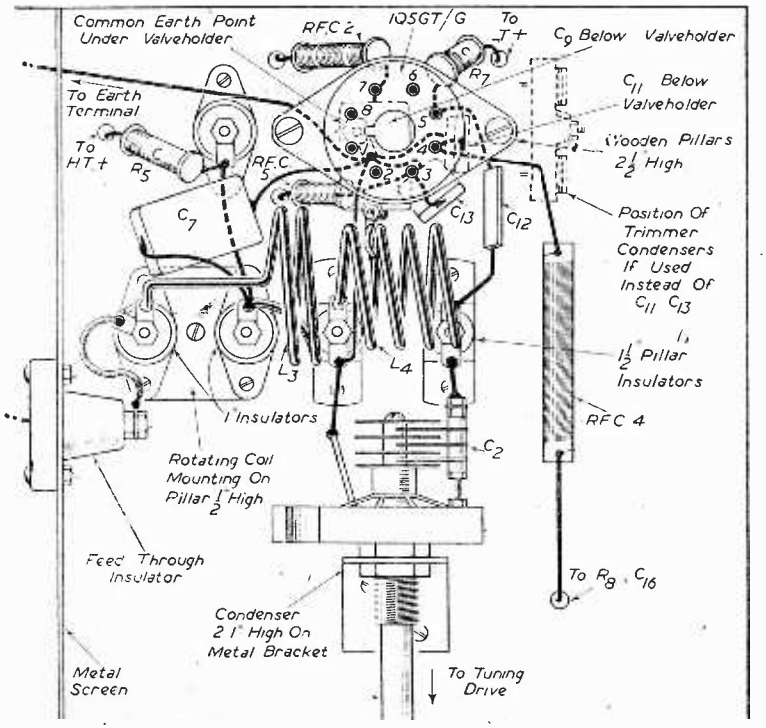


Fig. 9.—The above illustration shows method of mounting and dimensions for the slow-motion reaction control drive.

A good aerial system is just as important as a good receiver on V.H.F., and it is recommended that a resonant dipole at least be used for the frequencies in which the operator is interested.



Valve Base Connections

1 ——

2 Filament To C9 And Tapping On L4

3 Anode To C13 And R.F.C.5

4 Screen To C11 And R.F.C.4

5 Control Grid To C12 And R7

6 ——

7 Filament + To C9 And R.F.C.2

8 ——

Fig. 6.—Another section of the chassis, showing the wiring of the detector stage.

Note – If Trimmer Condensers Are Used To Connect Anode And Screen To Earth, The Fixed Condensers C11 And C13 Are Omitted. Valve Pins Viewed From Top Of Valveholder. Due To Very Close Wiring Under The Valveholder, The Theoretical Diagram Should be Studied Also To Avoid Errors.

Better still, a simple beam, either fixed or rotating, will give greatly improved results over the normal long-wire aerials. The beam should be erected as high as possible to avoid the screening effect of buildings, although it must be borne in mind that, as far as tropospheric DX on 5 metres is concerned, results will be greatly influenced by the location of the station, as hills and mountains exert a very strong screening effect.

Results

The writer's location is a poor one for V.H.F. reception, being at sea-level, and screened in some directions. However, with this receiver world-wide reception has been possible on 28 Mc/s, and the best tropospheric DX on 58.5 Mc/s was the reception of a station 130 miles distant. Television sound has been well received at 65 miles, together with police transmissions on 80 Mc/s. As considerable activity in Britain on 58.5 Mc/s and 50 Mc/s will probably continue for some time yet, and DX reception of U.S. and South African amateurs will still be possible at suitable times until the sun-spot activity declines, this receiver should provide some very interesting listening. The signal-to-noise ratio is excellent, and background noise very low.

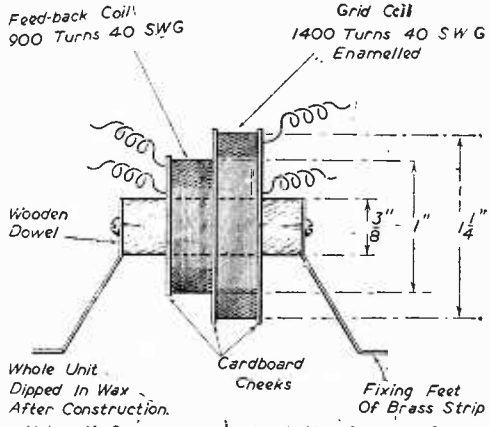


Fig. 7.—Full details of the quench coil.

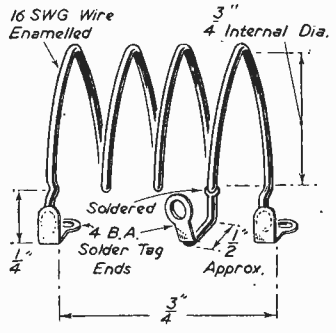


Table Of Coil Data

No.	Frequency Range (Megacycles)	No. Of Turns In R.F. & Detector Coils L_2 L_4 3/4" Internal Dia.	No. Of Turns In Coupling Coils L_1, L_3 1" Internal Dia	No. Of Turns In L_1 For 80 Ohm Feeder
1	60 - 90	3	1	1
2	50 - 75	4	1 Or 2	1
3	35 - 55	7	2	2
4	27 - 40	9	3	2

Fig. 10.—An example of the 4-turn detector coil and full data for all coils required to cover from 27 to 90 Mc/s.

Television at B.I.F.

RADIO INDUSTRY COUNCIL'S NEW AERIAL

TO ensure that demonstrations of television given at any exhibition held at Olympia, London, shall be satisfactory and do credit to the industry and to the B.B.C., the Radio Industry Council, by arrangement with the owners of Olympia, has erected a special television receiving aerial on the roof. The aerial will be used at the British Industries Fair in May, when at least 10 firms will be demonstrating television.

By that time it is hoped also to have screened diathermy appâratus which is at present causing interference, the cost of screening to be borne jointly by exhibitors in the radio section.

The aerial is to be presented by the R.I.C. to Olympia ; the R.I.C. will maintain it and supervise the internal arrangements for "pipe-lining" the programmes to the various receivers.

At the B.I.F. television demonstrations will be given during the normal morning and afternoon transmissions and during those times the television sound broadcasts, if suitable, will be used also for the demonstration of ordinary radio receivers. At other times B.B.C. sound programmes and gramophone records will be used for a common input for all domestic radio receivers, the exhibitors having agreed not to use separate aerial systems.

Exhibitors of certain special equipment, such as VHF, may apply for permission to use aerials, provided the sets are operated in substantially sound-proof rooms and cause no interference with the television or other programmes.

The restriction on demonstrations, which was mutually agreed at a representative meeting of exhibitors, presided over by Mr. Walter York, and attended by officials of the B.I.F., applies also to portable receivers and gramophone records which will be played only in sound-proof rooms.

Low-voltage Circuits

Main Features of the "Personal" or Portable and Other Experimental Receivers Described

By F. G. RAYER

EXPERIMENTS with various possible circuits show that surprisingly good results may be obtained with only low-voltage supplies, provided the design is suitable. Such circuits have several practical uses, both in portable or stand-by receivers and in sets intended for more continuous use.

Receivers built up round these circuits may be operated from the 24 to 30 volts provided by the small lighting plants now quite popular. No additional batteries will be required, all the convenience of "mains" operation being obtained. A small car-radio may also be built up along these lines, the 12 volts provided by the accumulators being used. Other possibilities will also suggest themselves, some of these taking the form of small portables or pocket receivers.

Another interesting circuit, suitable for earphone reception, may be driven from the mains without any rectifier or smoothing circuit. A very cheap one-valver can be made in this way.

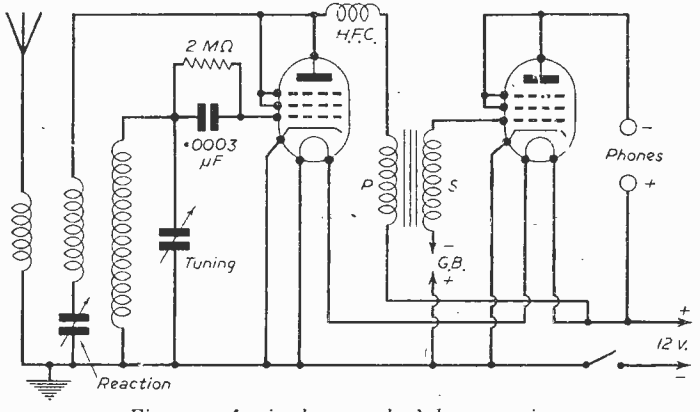


Fig. 2.—A simple 12-volt 'phone receiver.

The circuits do not make use of vibrators or other means to step up the low voltage to the value usually employed for high tension. Such circuits are only of standard design with an addition in the form of a rotary transformer, etc., and are much more complicated than the circuits described here.

A House-plant Circuit

A receiver built up round this circuit and operated on a 24 to 30 volt house-plant (petrol-electric generator with accumulators in series to total 24 or 30 volts) gave surprisingly good results, satisfactory speaker reproduction being obtained. (See Fig. 1.)

The circuit is simple, but several points should be noted. Transformer coupling is used in both L.F. stages to give maximum gain and avoid excessive voltage drop to the detector and L.F. anodes (as would arise with resistance-capacity coupling). A push-pull output stage is used to give maximum volume with the low anode voltage available. In the R.F. stage no screen-dropper resistor is used as the full 30 volts may be applied.

6.3 volt, .3 amp. valves were used, the five heaters being connected in series for operation from the 30 volt supply. It will be seen that the consumption is only .3 amp. plus the few milliamps taken as high-tension current. This is a great economy over the systems mentioned, where a consumption of 5 to 10 amps. is not unusual (most

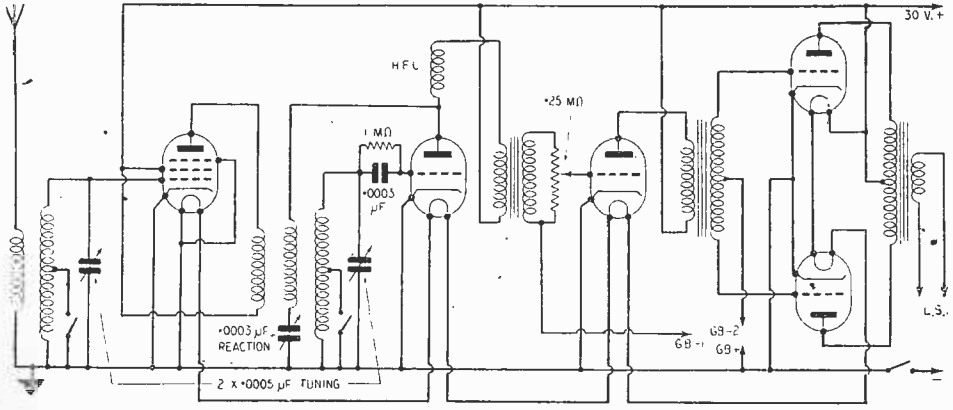


Fig. 1.—A circuit for a receiver for 30-volt operation.

of this being taken by the rotary converter or other means of providing high tension).

With the circuit shown in Fig. 1 some overloading may take place when the volume control is at maximum. This is not important as it can easily be avoided and the extra amplification is useful when listening to stations other than the locals.

Tuning coils, transformers, etc., are all standard components. Battery bias is used so that the value can be adjusted with ease. About 1.5 to 3 volts

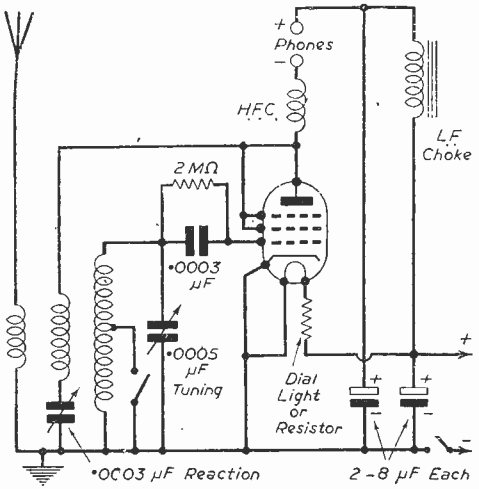


Fig. 3.—A 1-valve circuit showing position of H.T. smoothing and voltage-dropping resistor.

is most suitable.

This circuit can be used on a 24-volt supply by removing either one push-pull valve (a single output valve being used) or by removing the R.F. *or* L.F. stage. If local-distance reception only is required the R.F. stage can be omitted.

A Phone Receiver

Fig. 2 shows a simple circuit for stand-by use on 12 volts or 12 volt car-radio use. The efficiency maintained by the valves (the 6K7 is recommended for both positions) is demonstrated by the fact that the detector will oscillate readily without the turns on the reaction coil having to be increased. Unless the aerial is poor more than enough volume is obtainable.

Screen grid, suppressor grid and anode are strapped, and this gives greater volume than with the usual method of connection. The volume is also slightly greater than if triodes are used, though two valves of the 6C5 type are quite good.

Tuning and reaction condensers will be of usual value—.0005μF. and .0003 μF. for medium and long waves and about .00015 μF. and .0002 μF. for short waves.

H.T. Smoothing

If a receiver is operated from an accumulator which is being charged at the same time a purring from the dynamo will be audible. If it is particularly desired to listen at these times and the sound is bad the H.T. supply should be smoothed. As the output of the dynamo is D.C. and there will be the necessary accumulators shunted across it very simple smoothing will usually be sufficient.

Fig. 3 shows a suitable smoothing circuit—a smoothing choke is included in the H.T. plus lead with condensers to H.T. minus. Take care not to connect this in such a position that the *heater* current is required to pass through the choke.

With very small receivers two 2μF. condensers with a resistor of about 5,000 ohms, instead of the choke, can be used.

Voltage Dropping

If there is excessive voltage for supplying the valve or valves direct (as there may be if every small receiver is made) a resistor should be included, as shown in Fig. 3. To operate a single 6.3 volt valve from a 12-volt accumulator it is only necessary to connect a 6.3 volt, .3 amp dial light in series with the heater. A resistor of about 60 ohms may be shunted across the dial light.

In other cases a small mains-dropper or an appropriate length of line-cord can be used. For .3 amp valves 20 ohms will be required in circuit for each 6 volts to be dropped. If line-cord of 60 ohms per foot is used it will be very simple to measure off the required length.

Mains Operation

Such circuits lend themselves readily to the construction of a simplified type of mains receiver. Such a circuit is shown in Fig. 4. No rectifier, smoothing or voltage-dropping circuits are used, the high-tension current being supplied by a 9-volt grid-bias battery. Under these conditions even a single valve will give satisfactory earphone reception. The high-tension drain is slight and, of course, more voltage can be used, though this is not necessary for earphone listening.

A filament transformer with a suitable secondary is used to heat the valves, leads marked "X.X."

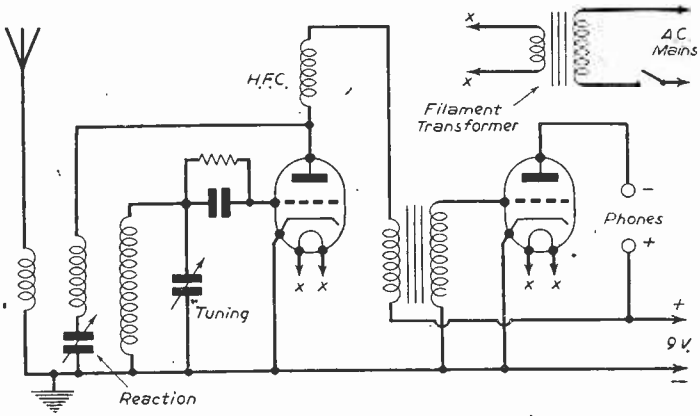


Fig. 4.—A 2-valver for mains operation.

being connected together. The on-off switch is included in the mains circuit.

After switching off, the receiver will continue to function for about 30 seconds. This does not indicate a fault, the cathodes cooling slowly so that the set continues to operate from the battery supply. Component values will be as in the other circuits given.

Valve Types

As stated, the 6K7 functions well with a low anode voltage (down to 6 volts or so). The 6C6 and 6D6 are similar types though they do not appear to function quite so well. The 6C5 is a good valve for triode positions. All these have .3 amp heaters and may be connected in series.

An output tetrode such as the 25L6 may be used for output stages, but this has a 25-volt heater. Hence, it should be connected directly across a 24-volt supply, or have one 6.3 volt .3 amp valve in series with it for 30-volt operation.

