MAKING AN INEXPENSIVE CAR RADIO

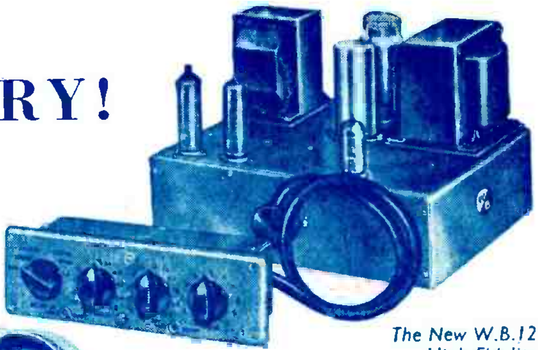
PRACTICAL WIRELESS

1'3

JUNE 1956

EDITOR: F.J. CAMM

ENTHUSIASTS EXTRAORDINARY!



The New W.B.12 High Fidelity Amplifier Price £25

We are constantly surprised (but justifiably proud) at the amazing volume of testimony we receive about our High Fidelity range. Every day letters arrive from all parts of the world, praising the performance of our products in no uncertain terms.

When we decided to re-enter the ever-growing Hi-Fi market — having originated the Concentric Duplex loudspeaker in 1935—we knew that we should be selling to a very critical public, and that only the best would satisfy them. Yet, at the same time, we realised that price would be a consideration with most people. How successful we have been in producing true Hi-Fi reproduction at realistic cost can be judged by our daily increasing post-bag.

To users all over the world, we say "Thank you": you have proved beyond all dispute that the experts who spoke so flatteringly of our products were voicing the feelings of High Fidelity enthusiasts everywhere.

Stentorian Cambric Cone High Fidelity Units The famous HF1012 at £4.19.9 Others from 47/6

Tweeter Units £4.4.0 & £12.12.0

Descriptive leaflets sent on request. Ask your usual dealer to demonstrate, or see and hear all Stentorian products at our London office (109 Kingsway, W.C.2), any Saturday from 9 a.m. to noon.

WHITELEY ELECTRICAL RADIO CO. LTD · MANSFIELD · NOTTS

Space-saving suggestion

CHASSIS MOUNTING

DRY ELECTROLYTIC CONDENSERS

The saving of space resulting from the use of these condensers is one of the chief reasons for their popularity. Type 928 is of particular interest to designers of rectifier units as a small and efficient substitute for a large 800 v. paper condenser.

Except where indicated, these condensers use plain foil electrodes. The can is negative, but when this connection is not required via the chassis, insulating washers and terminal tags are available upon request.

Capacity tolerance; —20% to +50%. Voltage range: 250 v. to 800 v. Peak Working.

Capacity in µF.	Peak Work'g Volts	Surge Volts	Dimensions in Inches			T.C.C. Type No.	List Price Each
			H.	D.	Screwed Boss		
*32	350	400	2 7/8	1	1/2	312	9/-
4	500	600	2 7/8	1	1/2	512	7/-
8	500	600	4 1/2	1	1/2	512	8/-
16	500	600	4 1/2	1 1/2	3/4	512	11/6
32	500	600	4 1/2	1 1/2	3/4	512	17/6
*8	800	900	4 1/2	1 1/2	3/4	928	18/-

*Etched Foil.

THE TELEGRAPH CONDENSER CO. LTD

RADIO DIVISION: NORTH ACTON · LONDON · W.3 · Telephone: ACOrn 0061

PREMIER RADIO COMPANY

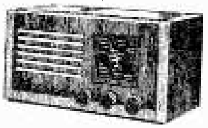
B. H. MORRIS & CO., (RADIO) LTD.

OPEN TILL 6 P.M. SATURDAYS **(Dept. P.W.) 207, EDGWARE ROAD, LONDON, W.2** Telephone: AMBASSADOR 4033 PADDINGTON 3271-2

BUILD THESE NEW PREMIER DESIGNS

3-BAND SUPERHET RECEIVER

MAY BE BUILT FOR **£7.19.6** Plus 3/- Pk. & Carr.



Latest type Superhet Circuit using 4 valves and metal rectifiers for operation on 200/250 volts A.C. mains. Waveband coverage — short 16-50 metres, medium 180-550 metres, and long 900-2,000 metres. Valve line-up 6K8 freq. changer, 6K7, IF, 6Q7, Detector AVC and first AF, 6V6 output. The attractive cabinet to house the Receiver size 12in. long, 6½in. high, 5½in. deep can be supplied in either WALNUT or IVORY BAKELITE or WOOD.

TRF RECEIVER

MAY BE BUILT FOR **£5.15.0** Plus 3/- Pkg. & Carr.

The circuit is the latest type TRF using 3 valves and Metal Rectifiers for operation on 200/250 A.C. mains. Wave band coverage is 180/550 metres on medium wave and 800/2,000 metres on long wave. The dial is illuminated and the Valve line-up is 6K7 H.F. Pentode 6J7 Detector and 6V6—Output.

INSTRUCTION BOOKS 1/- each (post free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

4-WATT AMPLIFIER

MAY BE BUILT FOR **£4.10.0** Plus 2/6 Pk. & Carr.

Valve line-up 6SL7, 6V6 and 6X5, FOR A.C. MAINS 200/250 VOLTS. Suitable for either 3-ohm or 15-ohm Speakers. Negative feed-back. Any type of pick-up may be used. Overall size 9 x 7 x 5in. Price of Amplifier complete, tested and ready for use, £5.5.0 plus 3/6 pkg. and carr.

CABINETS—PORTABLE

Model PC/1
Brown Rexine covered, 15/11.
Overall dimensions 15in. x 13½in. x 5in.
Clearance under lid when closed 2½in.

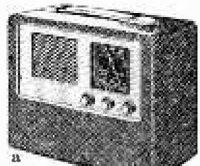
Model PC/2
Grey Lizard Rexine covered, 45/-.
Overall dimensions 15in. x 13in. x 6in.
Clearance under lid when closed 3in.

Model PC/3
Rexine type covering in various colours, 69/6.
Overall dimensions 16½in. x 14½in. x 10½in.
Clearance under lid when closed 6½in.

All the above Cabinets are supplied with Panel, Carrying Handle and Clips. Packing and Postage 2/6.

Send for details of the Premier Wide angle Televisor design which may be built for £30.

ALL-DRY BATTERY PORTABLE RADIO RECEIVER



4 miniature Valves in a Superhet Circuit covering medium and long waves. Rexine covered Cabinets 11½in. x 10in. x 5½in. in two contrasting colours. Wine with Grey Panel, please state choice when ordering. The SET MAY BE USED EVERYWHERE—*home, office, car or holidays.* INSTRUCTION BOOK, 1/6 (Post Free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

MAY BE BUILT FOR **£7.8.0** Plus 2/6 Pk. & Carr.

A Range of High Fidelity Amplifiers, Speakers and Record Players by the following makers in stock: Leak, E.A.R., Rogers, Goodmans, Wharfedale, W.B. Stentorian, Larenz, B.S.R., Collard, Garrard, Lenco, Connoisseur. We shall be only too pleased to demonstrate any of the above equipment.

B.S.R. Monarch 3 speed Autochanger £7.19.6, postage and packing 5/-.

3 Speed single