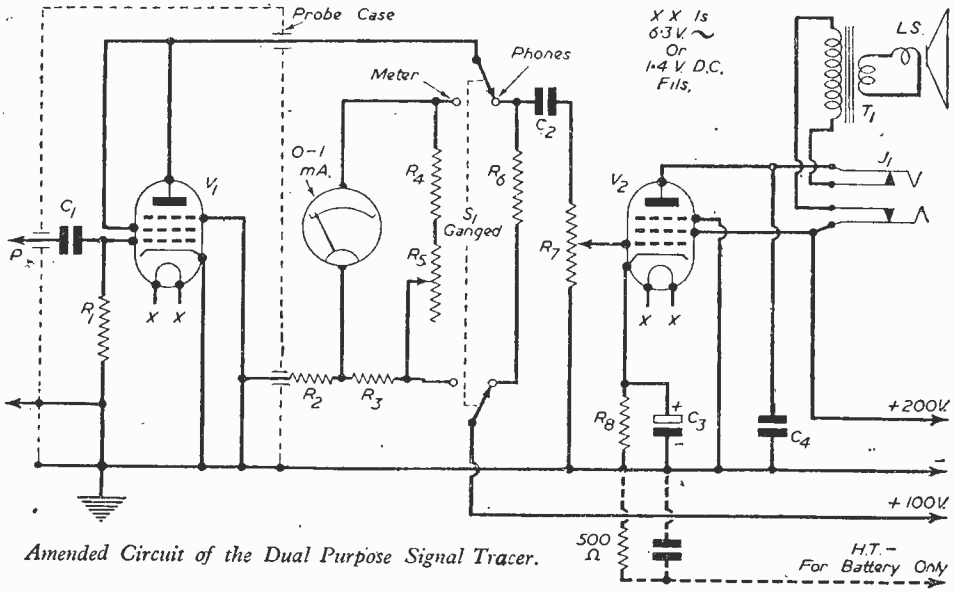
Naturally, valves with heater ratings other than .3 amp may be used. Valves of the 13 volt .2 amp class, such as the Cossor 13SPA, may be used with a 12-volt battery or with two in series for 24 volts.

The method of connecting the heaters may depend upon the voltage to be used. It will be found that three 6.3 volt valves, heaters in parallel, will make a good R.F.-Det.-L.F. circuit for 6-volt operation. The circuit shown in Fig. 2 could, in this way, be modified for 6-volt use.

Battery-type valves with directly heated filaments are not recommended for any of these circuits, as results obtained from them are very inferior in comparison with the mains types mentioned. If an attempt is to be made to use such valves for earphone reception it should not be overlooked that their filament ratings are very different from those mentioned and the circuit must be adjusted accordingly.

Dual Purpose Signal Tracer

IN our April issue a contributor described a useful dual purpose signal tracer which was in use in his service department, and which has aroused considerable interest amongst experimenters and other service engineers. It has been pointed out, however, by several readers that when the meter is switched into circuit a part of the H.T. supply would be short-circuited. Our contributor has supplied an amended circuit diagram which is reproduced below, and it will be seen that the position of the two resistors R2 and R3 has been modified slightly, and the connection to the lower switch contact also modified so that the short-circuit is removed. It should be remembered that the meter must be connected in reverse, that is, with negative terminal to the junction of R2 and R3. Some doubts have also been expressed regarding the biasing arrangements. R8 and C3, and the dotted resistor and condenser below them. When the tracer is used with A.C. valves and supplies, the biasing is effected in the cathode circuit of V2 in the usual manner, through R8 and C3, the connections in broken lines being ignored. When used with battery valves and supplies, however, there will be no cathode circuit, and the additional 500 ohm resistor and condenser are then included in the H.T. — line.



Amended Circuit of the Dual Purpose Signal Tracer.

Vibrator Switch Unit

A Home-made Addition for the "Walkie-talkie" Type 58 Vibrator

ASSUMING that the vibrator is complete (less grid-bias battery) in carrying case, with original accumulators, the unit is designed to take the 10-hole plug (Jones' plug) which terminates the lead from the vibrator. The two four-hole plug leads are cut off close to the main plug and the ends covered with insulating varnish. The unit is built into a small box approximately 6½in. long by 3½in. wide; it has a sloping top, being 1½in. deep in front and 3in. deep at rear. The switch, variable resistor and U2 cell are housed in the box, switch knob and 10 sockets on top of case, knob for resistor at rear, and ten small metal plugs to fit the 10-hole socket are on the underneath of box front. These plugs were made by bending pieces of 20-gauge wire, then soldering and filing the ends till they were a snug fit in the sockets. It is advisable to make a template for the final assembly of the plugs. It will be noted in the diagram that sockets are numbered from right to left. Looking at the plug, however, the sockets are numbered from left to right, and this is how they are mounted on unit. The U2 cell is necessary to operate relay in vibrator to obtain 180 volts. Using 90 volts, it was found that the vibrator took .75 Amps, whilst at 180 volts it takes 1.25 Amps. The space for holding spares in the carrying case is now used for accommodating two spare vibrators and a 9-volt grid-bias battery.

It should be noted that the unit is for use with receiver using separate 2-volt accumulator for low tension supply.

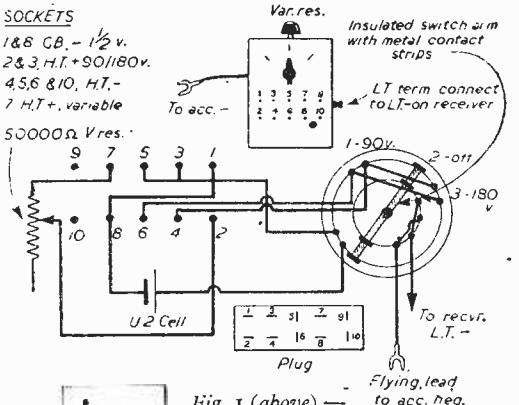


Fig. 1 (above).— The U2 cell provides 1½-volt G.B., and operates relay in unit. A 9-volt battery is in lid of unit carrying case with + connected to case. The negative wander plug on lead is soldered to stud of original G.B. — in base of vibrator. Fig. 2 (left).— Modifications to the plug for parallel charging.

Separate Charging

The charging lead supplied with the power pack is only suitable for charging with the vibrator unit and the two accumulators *in situ*, that is to say, connected together in the carrying case. Should it be desired that the batteries be separated from the unit for re-charging, the 4-pin plug terminating the lead requires modifying. On dismantling the plug, it will be found that two pins are connected together and the other two disconnected—one floating. The floating pin is connected to the single pin so that the plug is wired, as shown in Fig. 2. It can then be plugged into socket on top of accumulators for charging both in parallel.

Car Ignition & Aircraft Safety

ACCORDING to a senior signals officer of the Ministry of Civil Aviation, radiophone services on which the bad-weather safety of aircraft largely depends can be made unusable by a single "unsuppressed" car, lorry or tractor-engine running near the receiving aerials, and indication of an aircraft on a radar screen can be lost in a "snowstorm" effect of interference from the ignition.

"All our own vehicles are now equipped with suppressors," the officer said, "and when necessary we fit them to other cars and vehicles using the airport.

"Interference from farm tractors can make ground-to-air radio communication exceptionally difficult. As soon as the familiar crackle of interference is heard the radio-operators report it, the trouble is traced and a suppressor fitted to the vehicle on the spot. We find that when we explain the position to the farmer we can rely on his co-operation."

The Radio Industry Council, representing 95 per cent. of the radio manufacturers in Britain, already has the co-operation of the G.P.O., B.B.C., British Railways, London Transport, road haulage organisations, and the police and fire services in its campaign to suppress motor vehicle interference with radio and television reception, and has received the following in a letter from the London Transport Executive:

"The demonstration of the device designed to suppress radio interference has proved that the fitment is effective, and London Transport is, therefore, proceeding with all speed with the fitting of this device to all of the Executive's petrol-engined buses, coaches, private cars, miscellaneous vans and lorries. The suppressor units have been ordered, and we hope that in the course of some weeks the whole of our fleet of vehicles will be so equipped."

ON YOUR WAVELENGTH

By THERMION

Brains Trust Changes?

THE B.B.C. has announced that "in all the circumstances it would be best if Dr. C. E. M. Joad did not appear in the Brains Trust programme." Now is the time either to drop this absurd programme altogether or to reconstitute it on sane and scientific lines. For, make no mistake about it, what was originally intended to be a scientific body which would answer questions in a scientific way has become just a variety turn and a piece of radio amusement laughing stock.

I have listened to very many of these programmes and am astonished at the hesitation of its members in answering questions. They hedge, hum and hah, circumnavigate the question, avoid a direct answer, and seldom give any worth-while information.

The questions seem to be selected to avoid members of the Brains Trust being caught out, for they are questions which only invite opinions.

Another point: if the Brains Trust is to continue it should have a different panel of experts at every session. It is quite fantastic, and certainly unacceptable to me, to suggest that a handful of people, with an occasional guest artist (I use the word advisedly), should be competent year in and year out to answer questions on almost every subject under the sun. Where questions relating to exact science have been asked on a large number of occasions the Brains Trust has been wrong. Indeed, as older readers will remember, some years ago I wrote an article criticising the Brains Trust on the score of its lack of scientific reliability. Some time afterwards I lunched with Joad and he admitted that they had no prior knowledge of the questions. But then neither has a student who sits for an examination. If the student gets the wrong answers he is failed. One does not expect an expert to fail, otherwise he should be sitting for the examination as well. I think Joad saw the point.

In any case, I do not admit that the B.B.C. is competent to pick a panel of experts to constitute a Brains Trust. I suggest that in all the circumstances the programme time could be better occupied. The Brains Trust has had a fair run. It has not done what it has set out to do, and has merely become a music hall act. There are far better music hall acts which could be engaged at a tithe of the cost.

If you, dear reader, asked me to define a music hall act I could only reply "it depends what you mean." I think that all intelligent listeners are nauseated by the nonsense which is radiated as brains.

Twenty Questions

And whilst I am dealing with this matter there is another programme, Twenty Questions, which I always refer to as Anona Wynne's programme. If variety is the spice of life, why don't they vary the artists? It gets more than a little boring at the commencement of the announcement of most objects to hear Anona bobbing up with the first question. I suppose this programme is amusing to children, but I do not think in general that parlour games such as Charades and Guessing Competitions are suitable for radio. If I am wrong about that I certainly am right in stating that the listening public would prefer to hear a different set of experts each time.

Television as an Export

I AM very glad to see that a vigorous campaign to promote the export of British television equipment has been decided upon by the Radio Industry Council. All possible markets abroad for transmitting equipment and receivers are being reviewed and the industry will demonstrate television in exhibitions in appropriate countries.

Suitable space has been secured in a central area to make a start in the British Exhibition in Denmark, to be held at Copenhagen in September. British television transmitting equipment will be sent there and enough receivers to give the Danish public an opportunity of seeing how good British television can be.

Mr. J. W. Ridgeway, chairman of the Radio Industry Council, recently visited Copenhagen to inspect available accommodation for the British exhibit. The place chosen is the Nimb Restaurant in the Tivoli Gardens.

Midget Radio

DEAR Thermion,—I saw such a set as you are looking for constructed by a naval officer during the war. I am at present collecting parts to make one myself, when I have time—probably next winter.

The circuit is given in the "R.C.A. Valve Manual" with values of resistances and condensers and coil details.

Valves are 1R5, 1T4, 1S5, 3S4 Wearite midget I.F.T.s, quarter watt resistors, midget 1 meg. volume control and switch, 2½in. Celestion speaker, H.T. battery is 67½ v. "batterymax" and L.T. two U2 torch cells in parallel.

The chassis was about 5½in. x 3½in. x 1½in., the cabinet about 9in. x 9in. x 4in. of wood was grooved round the outside 1½in. wide by 1/16in. deep and the frame aerial wound in this and then covered with plastic tape.

The cabinet contained the chassis, speaker, not mounted direct on chassis, batteries below, and gave good results in the train on journeys from London to Scotland. Medium wave range only was covered.

I hope this information may be of use to you.—Yours faithfully, (Dr.) Ian R. MacIntyre.

Recording Technique—1

This Article Describes Several Methods of Adding Monitoring Equipment to Recording or P.A. Amplifiers, Their Advantages and Limitations

By R. KEMSEY-BOURNE

Introduction

THIS article is written with the requirements of dise recording primarily in mind, but a number of the topics mentioned find applications in other fields of sound-engineering, such as P.A. systems and film projection.

The word "monitor" in radio parlance means some device by which an operator can follow aurally or visually what is being transmitted through a given channel at any time; thus a monitor speaker, or headphones or cathode-ray tube, enables him to check the ouput of an audio or video channel and, if necessary, to adjust its quality to a maximum.

Disc Recording

When we make a disc recording, from the moment the cutting stylus is lowered to make the first groove on the revolving blank until the time it is raised from the run-out spiral, we require some means of knowing just what is going on to the sound-track. The questions we have to ask and answer are: What is being recorded, at what volume, with what tone quality? In short, how is the finished record likely to sound when it is played back?

During recording the power fed from the output stage of the recording amplifier to the cutting-head on the recording machine must be kept within defined limits, which vary with the equipment used. If the cutter is fed with too little power then the recording will be weak, and will have a low signal-noise ratio. If the power is too great at any point then the cutting stylus may be moved so far that one groove affects the next one or even runs into it; this over-modulation damages both grooves and ruins the record as a whole. For obvious reasons the tone quality of the sound power must be consistently as good as it is possible to obtain with the equipment used.

In practice, the power and quality of the sound output are best checked by both metering and audio-monitoring at the same time. (Metering will be dealt with later.) The volume may be varied during recording either manually or by some suitable compression device, but in general tone-quality should not need to be varied in cutting discs revolving at 78 r.p.m.

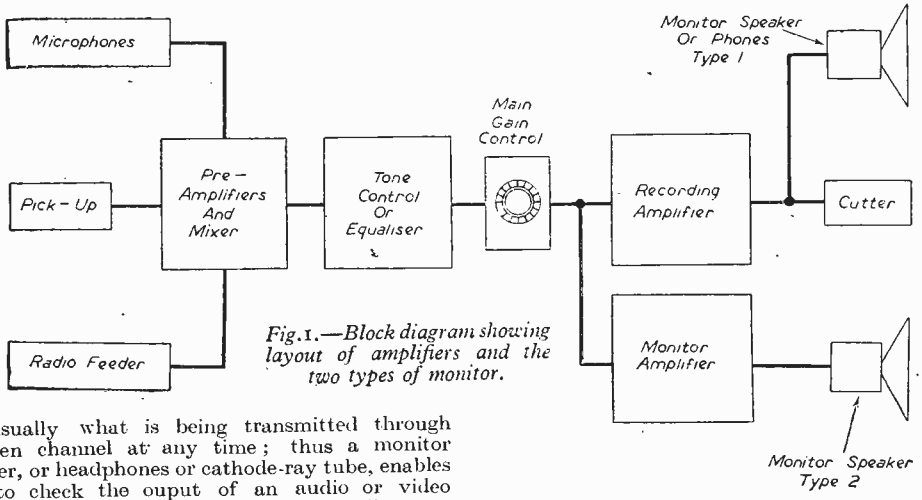


Fig. 1.—Block diagram showing layout of amplifiers and the two types of monitor.

Speaker or 'Phones?

Whenever possible it is better to use speaker monitoring, and to have as good a speaker as one can afford. In studio practice monitor speakers are baffle-mounted and placed immediately above the machines in the recording room. The studio's

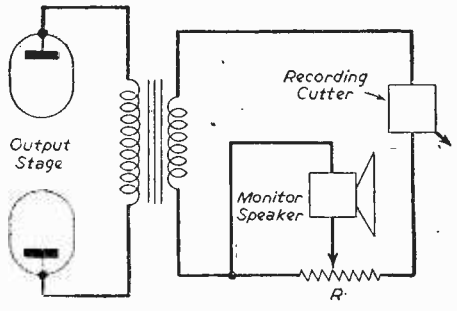


Fig. 2.—R is varied to give comfortable monitor volume. For 15 ohm cutter and 15 ohm secondary, R is 5 ohms, with 3 ohm monitor speaker.

sound insulation ensures that reasonable volume can be used without fear of acoustic feedback into the microphones.

For outside recording sessions, or where microphones are not acoustically isolated from the recordist and his apparatus, headphones must be used. To monitor the recording of a radio transmission late at night it might not be advisable to use a speaker at normal volume, so that if you must record AFN at midnight, do your monitoring on 'phones. A good pair of 'phones properly matched will give excellent results, although most operators find it easiest to judge acoustic balance from a speaker. It can be tiring wearing 'phones for a length of time continuously, although most amateurs are used to that, and on the other hand 'phone listening is unaffected by room acoustics.

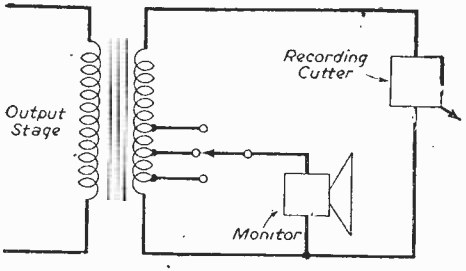


Fig. 3 (a).—Monitor speaker is fed from tappings on the secondary of output transformer.

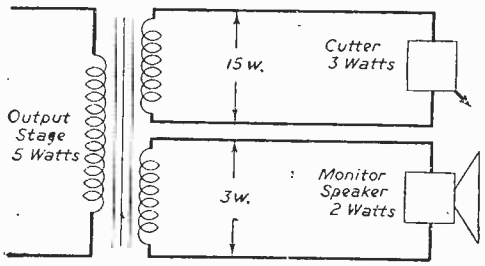


Fig. 3 (b).—Recording cutter and monitor are fed from individual windings, each taking a fixed percentage of output power (see text).

Using the Monitor

Let us assume that we have a monitor speaker, and that it does represent to us the output fed to the recording-head. Before we are ready to cut any recordings at all, either from microphones or radio-feeder, the controls on the channel-mixer, equalisers and power amplifier are set so that the resulting sound from the monitor is as good in balance, tone and general quality as possible. Meters help us to control the intensity between the proper limits, but we judge quality by ear. This calls for cultivated hearing and good equipment; no one can judge balance on a poor speaker mounted in a boomy cabinet.

The volume of the monitor speaker should be adjustable independently of the power fed to the recorder, but once set it is varied with changes of the main gain control. With the monitor set to a comfortable level for an input at which we know the cutter produces a good track, we may vary our controls as required, knowing that so long as this level is maintained on the monitor the recording will be satisfactory.

Now we will see how a monitor speaker may be wired from the recording amplifier.

Types of Monitor

There are two types of monitoring schemes, which are shown diagrammatically in Fig. 1:

(1) Monitor is fed from the same output stage as the recorder;

(2) Monitor has its own output stage and draws no power from the main equipment.

Simple Monitors

If possible the output stage feeding the cutter should not be required to feed power to a monitor as well. Headphones have the advantage that the power they draw is very small, so that high-impedance 'phones may be shunted across a low-impedance cutter without any undesirable effects in all but the highest quality work.

When a monitor speaker must be fed from the recording amplifier, then the output stage must be capable of meeting the power requirements of monitor and cutter together without any overloading. An amplifier to be used for recording should be capable of an undistorted output of at least six watts, preferably 10-12 watts, even though the recording head may require only a fraction of this power, say two watts.

Figs. 2, 3, 4, 5 and 6 show simple circuits of various types. Since they all draw power from the output circuit, where volume controls are incorporated, a

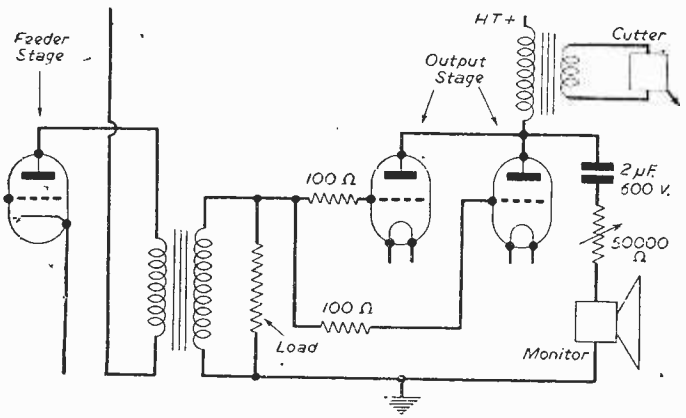


Fig. 4.—Monitor is connected to primary of output stage via blocking condenser and high resistance that serves as volume control.

change in speaker volume will affect the output to the recorder.

The circuit of Fig. 3 (A), in which impedance matching is inaccurate, can be developed into Fig. 3 (B), where the cutter and speaker have individual secondaries. The turns ratio for any secondary is given by :

$$N = \sqrt{\frac{100\ R}{n\ Z}}$$

where

R is the primary load in ohms (optimum for stage)

Z is the impedance of load on particular secondary

n is the percentage of total power to be taken.

Thus if we want a 15 ohm cutter to take 60 per cent. of the power output from two push-pull PX4, 8,000 ohms optimum load, and a three ohm monitor speaker to take the other 40 per cent., then the cutter is fed from a secondary with a turns ratio of

$$\sqrt{\frac{100 \times 8{,}000}{60 \times 15}}$$

which is approximately 30 : 1, and the speaker secondary has a step-down ratio of

$$\sqrt{\frac{100 \times 8{,}000}{3 \times 40}}$$

which is approximately 82 : 1. Both these loads will then be properly matched, and the cutter may be replaced by a 15 ohm speaker for playback, which the three ohm speaker will, of course, monitor.

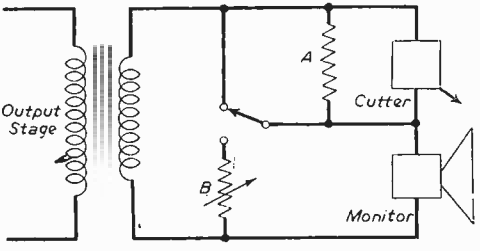


Fig. 5.—Record/playback circuit. With 15 ohm cutter, secondary and speaker, A is 10-15 ohms and maximum value of B is 25-30 ohms.

Fig. 4 shows a modification of a circuit used for monitoring sound film projection. Power is fed to the cutter through an output transformer in the usual way. The monitor is connected to a high-impedance point in the parallel-triode output stage through a blocking condenser and a high resistance that serves as a volume control. This type of connection may equally well be made to the primary of any type of output stage.

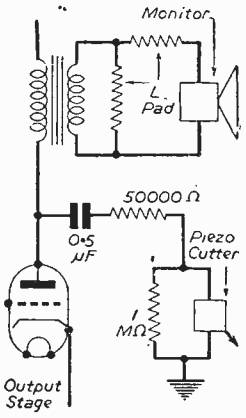


Fig. 6.—For piezo recorder. Transformer secondary matches monitor speaker ; L pad removed for play-back.

In Fig. 5 the speaker volume during recording depends on the setting of B. For 15 ohm secondary and speaker, the maximum value of B should be of the order of 25-30 ohms.

In Fig. 6, the only circuit here for a piezo-electric recording head fed direct, speaker volume for monitoring is reduced during recording by an L-pad, which would be switched out for re-play.

Microwave Multichannel Radio Communication System

THE Plessey centimetric (microwave) radio link has been developed to provide multi-channel two-way radio telephone communication in situations where the provision of landline equipment is either not possible or is undesirable. The microwave radio " beam " is extremely narrow, and is not unlike the beam produced by a searchlight. It will speedily and efficiently bridge a communications gap across a stretch of water, across marsh land, jungle, desert and similar localities where the erection of land lines or the submersion of marine cables would be costly and difficult. Provision has been made for eight duplex channels so that it is possible to operate simultaneously eight mixed speech and multiple telegraph circuits.

Either speech or telegraph duplex channels are provided of a 4 kc/s bandwidth over one R.F. carrier in the 6 cm. waveband (i.e., a carrier frequency of about 5,000 megacycles per second).

Incoming and outgoing levels similar to those obtaining with normal line practice can be separately accommodated. The signal to noise ratio also compares with that found in normal line working.

Modulation

The method of modulation is that of constant amplitude variable width pulses applied to the screen of the transmitting valve. The multiplex system is that of time division, the individual channels being scanned or sampled on an amplitude basis at a repetition frequency of 9 kc/s.

The pulser and separator unit has a stable 9 kc/s oscillator which feeds a phasing unit giving a polyphase output. Each of these phases triggers off a pulse in time sequence in each of eight channel units. These channel units contain the pulse forming and width modulating circuits. Each pulse applied to the screen of the carrier oscillator valve enables it to transmit carrier for a duration corresponding to the pulse width together with a synchronising pulse at the beginning of each pulse train.

A.C./D.C. Circuits—1

The Special Features of "All-mains" Working, Including "Battery-mains" Circuits, Explained

By W. J. DELANEY (G2FMY)

TO many amateurs the small A.C./D.C. type of receiver is regarded as somewhat of a mystery, and whereas a full knowledge of the working of straightforward A.C. or D.C. receivers may have been obtained, this universal type of receiver has been left alone and probably regarded as too complicated. This is found to be mainly due to the fact that in most cases a line-cord is fitted and this seems to have endowed the receiver with some property which makes it too complicated for the beginner. Actually, of course, there is very little which is complicated about this type of receiver and it is proposed to explain in this article the various features which go into the design of both the "all-mains" and the newer type of "battery or mains" receivers.

For a moment let us forget the line-cords, ballasts, barretters and other odd terms which are often used in association with these receivers, and see how they differ from the straightforward mains type of circuit. In any mains circuit the two principal

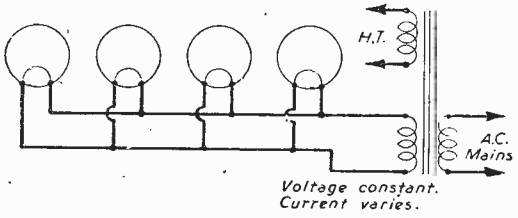


Fig. 1.—This is the normal A.C. heater-fed arrangement.

requirements are the provision of H.T. and L.T. supplies. In the normal type of A.C. receiver, raw A.C. is fed to the heaters at low-voltage, and this is conveniently obtained from a secondary winding on the mains transformer (Fig. 1). The H.T. is obtained from another winding, and, as it is necessary to use direct current, a rectifier (either valve or metal) is included in this part of the circuit. Practically every amateur is familiar with these arrangements and they present no difficulty. Well, the A.C./D.C. receiver is no different in principle, and the only departure from the above design is the omission of the mains transformer so that the receiver may be used on D.C. mains.

Power Supplies

As there is no transformer we are faced, first of all, with the problem of obtaining the supply for the heaters of the valves. In the A.C. receiver the heaters are connected in parallel so that a low voltage at a rather high current is provided, the use of indirectly-heated cathodes being adopted to avoid risk of hum due to the raw A.C. supply. The transformer secondary has a step-down ratio to deliver the appropriate voltage. In the A.C./D.C. arrangement we still have to reduce the voltage of the mains supply to that required by the valves, and if the ordinary A.C. type of valve were used, with a heater rated at 4 or 6.3 volts, this would mean that a resistor would have to be included to drop nearly 200 volts at 3 or more amps. This would not only be very inconvenient, but very uneconomical, and so a different type of valve is generally employed.

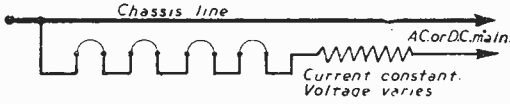


Fig. 2.—The basic heater circuit where D.C. mains are the supply source.

Starting with the fact that the mains will have a voltage between 200 and 250 our object would be so to arrange the heater supply that very little voltage has to be wasted and, therefore, in theory, if we could have heaters rated at 200 volts this would be ideal. However, such valves are not available, but if the heaters of lower rated valves are connected in series, it should be possible to arrive at a total which approaches that of the supply and thus leaves very little to be disposed of. This, then, covers the first main point of the A.C./D.C. circuit: high voltage heaters are employed and they are connected in series. It will be found that as a general practice the valves for the early stages of the receiver are generally rated at 12.5 volts, power output valves are from 25 to 50 volts, and rectifiers (which have to be employed for the H.T., as will be mentioned later) at up to 45 volts. One important fact has to be borne in mind, however, and that is that as the heaters are series connected they must all pass the same current, and in general it is not permissible to mix the heaters

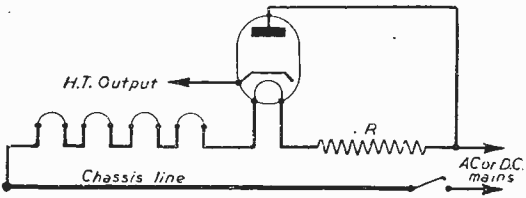


Fig. 3.—The above diagram shows the basic voltage, L.T. and H.T., supply arrangement for A.C. or D.C. mains supplies.

so far as current rating is concerned. (It is, in fact, possible to use various types by mixed series-parallel connections, but this will not be dealt with at this stage.)

Heater Circuits

In addition to the above points there is one further main item, and that is the order in which the heaters are connected. The detector stage in a receiver is very susceptible to hum, and obviously it

is desirable to ensure that if any hum is present it should be in those stages which do not feed amplifying stages, as by that means hum would not be amplified from stage to stage. Therefore, it is necessary to wire the heater circuits in an "out of order" arrangement, the most commonly adopted scheme being to include the rectifier heater first, that is, on the mains side of the chain, and the detector last in the heater chain, or, in other words, at the "earth" end. We have thus solved the first point in the A.C./D.C. circuit design, namely, that the mains are fed direct to the heater circuit with heaters in series, and as we need the negative side of D.C. mains to be our final H.T. negative line, one side of the mains input must be joined to our "earth line" (but note, NOT to earth) and the other side to the heaters. The total voltage to

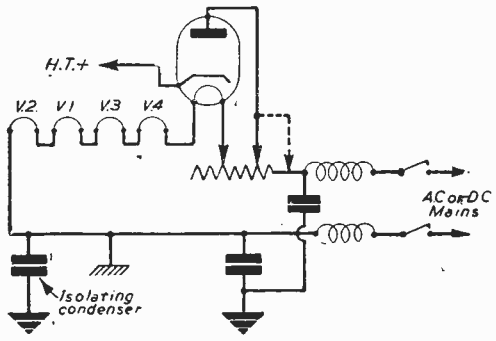


Fig. 4.—A more detailed circuit for A.C. or D.C. mains supplies showing the inclusion of H.F. filtering arrangements.

be disposed of will vary according to the valve combination and the particular types of valve employed, but whatever it is, it may be dropped through a wire-wound resistance capable of carrying the heater current, which is that of any single valve in the chain. Customary values for these are .15 or .3 amp., the former being the most popular. This resistance, R in Fig. 3, can be in any desired form: a special component for mounting on the chassis, a lamp consisting of iron wire in a gas and known as a "barretter," or a mains lead in which one lead is wound with resistance wire round a core of asbestos string, and which is known as a "line cord."

H.T. Supply

Before arriving at the value of the resistance required we must consider the H.T. supply. As mentioned earlier, on D.C. we could use the mains supply direct, but on A.C. we have to provide rectification. Now a half-wave rectifying valve has the property of allowing direct current to pass and acts merely as a high resistance, whereas when A.C. is applied a pulsating D.C. output will be obtained at the cathode if the A.C. is applied between heater and anode. This, then, is the arrangement which is adopted: the positive side of the D.C. mains (or one side of the A.C. mains) being taken to the anode of the rectifier, and the output is then taken from the cathode. This is the reason why, on D.C. supplies, it is necessary to insert the mains plug the correct way round, the set failing to work if it is inserted incorrectly. The above details are "basic", and there are a number of essential additions and what may be called refinements which should be dealt with here. Firstly, there is the question of mains-borne interference. It is customary in some receivers to include special chokes in each of the mains leads capable of carrying the current which is passed, and with one or two condensers across them to earth. Switching, too, may be provided either in each lead or in one only, preferably that lead which is joined to the "earth" line. As the set may be plugged into D.C. mains in which one side of the supply is earthed at the power supply station, there would be a risk of short-circuiting the mains if the plug were inserted incorrectly, so that the A.C./D.C. type of receiver should have a good-quality condenser joined between its earth terminal and the chassis. Another point is that as all "earth" points in the circuit will be taken to the chassis line they will also all be at mains potential, and accordingly grub screws, and all metal parts, should be protected to ensure that the risk of a serious shock is avoided. Next month we will deal with the rest of the circuit design and the later types of special "battery or mains" circuits, using the 1.4 volt valves.

(To be continued.)

100 Radio Men Wanted

THE Ministry of Civil Aviation is seeking 100 young men to help maintain the vast network of wireless stations and radio "aid" installations which form the basis of the Ministry's nationwide air traffic control service.

With the approach of the summer flying season this service, which ensures safe flying to airliners, charter firms and private flyers alike, will be used to its fullest capacity. Almost every civil aerodrome has its local control radio in its control tower and many of them some form of radio aid. In Scotland the Ministry is now building four stations forming what is known as a "Gee Chain," a radar system which enables pilots to check their position in flight.

An additional 100 radio mechanics are needed at once to maintain the hundreds of transmitters, receivers and other gear spread throughout the country, which this huge organisation involves. About half of them are needed for the Scottish "Gee Chain."

If possible, they should have a sound knowledge of the fundamental principles of electricity and wireless and have had practical experience in the maintenance of radio and/or radar equipment. Those accepted would start as radio mechanics, grade II, at £5 15s. a week, and be eligible, after a period, for promotion to grade I, which has a maximum wage of £7 a week. Later, there are opportunities of promotion to maintenance overseer, with a minimum salary of £410 a year, rising to £500.

Anyone interested should write to the Establishment Officer (Est. B.4.a), Ministry of Civil Aviation, 10, Fleet Street, London, E.C.4. The "Gee" mechanics are given four weeks training at the M.C.A. Signals Training Establishment at Bletchley (Bucks) on the special types of apparatus they will be required to maintain.

Practical Hints

A Rotary Switch

THE accompanying illustration shows an eight-position rotary switch, made from two "Clix" International Octal valve bases (chassis mounting type).

The drawing is practically self-explanatory, but the main points are as follows:

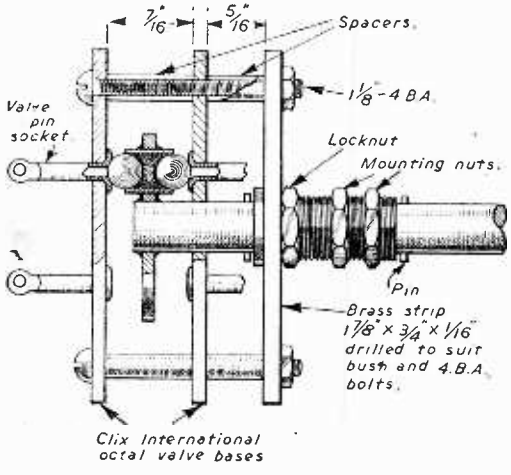
The bush is obtained from an old volume control and the 1/16in. pins are fitted to the ¼in. brass shaft to suit the length of bush. The two "Clix" bases are fitted face to face and the sockets are split in three places and the piece carrying the soldering tag eye is turned down flush on each socket.

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? We pay half-a-guinea for every hint published on this page. 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 notion sent in must be original. Mark envelopes "Practical Hints."

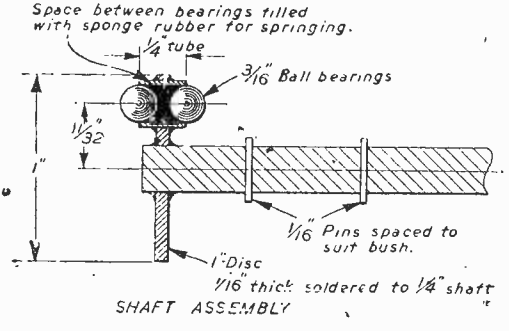
SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page iii of cover.



Main details of a rotary switch.

The 1in. x 1/16in. disc is drilled ¼in. clearance and another hole for ¼in. tube is drilled 11/32in. centre-to-centre. The tube is soldered to the disc and the disc is soldered to the ¼in. shaft.



How the rotating contact is built up for the rotary switch.

In between the two bearings is a piece of sponge rubber or small spring.

This switch is suitable for many uses and costs 1s. 6d. to make. All materials except valve bases are from the odds and ends box.

I use this switch particularly for switching in trimmers for station selection on the All Mains Midget 3, instead of using a push-button unit. The All Mains Midget 3 referred to is shown in December, 1943, and January, 1944, issues of PRACTICAL WIRELESS.—D. W. CRAUGHT (Ascot).

Replacing Speaker Cones

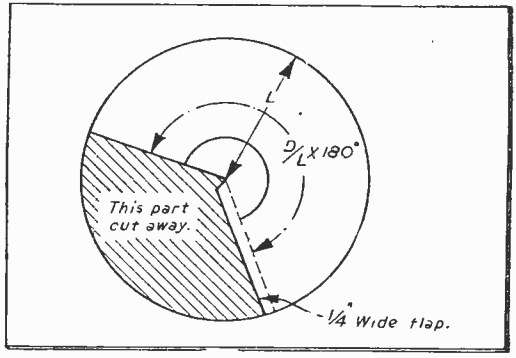
AS the ordinary serviceman's mathematics are usually a bit hazy, the following simple formulæ will be found very useful:

Before destroying the damaged cone the speech coil and spider fitting should be removed and the following measurements noted:

1. The diameter of the speech coil fitting (in inches). Call this "d."

2. The outer diameter of the cone (in inches). Call this "D."

3. The slant edge of the cone (in inches). Call this "L."



Cone replacement data.

On a sheet of good quality half imperial drawing paper draw a circle of radius L inches (see below). With same centre, draw a small circle of radius =(L—1) inches.

Join the centre to any point on the outer circle. Measure round from this line an angle of $\left(\frac{D}{L} \times 180\right)$ deg. (See illustration.)

It is usual to add a flap of about ¼in. for fixing.

Formulæ:

$$L = 1 + \frac{1 \times d}{D - d}$$

Radius of small hole =(L—1)

Angle at centre $= \left(\frac{D}{L} \times 180\right)$ deg.

—WILLIAM MCMILLAN (Strathaven).

Automatic

An A.C. Mains Receiver with Pre

By L. H

A SET was required which gave good reception of local stations and which was simple to operate. The following is the circuit which was evolved. Since only the Light Programme, on 261 metres, and the Home Service, on 342 metres, were needed, pre-set tuning seemed the ideal, and so a two-position switch of the wafer type was used to connect pre-set condensers into the tuned circuits. The easiest two-valver to construct, of course, is the detector-output type, but this is unsatisfactory for at least two reasons. As only one tuned circuit is generally used the selectivity is not adequate, and though the set may sound all right during the day, at night the continentals join in the fun and add their quota to the output.

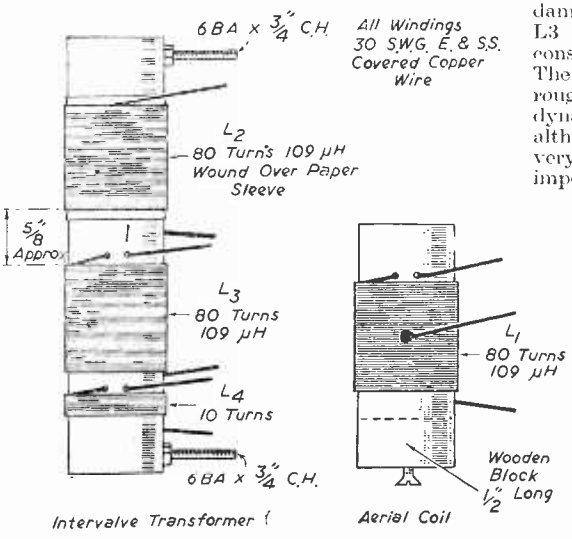


Fig. 2.—Details of the home-made coils.

Secondly, with no R.F. amplification the detector must work at milli-volt level and cannot be made as linear as one whose input is several volts.

If, however, we use one valve as an R.F. amplifier, the detector must be incorporated with the output valve. For headphone use the output valve can then be a leaky-grid detector, but if a loudspeaker is used at least 300 milli-watts will be needed on the louder passages and this cannot easily be attained. Easily the best detector-output valve is the diode pentode and so an EBL31 was used. This valve will give an output of 300 milliwatts when just under a volt is applied to the grid, and so will give a very good performance with only one stage of R.F. amplification.

Having given a description of the main features of the circuit we may run over the details more fully.

Circuit Details

The aerial is tapped halfway down the aerial coil, a position which gives the best compromise between sensitivity and selectivity, and the aerial coil is tuned by either C1 or C2. The R.F. amplifier used is a 6J7, in the anode of which is the second tuned circuit of the set, decoupled by R3 and C7. Without reaction this valve will give an amplification of about 20, measured between its grid and the anode of the diode detector. The third tuned circuit, again tuned by two pre-set condensers, C9 and C10, leads directly to the diode detector. Diode detectors are generally criticised for their damping of the tuned circuits of a set, but in this case the damping is negligible. The dynamic impedance of L3 tuned by C9 or C10, is about 70,000 ohms, considered as a parallel tuned circuit at resonance. The input impedance of the diode detector is roughly 500,000 ohms, or over seven times the dynamic impedance of the tuned circuit, and so, although the diode shunts the tuned circuit, it has very little effect, actually reducing the dynamic impedance by one-eighth. Now it may seem rather

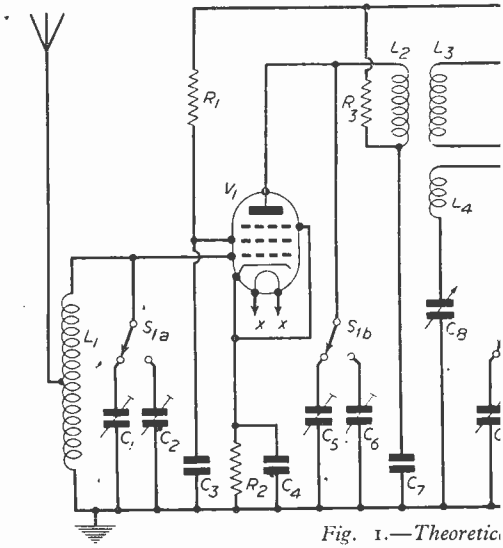


Fig. 1.—Theoretic

LIST OF C

V1	6J7G
V2	Mullard EBL31.
V3	5Z4G.
C1, C2	300 pF ± 20% trimming condenser (Bulgin CP3).
C5, C6	
C9, C10	
C3, C12	0.05 μF paper tubular 250v. D.C. working.
C4, C7	0.1 μF paper tubular 250v. D.C. working.
C8	200pF variable.
C11	100pF mica.
C13	50 μF 12v. D.C. wkg. electrolytic.
C14, C15	Hunt J39 8 μF electrolytic.

Two-valver

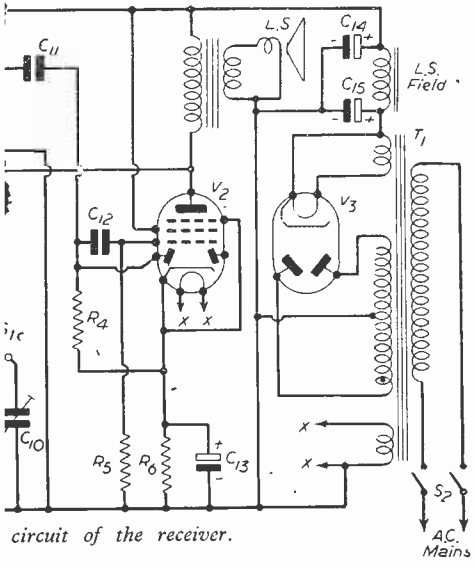
t Tuning and Home-made Coils

NAPIER

strange to put reaction on a diode detector, but this is a good working arrangement. When a diode is used in a domestic superhet as the second detector, a filter to remove R.F., consisting of, say, a half-megohm resistor and a 100pF condenser is put between the diode and the grid of the next amplifier. By the simple means of leaving this filter out enough R.F. is passed on and amplified by the pentode to give good reaction. This reaction is controlled, of course, by C8, a 200pF variable condenser. The output valve is cathode biased by R6, and the grid leak R5 returned to earth. The rectifier and smoothing are conventional and there is little to say about them.

Winding the Coils

As shown in Fig. 2 the coils are wound on



circuit of the receiver.

MPONENTS

R1	470 KΩ ±20% ½ watt.
R2	680 Ω ±20% ½ watt.
R3	10 KΩ ±20% ½ watt.
R4, R5	1MΩ ±20% ½ watt.
R6	330 Ω ±20% ½ watt.
S1	3 pole 2 way (Oak).
S2	2 pole on/off (Bulgin S270).
T1	Mains transformer, 250-0-250v. 30 mA., 6.2v. 2 a., 5v. 2 a.
LS1	Loudspeaker, 5in. energised field, with 7000 Ω matching transformer (Rola model F).

Also 3 octal valveholders (Amphenol-Celestion). 2 knobs.

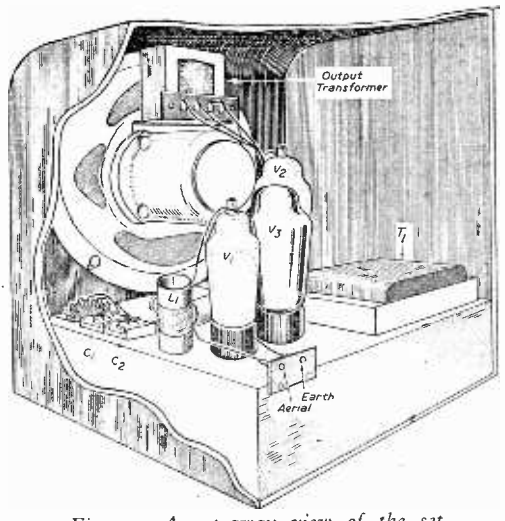


Fig. 3.—A cut-away view of the set.

1in. diameter paxolin tube. If this isn't to hand a former made from shellacked paper is very satisfactory. The measured Q of the windings on the intervalve transformer coil was 125, despite the fact that the former was made of gummed paper. L3 is wound directly on the former and the winding looped through the small holes provided. L2 is, however, wound over a single sheet of paper and Durofix, or other celluloid-based adhesive, smeared over the finished winding. This is enough to fasten the coil securely and it can then be slid along the former to alter the coupling between primary and secondary. Five-eighths of an inch is a suitable distance apart for L2 and L3. This gives

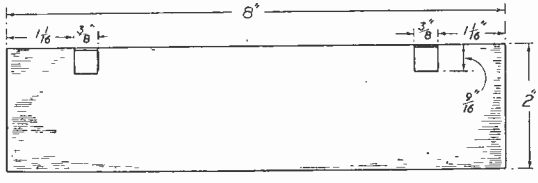


Fig. 4.—Front elevation of chassis.

slightly over-critical coupling when the reaction is turned down. The effect of the reaction is, however, to reduce the effective coupling as reaction is increased, and so the distance between L2 and L3 has been made variable to suit local conditions. It is best adjusted when lining up the set.

The aerial coil is similar in construction

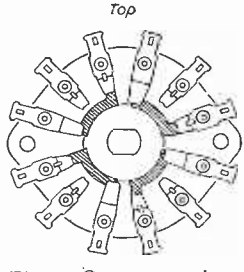


Fig. 5.—S_1 contacts viewed from inside set.

to the transformer coil. When half the turns have been wound on the wire is bared and a small loop made to take the aerial connection. The rest of the winding is then put on.

The Chassis

Eighteen s.w.g. aluminium makes a strong chassis. The dimensions may have to be altered slightly, of course, if different components are used. The holes are most easily cut before bending. The rectangular hole for the station selector switch is so arranged that the chassis forms a screen between the aerial and the transformer sections of the switch. Then the reaction condenser has to have a similar hole in order that the external controls may be level, and give a good appearance to the set.

Two metal clamps, easily cut from 18 s.w.g. aluminium as well, are used to hold the cathode decoupling condenser for the output valve, on the underside of the chassis, and the two smoothing condensers on top. A 6 B.A. screw holds the clamps and the condensers down.

Having cut the chassis and bent it to shape, the next step is to mount the components. The aerial coil is fastened by a small wood-screw through the hole provided, and the intervalve transformer coil mounted by means of the ¾in. 6 B.A. screws shown in the coil winding diagram, so that the coil is ½in. from the chassis on the underside. This keeps the eddy current losses low. The valveholders may then be screwed down, not forgetting the 6 B.A. soldering tags, to which earthing points are made. The wiring should be as short and direct as possible. In the wiring diagram the components have been spread out so as to show the connections more clearly. A spare pin on the rectifier valveholder has been used to take the R.F. amplifier decoupling condenser C7 and the decoupling resistor R3. No tag-boards are needed, except that on which the aerial and earth socket is mounted. The junction of the output-valve grid lead, C12 and R5, is left unsupported in the wiring.

Nothing has been said so far about the cabinet. This may be anything of convenient size, and the amateur will probably have one to hand.

The only components mounted in the cabinet are the loudspeaker and the mains on/off switch. The tall components have been mounted near the edges of the chassis, so that the loudspeaker may be mounted as low as possible, and so keep the cabinet dimensions small. The on/off switch is mounted near the rear of the cabinet on the left-hand side. When the chassis has been wired, the loudspeaker and on/off switch may be connected, leaving leads long enough for the chassis to be partly withdrawn from the cabinet when lining up the set. Otherwise it will not be possible to reach the pre-set tuning condensers. The method of fastening the chassis into the cabinet depends on the type of cabinet used.

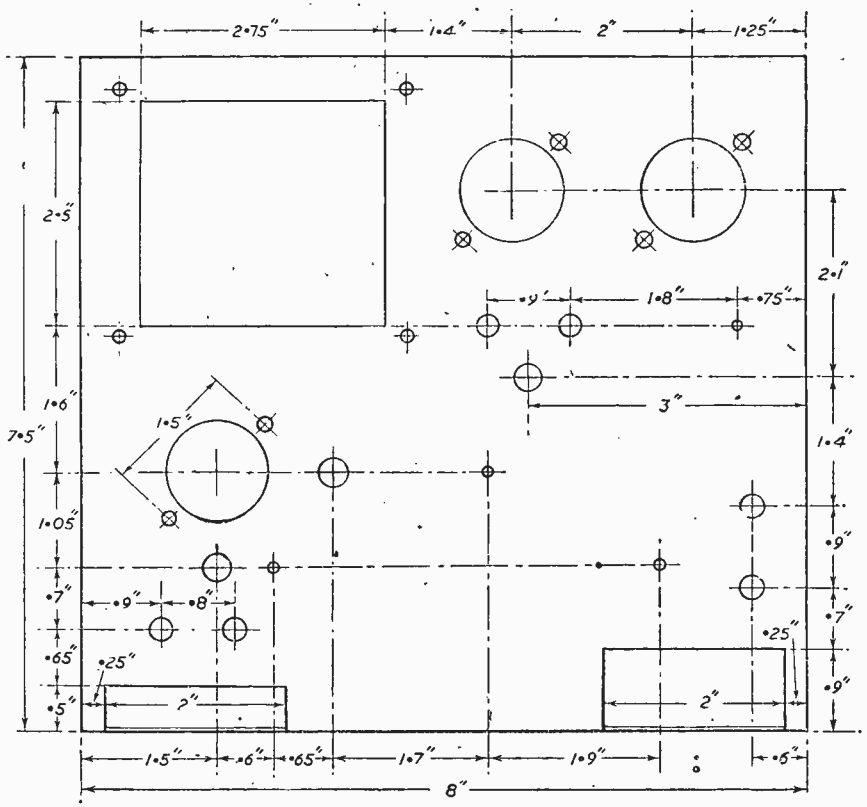


Fig. 6.—Drilling and cutting dimensions of the chassis.

Lining Up

Having checked the wiring for mistakes, the next step is to get the set working. As there are three tuned circuits the set is very selective, and mistuning of condensers will prevent a signal getting through unless it is very powerful. An outdoor aerial of reasonable size is therefore needed. All trimmers should be first tightened, and reaction turned up until the set is nearly oscillating. The station selector switch should then be turned to the left-hand position and condensers C1, C5 and C9 unscrewed about

a turn each, moving the condensers together in this way should soon enable the Home Service to be heard. The Bulgin CP3 condensers have a tolerance of ±20 per cent. and so a little searching may be needed. However, once located, the lining up may be quickly done. In case of difficulty the aerial may, in the first case, be put directly on the grid of the 6J7. After the Home Service has been aligned, the station selector switch must be turned and C2, C6 and C10 adjusted to bring in the Light Programme. This will normally be found at about two turns from the maximum capacity position. If the aerial has been put on to the grid of the 6J7 it must be moved back to the aerial socket when adjusting C1 and C2, otherwise the capacity of the aerial is enough to prevent C1 and C2 resonating in their range of capacity. Finally, and to make operation of the set fool-proof, a few turns may be taken from L4, so that with the reaction condenser fully meshed the set does not quite oscillate. Then it is not possible for anyone to leave the set oscillating.

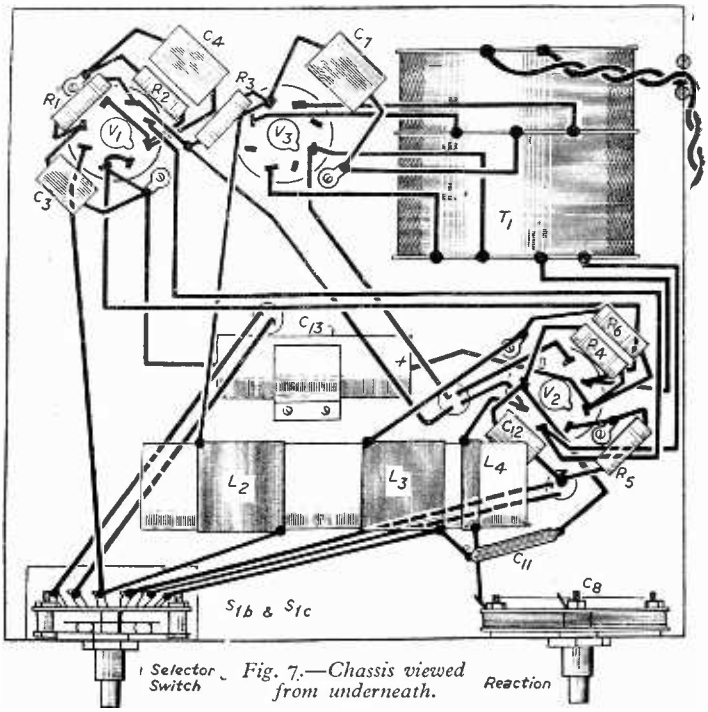


Fig. 7.—Chassis viewed from underneath.

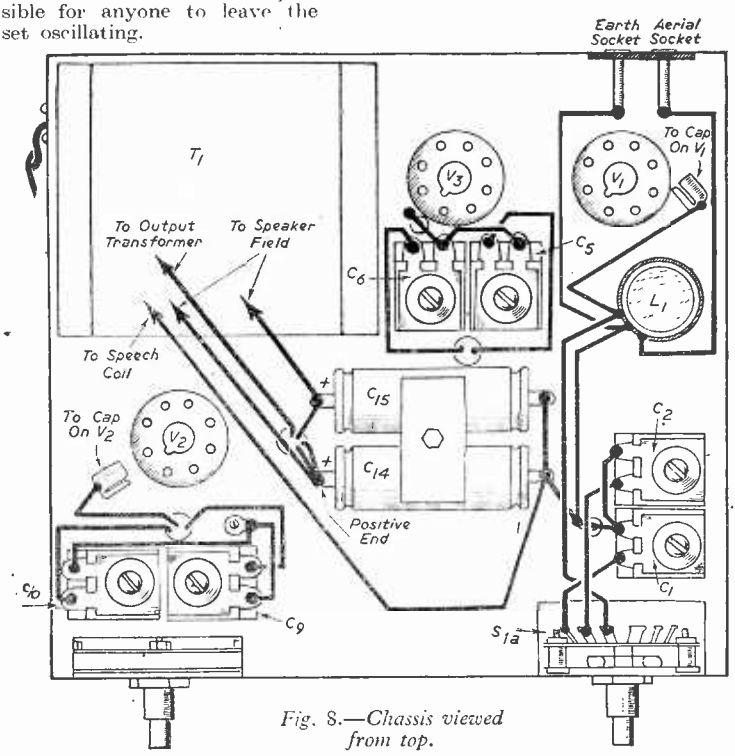


Fig. 8.—Chassis viewed from top.

It is possible that when first built, the set may oscillate with the reaction turned down. This may be cured when lining up the set by detuning C1 and C2 so that they have *less* capacity than C5 and C6. This alters the phase of the feedback through the stray capacities of the 6J7G and renders the stage non-oscillatory. In a stubborn case increasing the value of R2 from its present value of 680 ohms will stop any "howling."

In the original set 20 millivolts modulated 30 per cent. at 400 c.p.s., and applied to the aerial terminal through a standard dummy aerial gave 50 milliwatts output.

Technical Notes—1

Our Contributor "DYNATRON," Returns to the Valve Vector and Other Controversies

"THE 'big guns' have been silent for some time now," says a well known commentator on technical topics in a contemporary periodical. He is referring to valve equivalent circuits once again, and—probably what he has in mind—the vector controversy.

He apologises for again venturing into the arena to try to make sense of conventions which have grown like mushrooms around this subject. He considers it "presumptuous" to voice opinions where—he might have added—some big guns have made a general mess of things.

I do not think he has anything to fear if he sticks to *his* "guns." I do not suggest that any "gun," big or otherwise, can give a consistent account of

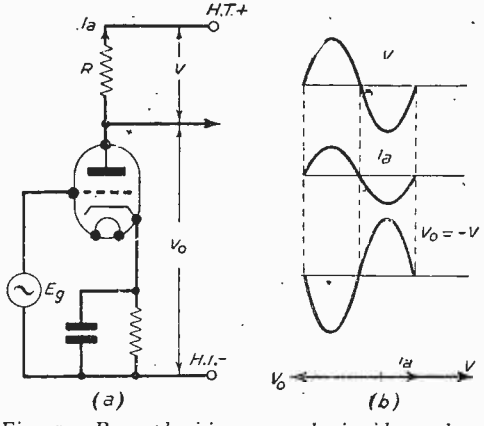


Fig. 1.—Re-emphasising some basic ideas about "phase." Is it true, or not true, that the alternating-current Ia develops a voltage-drop V across R, in-phase with Ia *? This is necessarily true of every other A.C. circuit, V being the equivalent of "supply voltage." Then, the output voltage Vo* must *have the sign (and phase) of the potential-difference in R—opposite to V. All the "big guns" ignore this, but they will be hard put to it to show any fault with our* facts *!*

phase relations in an equivalent circuit of pure resistances. But I am all for a genuine effort to clarify things and, in radio at any rate, I frankly fail to see why one or two academic names should have more right to speak than people with lesser qualifications who at least show practical common sense in their approach to theoretical problems.

It is not for a moment suggested that all experts are fools. There are many eminent names for which I have a profound respect, especially when one of them has the courage to come forward and say without fear or favour why he thinks another authoritative writer is making a subject ten times as complicated—as did happen some time ago.

One must remember, too, that there is a great deal of prejudice in the technical and scientific worlds. An eminent professor whose name is a household word in radio once told me in a letter how he had "protested in vain" against the use of American jargon such as "demodulation"—with reference to detection—and he agreed there was nothing whatever akin to "modulation" in a triode-hexode frequency-changer.

By all means read the authorities. If I complain of the attitude of *some* authorities in the present article, it must not be thought I am setting-out to "flay" technicians and specialists in general. Many are much too busy to write on fundamental problems.

All the same, those who have, and are still writing, continue to be preoccupied with the equivalent circuit, which only serves to obscure all the essential facts connected with "phase," whatever its merits in other ways.

That may sound a little sweeping. I have a few more "sweeping" statements to make, and I hope you will read on and consider my reasons.

Is There "Prejudice"?

Take the valve vector controversy.

A while ago, the commentator whom I have mentioned outlined in his columns a few interesting problems on valve circuits. All such efforts have my entire support, even if an article serves only to stimulate discussion of debatable points.

But one problem which he touched upon caused me grave doubts whether he was really trying to be helpful to his readers. He surely must have known better!

I asked myself *why* it was really necessary for him to quote a formidable array of "big guns," giving their letters and qualifications, if not for one purpose: to suggest how terribly profound was a relatively simple matter—the "signs" of applied E.M.F. and potential-difference in a resistance.

All these eminent men, we were informed, had argued the point very learnedly in no less than three of the leading radio journals.

What was the reader intended to deduce from this fact? That the *negative sign* of "P.D." had only recently been settled—or, in any case, since it had received the earnest attention of so many big guns, the obvious thing for the ordinary reader to do was to shut up and accept it all as gospel.

It surprised me the more that these eminent men permitted their names to be quoted in reference to this particular point, which writers such as Morecroft had adequately explained many years ago! If you doubt me, you will find a discussion of the relative signs of "P.D." and "E.M.F." in Morecroft's "*Principles of Radio-Communication.*"

Coupled with other facts which I knew, I began to ask myself seriously whether there was not as much obscurantism and prejudice in the technical world as, let us say, in politics or religion.

Ostrich Tactics?

Owing to difficulties caused by the reversed phase of the output voltage *Vo* in an amplifying

stage, Fig. 1, I once inquired of a few authorities whether it would not make vectorising easier for the student if we started (in the anode circuit) by using the standard A.C. convention that an alternating-current flowing in a pure resistance (R) is in-phase with the applied voltage across that resistance.

In other words: while *Vo* is a phase-reversed voltage, at 180 deg. to the current, it would be easier to start with *the voltage across the load resistance;* show *Ia* in-pbase with this "supply" voltage *V*, Fig. 1b, then draw *Vo* always equal and opposite to *V*. The advantages of doing so may not be so obvious in this simple case, but it is surely starting upon a sound A.C. foundation and avoids muddles such as assuming two *current* components in the anode circuit 180 deg. out of phase.

However, as I have explained before, the authorities would not have it that *V* had any objective existence! It was a figment of my imagination, since the only alternating potential which can possibly be found in any valve circuit is the phase-reversed output voltage *Vo*. There is not, they said, any so-called "applied voltage" *V* at 180 deg. to *Vo*.

I next pointed out that, because the +H.T. line was at fixed potential, *Vo* took the *negative sign* of the *potential-difference* across *R*, and not of the applied E.M.F. If the —H.T. line were the "fixed potential" side as in a cathode follower, the output voltage would have the phase of the applied E.M.F.

I will ask technical readers to decide for themselves whether I was not explaining, (a) that the "P.D." across R is of opposite sign to the applied E.M.F., and (b) that, because one end of *R* is at a fixed positive potential, any alternating voltage taken off the *anode* end must necessarily have the negative sign of the P.D.

I have said before that I claim no particular credit for pointing out these facts. They are pretty obvious, once considered, whilst writers such as Morecroft had given accounts of the negative sign of a "load reaction."

What is significant is that none of the writers who have contributed articles on the subject have said a single word touching upon these basic issues! Instead, we learn how some of them "showed"(?) comparatively recently why P.D. and E.M.F. must have opposite signs—still without reference to the significance of the fact in valve circuits!

Again, I ask *why*? Is it not a case of deliberately flying in the face of facts; to devise abstruse conventions in order to prove to the ordinary reader how terribly involved these things are—or how naïve it is to have the presumption to suggest any "simple" explanations?

No doubt, if "Prof.——" or "Dr.——" so-and-so had "pointed out" the true facts concerning the negative sign of *Vo*, it would have been hailed as an important contribution to knowledge! But for me, "Dynatron," to have the audacity to suggest such truths—well—can anyone possibly believe they are true?

What I have been asking myself quite seriously for a long time now is whether some "big guns" are in the least concerned about "truth." It all begins to look like one big game of bluff and jugglery, to gain a little credit for inventing the most ingenious "conventions" that will steer the too-inquisitive student right away from the facts.

Ignoring Facts

If this sounds too sweeping an indictment, let us suppose for argument that the point about "applied E.M.F.," in the anode circuit is unimportant—it is easily demonstrable that failure to take account of it is the real explanation why difficult conventions, such as putting two *currents* at 180 deg., are invented.

But other equally fundamental issues are completely ignored—I think that is the proper word to use.

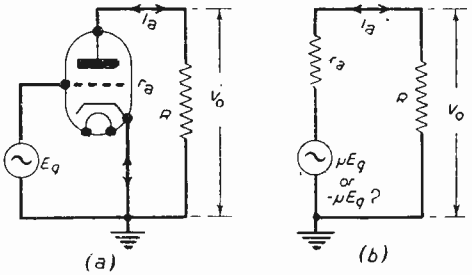


Fig. 2.—By "forgetting the H.T.," we get these "abstractions"—pure A.C. circuits—of the actual valve circuit Ia. But they fail completely to represent the voltage conditions of Fig. 1, since the relative "signs" of V and Vo depend upon the fixed D.C. potential *of the + H.T. line. There is nothing remotely resembling the true conditions in purely "A.C. equivalents."*

Thus it was shown in recent discussions with a correspondent in PRACTICAL WIRELESS, that the internal *ra* of a triode becomes a most important factor in drawing a vector diagram for a reactive load. My simplified treatment—and it was intended to be so—for pentodes was found to be wide of the mark, even with a reactance in the anode circuit of as much as ten times *ra*.

Another basic issue which we settled was that *Ia* can be out of phase with *Eg* when the load is reactive—again, a phase-shift that is mainly of importance in triodes.

I was perfectly aware that writers on vectors did show these two quantities out of phase. I questioned the matter in order to get right down to a discussion of fundamental principles. It remained for a correspondent, Mr. R. S. Hatch, to take me to task regarding my premises when triode valves are used.

Of all the writing and correspondence there has been on the subject in other periodicals, I ask you: has there been a single writer who got down to do a little explaining of basic points of such importance to any discussion of "valve vectors?" For that matter, I would be glad to hear of one textbook which contains a vector diagram, *with full explanation*, for a triode valve with purely reactive load.

Here are three vital principles which it is necessary for a student to understand: (i) that *Ia* sets-up a voltage across the load, of *opposite phase* to *Vo*: (ii) that the shunting effect of a triode upon a highly reactive anode load gives a nett impedance that is mainly resistive; and, (iii) that, with a reactive

load, *Eg* and *Ia* can be considerably out of phase in triode circuits—with pentodes, (ii) and (iii) are of but minor importance.

Is it not time radio literature intended to "enlighten" practical readers, should free itself of academic shackles, and discuss *actual* valve circuits? For many years, the equivalent circuit has served to befog a good many straight-forward issues.

Is the "H.T." Really Important?

After all is said and done, what is this "imaginary alternator" idea?

An *abstraction*, I think, is the right word. Like all abstractions, it has led to endless theorising and

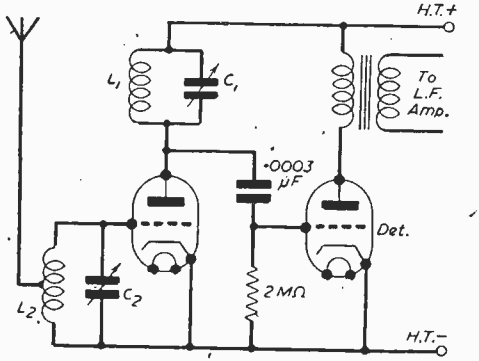


Fig. 3.—As an experiment, it is instructive to try an H.F. stage consisting of a triode with anode and grid tuned-circuits. It provides an object lesson in "H.F. instability!"

muddles of a kind not so far removed from purely speculative knowledge which philosophers have been trying to disentangle for ages!

By "abstraction" is meant taking out some one property and trying to make it fit in with facts it obviously does not include. "Let us forget the H.T." is the common injunction. If we do, we get the A.C. circuit of Fig. 2a, and the equivalent generator of 2b. At once, arguing starts concerning a set of A.C. "conventions" which will account for what is actually a combined D.C./A.C. circuit.

Thus, the latest commentary re-emphasises the need for omitting all reference to D.C. conditions.

Then what have we left? A pure A.C. circuit where there exists no possibility of showing *why Vo* becomes phase-reversed—not only the cathode, but the *fixed D.C. + potential* of the H.T. line must be considered in order to explain the negative sign of the output voltage. Even supposing "μEg" to be the actual E.M.F. generated by a real alternator, there is nothing in Fig. 2b, to act as a cause for a 180 deg. phase-shift. It is simply an A.C. circuit embodying pure resistances.

One writer on the subject did at least appreciate the necessity of taking the D.C. conditions into account, and tried to devise an equivalent circuit with that end in view. But things became terribly complicated—far beyond the simple facts of the case.

Would any of these writers care to show any flaw in the statement that the output voltage *Vo)* has the sign of *the internal potential-difference* in the load (which implies a "positive" component of the H.T. (and "*applied E.M.F.*"), equal and opposite to the "P.D.")?

Reduced to simpler language, this means: the volts existing across the valve *fall* have a "negative change" *because* a voltage-*rise* takes place across the load—if we call the latter a "positive change." to distinguish from the negative change across the valve, the "signs" of E.M.F. and P.D. acquire an objective meaning.

But, to say: forget all fixed D.C. potentials, and try to make sense of phase problems in an abstract equivalent circuit, is, to say the least, a typical instance of being "blinded by science."

In the Days of "Neutralising"

Though only of direct interest now to transmitter fans, a brief story of the days before "Screened-grids" still has its fascinations.

One or two H.F. stages in receivers is a commonplace to-day. Using H.F. pentodes, tuned-circuits of suitable design, and adequate screening, it is not too difficult to turn out a "straight set" of good sensitivity. The problem is simplified by the lower intermediate frequencies employed in superhets., even though initial adjustments are complicated in other respects.

But I don't know if you have ever tried a single *triode* H.F. stage? If not, it may be worth while as an object lesson of what receivers once were! I do not suggest for a moment that you will get any appreciable degree of H.F. amplification by rigging-up a stage such as Fig. 3 in front of the detector. If you do, you may well find after taking all necessary steps to secure stability, that the overall gain will be somewhat less than without the extra stage!

The better the amplification, the more difficult it will be to secure moderate freedom from sundry howls and whistles—the usual symptoms of H.F. instability. One valve will be bad enough, but if you want a real trial of patience and ingenuity, try *two* H.F. amplifiers! With the best of screening, the stability problem will become almost insuperable. You will at least gain added respect for experimenters in the good old days.

To be sure, amazing sets did appear in those days, some of them carrying highly picturesque names such as "The Bloodhound of the Ether," "The Transatlantic Six," etc. They embodied at least two H.F. stages, and—provided you succeeded in neutralising properly—they were good sets compared with the best available then.

Without neutralising, however, H.F. stages were little more than show-pieces, heavily-damped by various means to get freedom from self-oscillation.

Those of you interested in experiments as a means of getting to know more, will perhaps welcome a simple set-up to demonstrate the "inherent instability" of triodes.

OUR COVER SUBJECT

THE illustration on our cover this month shows the camera set-up in the television studio at Alexandra Palace to radiate the standard tuning signal which precedes every transmission. This gives gradations which enable receivers to be adjusted to give maximum light and shade, and at the same time enable a check to be made as to frequency response and synchronising efficiency. It is on the air for five minutes.

A Really Portable Transmitter-receiver

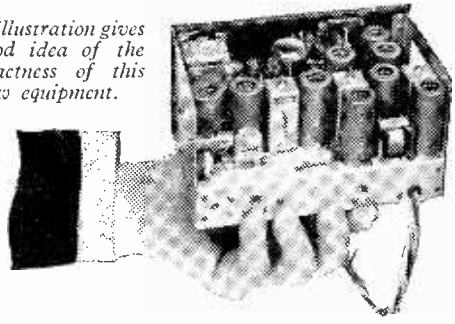
A New "Midget" Developed by Tele-Radio Development, Ltd.

NOW successfully tested before various Service Departments and Ministries and believed to be the first frequency-modulated V.H.F. crystal controlled hand-portable transmitter-receiver, the instrument pictured on this page, and known as the "Commando," is manufactured by Messrs. Tele-Radio Development, Ltd., of 177, Edgware Road, W.2. It weighs only 10lb. complete with batteries.

As the maximum power allowed by the Post Office authorities for this type of equipment is 1 watt into the final valve, the range is inevitably somewhat limited; however, frequency modulation (as well as giving comparative freedom from interference) makes possible about twice the output power which would be obtainable with amplitude modulation (using the same batteries); consequently in difficult built-up areas a range from a half to one mile is usual and about two to three miles or line-of-sight range in open country.

There is no tuning as the equipment is pre-set during production to any frequency within the operating channel allowed by the Post Office (65-95 megacycles), whilst hermetically sealed crystals in both the transmitting and receiving tuned circuits ensure absolute frequency stability.

With dimensions of only 9in. x 7in. x 3¾in., the set consists of a crystal-controlled transmitter with third harmonic taken from the crystal stage, and doubled in the next stage, followed with the final amplifier which delivers approximately 500-700 m/watts into the quarter wavelength whip aerial. The frequency modulation is obtained by a reactance valve on the crystal oscillator stage (phase modulation). The receiver consists of a seven-valve superheterodyne with R/F stage, frequency mixer, with crystal-controlled oscillator section, two I.F. stages and limiting valve. A pair of the germanium diodes described on page 251 are used as discriminator and followed by a conventional two-stage L.F. amplifier.



This illustration gives a good idea of the compactness of this new equipment.

The necessary power is obtained from a 90-volt Drymax layer-type H.T. battery, type DM517, and as L.T. a 2-volt Exide MR2A cell. The drain on the H.T. battery is 20 mA. when transmitting and 12-14 mA. when receiving; on the L.T. cell 700 mA. and 350 mA. respectively.

This instrument will be available for export and in this connection it is worth noting that British materials and valves are used, the latter being interchangeable with American types.

News from the Clubs

MIDLAND AMATEUR RADIO SOCIETY

Hon. Sec.: W. J. Vincent, G401, 342, Warwick Road, Solihull, nr. Birmingham.

AT a recent meeting of the above society Mr. C. Naylor Strong, G2RQ, gave a lecture on "The Design of U.H.F. Generators," with demonstrations of apparatus in which he was assisted by Mr. E. G. H. Brown, G5BJ. All who are interested in short-wave wireless communication are invited to attend meetings which are held in the Imperial Hotel, Temple Street, Birmingham, at 6.30 p.m., on the third Tuesday in the month, or to communicate with the hon. secretary.

WIRRAL AMATEUR RADIO SOCIETY

Hon. Sec.: B. O'Brien, G2AMV, 26, Coombe Rd., Irby, Heswall, Cheshire.

THIS society now has a net paid up membership of over 70, and holds two meetings per month, usually the first and third Wednesday evenings at the Y.M.C.A., Whetstone Lane, Birkenhead. The hon. sec. publishes a monthly newsletter which advises members of forthcoming activities, etc. An exchange and mart is organised by G8BM, and slow morse is transmitted on Tuesday and Friday evenings, for the benefit of learners, by G8BM, 3AKW, 6YS and 3AK6, on 1,860 kc/s. On Friday night the slow morse is followed by the Wirral Friday Night Top Band Net in which many stations join, and to which a great many more listen. Twenty-five of the 70-odd members hold transmitting licences.

Arrangements are in hand for a series of lectures preparing members for the City and Guilds examination, if a sufficient number of members are interested.

Prospective members are welcome at the meetings, or they may write to the hon. sec.

READING AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: A. Mercer, 23, Oakley Rd., Caversham, Reading.

AT recent meetings there has been a test of the society's Tx and Rx, with the aid of G5XB. This was followed by a "mystery parcel" exchange, in which all participants, if they were lucky, obtained that odd component they have been looking for. The remainder of the time was filled by a Brains Trust. Mr. G. T. Peck was unable to give his demonstration of high speed flash equipment, but the president, Dr. Lemon, filled the breach with a demonstration on very-low frequency oscillations. Several well-known, and some less well-known, effects of A.C. were demonstrated by mechanical methods at frequencies of 0.5 to 2 c.s.

Meetings of the society are held at Palmer Hall, West St., at 6.30 p.m. on the second and last Saturdays of each month, when any interested persons will be welcomed by the officers.

STOKE-ON-TRENT AMATEUR RADIO SOCIETY

Hon. Sec.: D. Poole, 13, Oldfield Ave., Norton-le-Moors, Stoke-on-Trent, Staffs.

THE society held a very successful exhibition of amateur radio equipment at the Tabernacle Hall, High Street, Hanley, Stoke-on-Trent, recently.

Most of the gear was constructed by the members, although there was a sprinkling of Government surplus about the place, but this was entered to show the public that it was possible to convert ex-Service to civilian use.

Underneath the Dipole

Television Pick-ups and Reflections. By "THE SCANNER"

WHAT a pantomime the entertainment industry is! Television, appropriately cast as the Cinderella of the show world, is not lacking in wicked uncles, bad barons, brokers' men, comic robbers and others who are bent upon killing the goose that laid the golden egg. First came opposition from the cinema interests, which naturally didn't want to assist a medium which might become a rival form of entertainment. And so they refused to allow any films, excepting very, very old ones, to be televised and extended the ban to cover newsreels. Courageously, the B.B.C. countered this move by producing a newsreel of their own, which has, in the course of time, surpassed the established cinema gazettes. The next obstruction came from the unions, and Equity, the Variety Artistes' Federation, the Association of Cine Technicians and the Musicians' Union each had their special axes to grind.

At the time of writing the unions are threatening to ban musicians, actors or variety artistes from televising unless the B.B.C. agrees to treat television as a medium entirely distinct from sound radio, with its own separate and increased fees. While there may be some grounds for sustaining the argument when the service is well and truly established, many reasonable people feel the demands to be premature. If there are any golden eggs to be awarded, they should go to the production staffs and engineers of the B.B.C., whose initiative and enthusiasm has brought the service to its present high standard.

Finance

After all, the 50,000 television licence-holders in the London area contribute only a fraction of the colossal costs of running the service. On the other hand, this number is increasing very rapidly, and with the opening of the Birmingham television transmitter later on this year (we hope!) the expansion of the viewing circle will be limited only by the capacity of the radio trade to supply sufficient television receivers. It will then become essential for the B.B.C. to pay their ace technicians and producers sufficient to retain them in the service, secure from the tempting offers of theatrical, film and commercial interests. Meanwhile, I hear that the television craze has caught on well and truly in America, with literally hundreds of television transmitting stations under construction or already working. The competition between stations is keen and progress will be fast. As there is no licence fee the programmes are largely provided by sponsors for advertising purposes.

Sponsored Programmes

The B.B.C. television service might well take a leaf from the American book by introducing competitive sponsored programmes here. I don't think there would be any harm, for instance, in allocating, say, two evenings a week for sponsored programmes. For the privilege of being allowed the discreet mention of their products, advertisers would be willing to provide first-class all-star programmes. Under these circumstances some of the more enterprising film people might well make use of "hired time" for boosting their films and their stars. Just think of the wonderful publicity value of the sound broadcasts of producer Herbert Wilcox for his films, "Piccadilly Incident," "Courtneys of Curzon Street" and "Spring in Park Lane," in which Anna Neagle and Michael Wilding starred. All of these broadcasts had an entertainment value and appeal which considerably assisted in packing the cinemas which exhibited these films.

There is no holding back television, and I feel sure that Herbert Wilcox's enterprise will be followed by other producers endeavouring to capitalise on the new medium instead of opposing it. After all, the televising of specially prepared "trailers" of coming film releases could prove an interesting weekly item on the programmes. I don't think the normal kind of film trailer, consisting largely of two and a half minutes of superlatives smacking you in the face, would do. But a five minute excerpt of a complete sequence from the finished picture would be most acceptable.

Musical Comedies

The successful television version of "No, No, Nanette" will undoubtedly be followed by further musical comedy productions. While I prefer the rather special style which the B.B.C. producers have evolved for the presentation of intimate revues, there is no doubt that the musical comedy idea has scored with viewers. I can well imagine the B.B.C.'s legal department feverishly engaged in sorting out the tangled web of copyright problems which are associated with this type of show. "No, No, Nanette" may have been entirely free from such difficulties, but I can well imagine some of the old musical comedies, which had a multitude of composers and authors, with the owners of stage rights, of silent film rights, of talkie and of music publishing rights, all to be suitably placated. Ever since Elinor Glyn sued a film company for infringing the copyright of her novel, "Three Weeks," by making a burlesque version of it, the lawyers have been industriously reaping a rich harvest of six-and-eightpences for legal advice on copyrights. They now look forward to a rich season of "plums" from television.

Personally, I find that the traditional opening chorus and ensemble, followed by dialogue and "cues for song" rather trying for the first ten minutes or so, after which I seem to become acclimatised to the traditional "business" and broad humour of the musical comedy type of show. When the producers can evolve a commencement which is less stagey, I feel that musical comedy will find a permanent and popular place on television. In the case of "No, No, Nanette," the familiar dialogue and haunting tunes seemed to be inextricably associated with the days of large rump steaks, plenty of butter and cream and P. P.

Eckersley's broadcasts from Writtle. Happy days! "No, No, Nanette" was trivial, but it was a tuneful form of "escape" from the morbid type of spiv and psychiatric melodramas with which we are so frequently regaled—and from the dictatorial documentaries. The latter might safely and appropriately be purged from the television programmes altogether.

Phase Modulation in Recording

Turning to more technical matters, I cannot let the month pass without reference to an interesting paper and demonstration given before the British Kinematograph Society on the application of phase modulation to recording processes. Messrs. J. A. Sargrove and D. A. Ball, who worked on radar, have evolved a multi-grid valve of a special type, which they call the "Phasatron." This valve responds to very slight phase changes in a high-frequency carrier, enabling extremely high-quality results to be obtained with small condenser microphones. Very good results were demonstrated with a recording of an orchestra made on film. This is a new and rather surprising development in the recording field which will be watched with considerable interest.

Multi-purpose Rectifier

Some Details of the B.T.H. Germanium Crystal

FOLLOWING its original work in the development of the stable silicon rectifier the B.T.H. has now produced an equally stable germanium rectifier, type CG, of similar construction to the silicon type but made only in the wire-ended form (1-C).

The silicon rectifier continues to occupy its unique position for all centimetre-wave applications; but, at the lower frequencies in more general use, the germanium rectifier has the definite advantage that it will operate satisfactorily at much higher voltages, up to 80 volts. It is also better able to withstand transient overloads.

Crystal rectifiers possess certain inherent and obvious advantages over the thermionic-valve diode and the metal-oxide rectifier. The diminutive germanium rectifier, *only* $\frac{1}{4}$*in. diameter by* $\frac{3}{4}$*in. long*, occupies only a minute fraction of the space of a thermionic valve, and further there is no heater supply, with its attendant 50 cycles hum, to be provided.

Compared with the metal-oxide rectifier the germanium rectifier has, size for size, a far greater power-handling capacity, and the point-contact construction allows a much superior frequency response, due to the lower contact-capacitance. This characteristic renders the germanium rectifier particularly suitable for use in many high-frequency applications.

Construction

The general construction of a germanium rectifier is illustrated in Fig. 1. Crystal A, made of a specially prepared flake of germanium, is attached to the end of a plunger B, which after contact adjustment is locked in the metal sleeve C by the grub-screw D. The tungsten-wire contact, or "cat's whisker," E is brazed into a metal end-piece F.

By a special process the enclosing low-loss ceramic tube G is silver-plated at each end, and is soldered on to the sleeve C and the end-piece F.

The contact pressure between the crystal A and the contact wire E is adjusted to give a predetermined rectifying characteristic, and the plunger B is locked by the grub-screw D. The cartridge is then hermetically sealed, and the assembly is completed by fitting the end-caps H into which are brazed the nickel connecting wires J.

Polarity Markings and Connections

The body of the germanium crystal rectifier is marked with positive and negative signs (Fig. 1) denoting the polarity of the voltage which, when applied to the rectifier, results in the "conduction" or "non-conduction" of current. It should be noted that the polarity markings on the

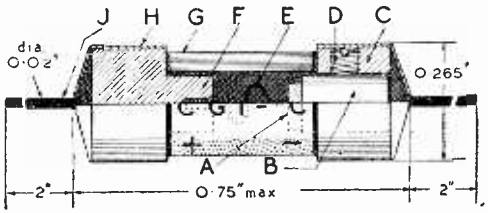


Fig. 1.—Half-section of germanium crystal rectifier, type CG.

type CG rectifier are the same as those used on the corresponding American type, and are opposite to those generally used for contact rectifiers.

When soldering the end wires care is necessary to minimise the conduction of heat to the rectifier itself; it is advisable to hold the wire with pliers close to the metal end-cap to prevent damage by over-heating. Otherwise the rectifier is remarkably sturdy. The assembly is tested to withstand a tensile stress of 20lb. between the metal ends; and the contact stability is such that it will not be affected by normal mechanical shocks in handling.

Performance Curves

Figs. 2 and 3 illustrate graphically typical operating characteristics of the germanium rectifier. Fig. 2 shows D.C. characteristics, while Fig. 3 is a frequency response curve.

Overloads

An important feature of the germanium rectifier is that it is not necessarily damaged by sudden or transient applications of excessive voltage. It will regain its normal characteristics almost at once, provided that the duration of the overload does not exceed a few milliseconds.

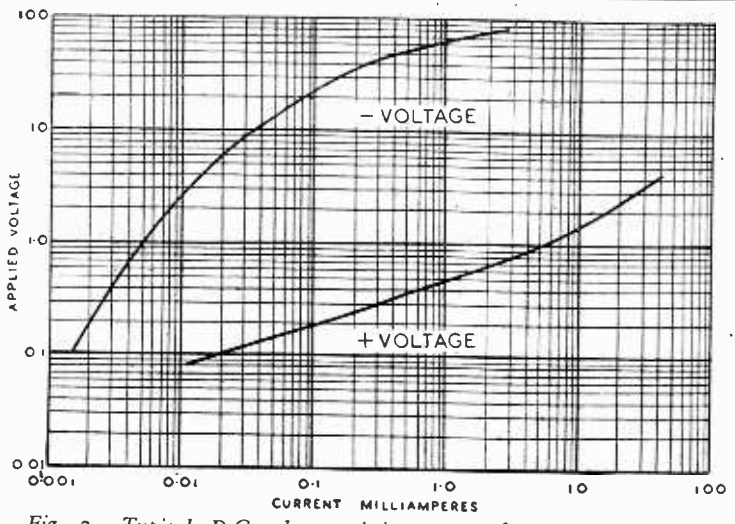


Fig. 2.—Typical D.C. characteristic curves of germanium crystal rectifier.

Temperature and Humidity

Each rectifier is hermetically sealed against the ingress of moisture, and may be used under tropical or Arctic conditions.

Operating and Shelf Life

Provided that the voltage and current ratings are not exceeded, an operating life of several thousand hours continuous running may be expected. There appears to be no limit to the shelf life of the rectifier, judging by statistics available.

Ratings

Max. reverse voltage, —80 volts (peak value).
Max. continuous input current, 50 milliamps.
Max peak input current, 400 milliamps (limited to one sec. duration).
Resistance at +1 volt, not greater than 250 ohms.
Resistance at —50 volts, not less than 50,000 ohms.
Total capacitance of unit, 1.0 micro-microfarad (average).
Max. operating temperature, 100°C. (with humidities up to 100%).
Min. operating temp., —40°C.

Uses

Some of the uses of the germanium rectifier are as follows:

Second detector: The rectifier may conveniently be used as a second detector in low-impedance, wide-band I.F. amplifiers up to 100 Mc/s.

Limitor: Considerable circuit simplification is possible and it may replace the normal diode.

Discriminator: It may advantageously be used for automatic tuning, and in F.M. systems where superior frequency response and compactness are of importance.

Automatic gain control: It can be used in practically all types of receiver as the means of developing the A.G.C. bias voltage.

In addition to the above, the special and outstanding features of the germanium rectifier, its simplicity and its small size, are employed to advantage in the following applications:

The characteristics of this type of rectifier are, of course, not the same as those of the silicon crystal rectifier, which is also a product of the B.T.H. Company, and about which a special pamphlet (No. 5859-10) is available on application to the B.T.H. Company.

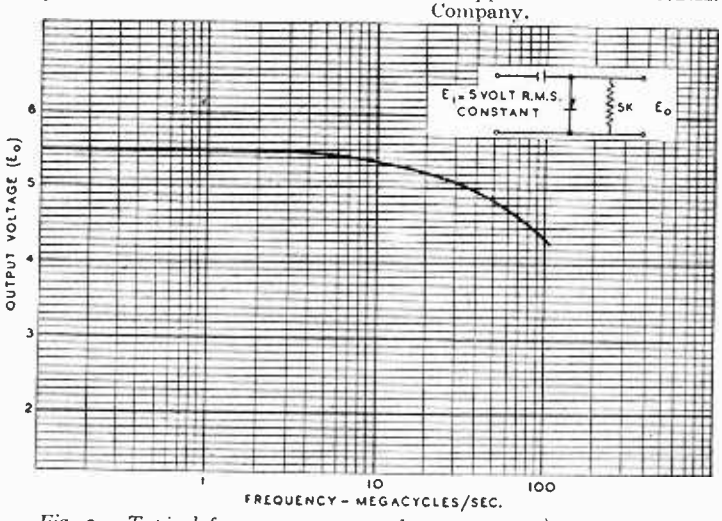


Fig. 3.—Typical frequency response characteristics of the rectifier.

Duty	*Application*
Power rectifier	Miniature components development.
Pulse generator	Modulating systems.
Rectifier	Telephone apparatus for A.C. operation.
Signal generator	Power, voltage or frequency monitoring.

CHANGE OF ADDRESS

All requests for information concerning the radio and mathematics courses conducted by the Technical and Commercial Radio College should, in future, be addressed to: T. & C. Radio College, King Edward Avenue, Aylesbury, Bucks.

Programme Pointers

Our Contributor, MAURICE REEVE, Continues His Discussion on What is a "Classic"?

I EXPLAINED last month that harmony was the cornerstone, foundation and edifice of all serious music, and that it was in the volume and quality of sound produced from the composer's ordering and arranging the "voices," i.e., harmony, of his work, to include every variety of contrapuntal device in their presentation, and their final inclusion in the architectural symmetry of form, where his greatness and characteristic qualities lay. It is these qualities, rather than the writing of lush melodies, that give to the music of Beethoven, Brahms, Bach, Mozart, etc., their titles to supremacy. The boldness and clarity, rather than the vocal line of their themes and motifs—sometimes no more than a figure in length but ever memorable none the less—add point and character to their work. The great melodists, Schubert, Mozart, Wagner, Chopin, did not confine themselves within the rigidities of classical form to the same degree, though each was a great harmonist and contrapuntalist—Wagner as great as any who has ever lived—and the overpowering "Wagner idiom" is so deeply embedded in his marvellous and unique harmonic schemes that he can serve as a prima facie case for the defence. In any case, his medium of self-expression, opera, would automatically have produced gorgeous melodies from such a master.

With song and operatic writers generally, Wagner apart, things must be different. The process of creation is somewhat inverted and the melody comes first, in the nature of things. Wagner's operas not being operas at all, in the Carmen or Traviata conception of the form, but his own special brand called "music drama," probably proves that he was a symphonist at heart plus his genius for vocal and histrionic delineation and characterisation.

Another Phase

Being so sure on this point brings me to another phase of the subject, one of the present day's abominations and perversions, and something which may serve to show the soundness of my argument more forcibly than anything else. I refer to the truncation, mutilation or spoliation of the masterpieces of music variously known as "adaptations for," "arrangements of" or "simplifications for students (q.v.) by," "truncations for teachers," and "arson for small audiences"; all of which add up to musical murder and worse.

Why? If one wants the answer to this question of whether a melody suffers a decline in quality, appeal and all the ingredients which have made it famous, by divorcing it from its original harmonic texture—of which, please note, it was ever only a part—and substituting a "simplified" version of taking the form of a "tom tom tom" accompaniment; I invite you to take any of the thousands of classics so mishandled, from a Schubert song to a Beethoven symphony, play it over, and then put on a gramophone record or wireless performance of the original, and judge for yourselves. I am sure you will not fail to be astounded at what you have been deprived of. Only the shell or husk remains.

Before proceeding I must avoid ambiguity on one point. I am not averse to the transfer of a work from one medium to another, usually the piano, as such; the piano being the only solo instrument capable of making its own harmony and counterpoint. But the harmonic and contrapuntal background *must* remain inviolate. What one loses in the timbre of the various instruments, combinations of instruments or voices for which the work was originally conceived is, of course, irreplaceable. When, to this irreparable destruction is added the scrapping of the main volume of harmony in the work, not to mention a change in the key to one "easier" for the "young performer" to "negotiate"; then, I say as absolute dogma, that what is left is not worth having, and that anyone who thinks it is, simply doesn't know what he is talking about.

Piano Transcriptions

The playing on the piano of the orchestral masterpieces, arranged either for two or four hands, is excellent in itself as well as very great fun and enjoyment. There are three or four first-class adaptations which make first-class introductions to the original works. The essential body of the work is left intact, thus enabling the performer to learn the harmonic lines, voices and inner parts. With the added help of a miniature score, it is not hard to transfer mentally—transpose—from the piano tune to that of the violin, cello, flute, etc., for which they were originally written. One can then go to the symphony concert with a complete mental picture that will be correctly brought to life when the conductor raises his baton.

But to imagine one "knows" this or that masterpiece from the truncated snippets of melody and tune so frequently given us these days here, there and everywhere, is an illusion and a chimera. Firstly, and no doubt with the best intentions in the world, these providers of the classics for everyman think in terms of melody only, just as a woman, wanting a blue dress, completely ignores the material, the fashion, the occasion it is required for, everything, in fact, except that one not so very over-ridingly important point of its colour. So it is with the arranger and adapter. The original medium chosen by the composer for expressing his thoughts, the key—colour—in which he wants them dressed, the harmony, etc., through which he displays the intellectual side of his nature and through which he gives his work its "stuffing" as well as a great deal of its emotional background; all this is to be thrown on the junk heap so that Mr. and Mrs. Everyman can have their melody.

Orchestral "Reductions"

In my view, a particularly reprehensible form this takes is the simplifying of works in their own medium. No transfer from one instrument to another is involved, and even the specious argument

of letting people get to "know" classics which they cannot hear in the original no longer applies. The "reductions" of Chopin's and Beethoven's works—and others—now before the public, cannot possibly serve any artistic or intellectual purpose. There are thousands of absolute masterpieces no harder to play than are the corpses to which the really difficult ones have been reduced. Why not be content with them? Why must people have Chopin's Polonaise in A flat without any of its thunderous octaves and crashing chords, and be deceived into thinking that they are playing "the" great Polonaise. They are not even playing a good imitation of it, as they do when they play the Beethoven or Mozart symphonies well arranged for two or four hands. When they are told that the "arrangement" in no way impairs the original work, they are being told just poppycock. And when they are exhorted to work, work and again work if they wish to become proficient players, we can join our cat when he laughs. Who wants to work when somebody has gone before us with a bulldozer and removed all the difficulties for us!

No, as there is so much glorious music for everyone in every branch and for every grade, why go about pinching other people's, and, what is worse, weeding other people's gardens but keeping the weeds ourselves.

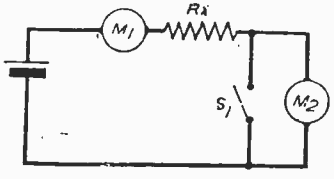
Measuring Meter Resistance

A Simple Method of Calculating an Important Resistance Value.

By N. MACKINNON

IT is often necessary to know the internal resistance of a moving-coil meter about to be used and, seeing that very few are marked, some means by which this can be determined is needed.

Having a fairly low-reading milliammeter, the resistance of which was unknown, some means was needed to determine the resistance without damaging it. To place the ohmmeter across it



Circuit arrangement for measuring meter resistance.

would have bent the needle and may also have damaged the hair spring.

Some advocate using an ohmmeter by applying it reversed, i.e., so that the meter being tested reads backwards. This method will very often damage the spring, and if the needle is not of the heavy type it also will be distorted.

Owing to the danger of damaging the meter the last two methods were abandoned (they can, of course, be used on meters of 10 mA and over) and the following method was used, the idea of this being that the components used would be found in any radio workshop.

Components

Of the components, all that is required are a multirange meter, a few odd resistors of the normal type (±20%) and a dry cell or accumulator.

First the cell voltage is determined. Then the multirange meter is adjusted to a range similar to that of the meter under test. A resistor is then chosen such that it will pass a current of about 70-90 per cent. of the full scale reading of the meter to be tested. This resistor is connected in series with the multirange meter and the cell, and the current passed is noted. The total resistance can now be obtained; this will be known as R_1.

The meter to be measured is next connected in series with the multirange meter and the resistor. Current then passed is read (read the multirange meter). The resistance of this circuit can now be found, and is known as R_2. By subtracting R_1 from R_2 the internal resistance can be found:

$$R_1 = Rm_1 + Rx = \frac{E}{I}$$

$$R_2 = Rm_2 + Rm_1 + Rx = \frac{E}{I}$$

$$\therefore Rm_2 = R_2 - R_1.$$

The circuit used is shown on the left:

M_1, multirange meter; M_2, meter under test; Rx, current limiting resistor S_1 shorting switch.

Practical example:

Meter under test, 2½in. moving coil 1.5 mA.

Cell volts, 1.45.

Current in $Rx + Rm_1 = 1.30$ mA (Rx 1,000 $\Omega \pm 20\%$).

$$R_1 = \frac{1.45}{1.3} = 1115\ \Omega.$$

Current in $Rx + Rm_1 + Rm_2 = 1.2$ mA.

$$R_2 = \frac{1.45}{1.2} = 1205\ \Omega.$$

$\therefore Rm_1 = R_2 - R_1 = 1205 - 1115 = 90\ \Omega.$

It will, of course, be seen that nearly any combination of resistors, voltages, etc., can be used in this method, the accuracy of which depends on how accurately the calibration can be read. With the higher grades of multirange meter the small inaccuracy can be ignored.

Impressions on the Wax

Review of the Latest Gramophone Records

GINETTE NEVEU, the famous violinist, who will be remembered by lovers of the classics for her recording of the Sibelius Concerto in 1946, has now recorded Brahms' Concerto in D, Op. 77, on *H.M.V. DB*6415-19 (nine parts on five records, one single-sided). The Philharmonia Orchestra, which accompanies her, is the same orchestra as in the Sibelius recording—except that Issay Dobrowen conducts in this case. Here in this new set of records, Brahms' thought is revealed under the fingers of the soloist; it is as if we were watching his own mind at work. Dobrowen also secures some fine playing in his vital moulding of the orchestral score.

Readers who have seen the film "Fantasia" will recall "The Sorcerer's Apprentice," which is one of Paul Dukas' best-known works, founded on a programme derived from Goethe's ballad of the same name. Paul Dukas was an expert orchestrator, and his death in 1935 was deeply deplored as the loss of one of France's most talented composers. Music like this shows off the Philadelphia Orchestra's virtuosity to perfection under its permanent conductor, the great Eugene Ormandy —*Columbia LX*1068.

Another interesting orchestral recording this month is Zandonai's "Juliet and Romeo—Cavalcata" and Puccini's "Manon Lescaut—Intermezzo, Act 3," on *Columbia DX*1472. Zandonai, little known in Britain, possesses a rare skill in writing for the orchestra, and like most modern Italians he devotes the utmost care to the relations between words and music. The Cavaleata (Cavalcade) shows his command of orchestra effect admirably. Of the two settings of Manon Lescaut's story contributed by Puccini and Massenet, Puccini's is perhaps the better opera. His unerring sense of the stage was invaluable to him in countless ways, and his Manon is much more securely placed in the modern operatic repertory than the Frenchman's. The Royal Opera House Orchestra of Covent Garden is directed into two very spirited performances by Franco Patane.

The composition "Bolero" was a powerful factor in making Ravel known to a wide public to whom he had been little more than a name: its obvious attraction excited those who had never studied the composer's less spectacular pieces. An abridged version, arranged by George Melachrino and played by his orchestra on *H.M.V. C*3723, is admirably done, for he gives all the essentials of the Bolero. Listening to this record one feels that the original version was just a bit too long for the theme that supports it, and by cutting the work to two sides of music Melachrino has made it an ideal length.

Vocal

The late Richard Tauber was not only a fine singer and a vigorous conductor but a composer whose operetta "Old Chelsea" had considerable success. Webster Booth's choice of "My Heart and I" is a graceful tribute from one of our most versatile tenors to the memory of a colleague whose tastes were not unlike his own. "Break of Day" is a grand old song popular about 1910, with a sentimental lilt that Booth conveys very delightfully. Both titles receive good orchestral backgrounds from Eric Robinson—*H.M.V. B*9633.

Two very popular singers who have recorded together this month are Joan Hammond and Heddle Nash, who have made the Garden Scene, Act 3, of Gounod's "Faust." They sing "The Hour is Late," "O Tender Moon" and "Why, You Dreamer!"—the latter song with the assistance of Owen Brannigan. The music makes considerable demands upon these singers, for the emotional pressure is high throughout the scene. To complete the two records, Miss Hammond, singing alone, has chosen the attractive Ballatella from "Pagliacci"—*H.M.V. C*3274-5.

Ascar Natzka has developed into an operatic bass good to hear. Successes at Covent Garden have given us a measure of his powers as Sarasto, and this record reveals him as an excellent Osmin. Osmin, of course, is the cruel, lustful old janitor of the Pasha's establishment in "Il Seraglio," and in this famous aria he gives some very Osminish views about the ladies. He couples it with "The Drinking Song" from "The Merry Wives of Windsor," on *Columbia DX*1473.

Variety

Danny Kaye, who scored the biggest success in the history of British variety at his recent appearance at the London Palladium, has recorded this month two of the numbers which he featured in his act. They are "Dinah" and "Minnie the Moocher" on *Columbia DB*2390.

Another well-known comedian who has recorded this month is Charlie Chester who, with his gang, sings the mermaid song "Miranda" from the film of that name, punctuated with Cheerful Charlie's famous brand of wise-cracks. On the reverse side, Greta Gynt sings "Lady Spiv," from the film in which she stars, "Easy Money"—*Columbia DB*2395.

Other well-known singers featured this month are Frank Sinatra, with "Falling in Love with Love" and "My Love for You" on *Columbia DB*2388; Turner Layton sings "Near You" and "Sometimes" on *Columbia DB*2399; and finally, Monte Rey has recorded "Bella, Bella, Marie" and "This is the Night" on *Columbia DB*2391.

Geraldo and his Orchestra, who are one of the biggest sellers on records, this month render Billy Reid's "Tree in the Meadow" and "I Never Loved Anyone" in the style which has made the band famous—*Parlophone F*2283. The singers featured are Archie Lewis and Denny Vaughan.

For swing fans there is "The Best Man" and "Dream for Percussion," played by the Ray Ellington Quartet on *Parlophone R*3104. "Dream for Percussion" was written by Ray Ellington and features him on drums.

Open to Discussion

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Wartime A.C. Receiver

SIR,—With reference to the article "Modifying the Wartime A.C. Utility Receiver," in the April issue. On page 139, second column, line nine reads: ". . . coil of Fig. 1 was removed) and pin 5 on V.1." This is an error. It should read: ". . . coil of Fig. 1 was removed) and pin 6 on V.1."

Also the coil pack, which I quoted as the "Osmor coil pack," was sold under that name when it was purchased by me, but it is now marketed under the trade name "Q-coil pack," and is manufactured by Messrs. Morgan Osborne, Ltd., Type H.O.—E. K. N. (Enniskillen).

Re-bond Tester

SIR,—I wish to thank you for publishing my letter in the April edition of PRACTICAL WIRELESS. I received many helpful letters and drawings concerning this instrument, all of which I answered personally. It was very refreshing to find how many people are ready to help. I feel if more of this spirit was shown in international affairs there would be less talk of war, and the world would be a much happier place to live in.

Thanking you again and all those friends who wrote to me.—W. M. MARSHALL (Clitheroe).

Home-made Television Receiver

SIR,—I have read your magazine for a year or two, and I think I have learnt a little recently that may be of service to your readers.

You have, I expect, had many inquiries from your readers about building a simple television receiver and I would like to point out that this can be done, by using ex-Service equipment, by the semi-initiates such as myself.

Firstly, one must purchase ex-R.A.F. receiver and amplifier, No. 3531; secondly, an ex-radar indicator unit of which I don't know the number, but the cathode-ray tube is a V.C.R.97, which is very suitable for television pictures once one gets used to a green picture. It also has the advantage that it functions very well on 1,000 volts, which is a distinct saving in power packs, also not too dangerous to ignorant fingers although it gives a nasty jolt, as I have found out.

The receiver consists of five-valve R.F. amplifier (E.F.50s), diode detector (E.A.50), video amplifier (E.F.50), which I left severely alone, also a time base that I dismantled and rebuilt, using the very simplest of circuits, one valve for line time base and one valve for frame time base, but surprisingly enough there is sufficient output from these valves to give a picture that will completely cover the screen of the V.C.R.97. By the way, I see I have left out the most important part about the receiver, namely, that it works on 45 megacycles and passes a very broad band of frequencies, so much so that sound sometimes breaks through.—K. ETHERDEN (Kenton).

Cathode-ray Tube Data

SIR,—May I add my opinions, etc., to those of W. G. Wood (Bristol), re the base connections of the V.C.R.97, April issue, PRACTICAL WIRELESS.

According to Mr. Wood, A1 and A3 are *not* connected together internally! May I differ by saying that they *are*, that is, if the maker's data is correct!

Mullard, who manufacture the '97 (civilian equivalent ECR60), furnish the complete data. To quote their leaflet "Contacts 5, 7 and 10 should be connected together externally." In fact, to settle the matter once and for all, I suggest anyone who intends using the V.C.R.97 for oscilloscope working—as I have done—should obtain Mullard's leaflet "ECR60. 11,246/1."

I have constructed an oscilloscope on an ex-R.A.F. viewing unit, but believe me, I find the completed unit much too bulky for amateur use—unless one has a spare wing to the house! Mark you, it's proved its worth since I completed the job. Persistence I find to be medium to short!

Your connections in the February issue of PRACTICAL WIRELESS, re V.C.R.97, are quite correct, except pin 10 should read A1 *and* A3. Wishing you continued success.—J. V. ROBERTS (Longton).

Pirated Call-sign—G2FXA

SIR,—I should like to point out that my call-sign G2FXA is being pirated on most of the bands open to licensed amateurs. I have been returning all cards received by me, to the stations that have claimed contacts, with a small note to the effect that they worked a pirate. Twenty metres seems to be the worst band for this pirate. Also I Q.S.L. 100 per cent. all genuine contacts. Hoping that the said "pirate" keeps within the allocated bands and operates his "station" as efficiently as the genuine G2FXA. Wishing your splendid mag. all the best.—G. D. DAVIES (Stockton-on-Tees).

Correspondents Wanted

SIR,—I desire to correspond with other readers who are radio enthusiasts, and to exchange ideas.

I am interested in transmission and reception on short waves.—R. MACKENZIE (1, Albemarle Place, Douglas Street, Nairn, Scotland.

SIR,—Readers who have purchased ex-W.D. gear may be able to obtain technical data, etc., from Civilian Publications Dept., War Office, London.

I would like to correspond with any readers owning the following sets, No. 19, R103A, No. 22, especially anyone building a 10m., 20m. "Ham-band convertor," for use with the 8 to 2 Mc/s rx's. All letters answered.—E. S. SYMONDS (5, John St., City Rd., Cambridge.)

Ex-Service Apparatus Prices

SIR,—In reply to Mr. Benson of Liverpool. He is a small trader who is satisfied with a reasonable profit. Under these circumstances he does not happen to be one of the accused. The people this correspondence is concerned with are the big business speculators, cited by Mr. Roosenburk, who attended the sales he mentioned. I quite appreciate the overheads and transport expenses, etc., as outlined by Mr. Benson. My dealings have been with four PRACTICAL WIRELESS advertisers and one government contractor who is personally known to me. In all instances I have received satisfaction, the latter being the most reasonable. If Mr. Benson will re-read my letter he will find that I am defending the fair dealing firms, and not condemning collectively those who buy and sell ex-Service material. I am prepared to take Mr. Roosenburk's figures as given, which perhaps the 100 per cent. to 900 per cent. profiteers mentioned by him will come forward and justify. I am all for the small trader and multiple stores making a fair and reasonable profit. In closing I would like to point out that so far as the correspondence pages of this journal are concerned, I write as a regular reader. The fact that I am a PRACTICAL WIRELESS contributor is incidental. — A. W. MANN (Middlesbrough).

Ex-R.A.F. Equipment

SIR,—I wish to apologise to Mr. B. E. Harris (Harpenden), relative to confusing his letter and that of Mr. K. A. Roosenburk. The confusion arose exactly as assumed. I trust it has not caused any inconvenience. Whilst writing, it may interest owners of 1116-1116A receivers to know that Air Ministry data concerning this set is no longer available and will not be reprinted. This information comes direct from A.M. to me as I wrote them with a view to obtaining aligning data.—A. W. MANN (Middlesbro).

Television Interference

SIR,—I was very interested in your "Comments of the Month," in the April issue of PRACTICAL WIRELESS, regarding the interference on television receivers caused by ignition systems of motor vehicles. You state that the G.P.O. have suppressed all their vehicles. While this may be so in the London area, it is definitely not so in the western section. We have no television receivers here, but the short-wave reception is badly marred by bad ignition systems.—"POST OFFICE ENGINEER" (Exeter).

Assistance Offered

SIR,—I have been a constant reader of your excellent journal for some five years, and enjoy it for being practical and not theoretical as some other publications.

As an ex-army W.-Mech., I have circuits, etc., on numerous army equipments now being sold and I'll gladly lend them to anyone to help them out.

Reference K.A., Liverpool, letter in the February issue, I understood all these sales are open to the public. I'm not in the trade but attended one of these sales recently and obtained four communication receivers for a very low sum. Three went to my friends and the fourth I kept. If a crowd of you "club" together you can beat this profiteering, and by using the "Open to Discussion" columns of PRACTICAL WIRELESS someone can usually help you with circuit diagrams.—H. BAILEY (28, Wykes Road, Exeter, Devon).

Reader Help

SIR,—Thank you very much for putting my valve query in PRACTICAL WIRELESS.

I have had so many replies from readers that I find it an absolute impossibility to reply individually to them all for their kindness and detailed description of both the kinds of valves and also connections and base type, etc. If it is not encroaching on your space too much, would you please give my sincere thanks to all who sent me the information I required.—H. A. STAINSBY (Newcastle-on-Tyne).

Ex-Service Equipment

THE co-operation of readers is sought in helping others out of difficulties regarding items of surplus gear as follows:

E. W. Webb, of Connaught House, Connaught Road, Littlehampton, Sussex, requires a circuit of the coil pack from the R1155.

F. G. Winfield, of 4, Richmond Drive, Chilwell, Notts, wishes to convert Test Set 73 to standard type.

D. E. Goldsworthy, of Charlton Manor, Faringham, Kent, requires coil details for the R101 receiver.

H. Bailey, of 28, Wykes Road, Exeter, Devon, requires circuit or alignment data for the Hammarlund HQ-129-X which is part of U.S.A. Navy RBG Equipment CHC 46140.

R. A. Ockenden, "Rydal," Summerfields Avenue, Hailsham, Sussex, requires circuit details of No. 18, Mk. III Walkie-Talkie.

H. Tarling, of 85, Prince Avenue, Prittlewell, Southend-on-Sea, requires details of the Eddystone 400X, ARC5 R28, 1147B and APN4/UD5 receivers.

J. S. Munn, of 29, High Street, Stamford, Lincs, has an ex-R.A.F. 1D-/G/APN-4 and wishes to modify it for use as a standard oscillograph. Has any reader experimented on these lines?

W. H. Jones, 5, Varna Road, Freemantle, Southampton, Hants, is calling for circuit details of the T/R9.

T. G. Brown, 73, Streatfield Road, Harrow, Middx, would appreciate details of German Forces valves LD2, LD15, LV(V?)1, LY15, LG1 and LG6.

I. G. Quick, 30, Norman Way, Acton, W.3, requires data on R1147A.

H. Cohen, 39, Camrose Avenue, Edgware, would like details and circuit of the Canadian R103 (*not* R103A).

R. G. Porter, 1, Eordway Avenue, Blackpool, Lancs, wishes to know A.C. voltage and frequency input, R.F. on switch positions 1, 2, 3, 4 and 5, the I.F. and band width and the function of switch ZYXN in relation to receiver R1355 and R.F. Unit 25.

J. Arthur, 6, Inverkeep Street, Greenock, Renfrewshire, requires details of R1116.

A. H. Smith, 1A, Lipson Terrace, Lipson, Plymouth, requires a circuit diagram of R3132B.

J. S. Fraser, 36, Rocklands Avenue, Begington, Wirral, Cheshire, requires information on R109.

N. Brokensha, 160A, Haverstock Hill, N.W.3, requires a circuit diagram of Communications Receiver Type P.C.R.

K. M. Nevo, 69, Lichfield Road, Stafford, has a Type 81B R.A.F. receiver and would appreciate data and circuit.

E. Hockley, 13, Playfair Terrace, Hunslet, Leeds, 10, Yorks, would like to contact a reader who has experience with the R1114 receiver.

A. Cullen, 112, Craigpark Drive, Glasgow, E.1, is in difficulty regarding the identification of the leads of Army Set and Power Supply Unit No. 1ZA21531. (Set marked 38 A F.V. ZA21576.)

D. H. Lang, 7, St. Giles Crescent, Queen's Park, Wrexham, Denbighs, would like some information on the U.S.A. B.C. F.M. 603.

R. Cook, 3, Forest Road, Dedworth, Windsor, Berks, is unable to get a power pack for R.A.F. Indicator Unit, Ref. No. 10QB/24.

F. Blair, 10, Gerrard Avenue, Rochester, Kent, requires information on ex-R.A.F. R3170A.

J. Blackmore, 39, Church Road, Upper Weston, Bath, Som, requires details of the ASK-1 aircraft receiver.

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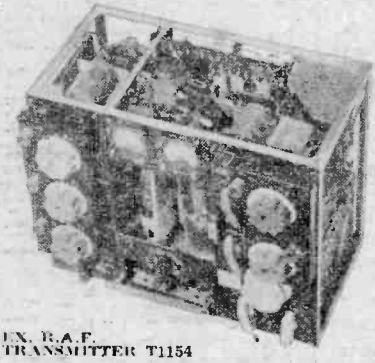

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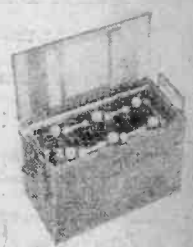

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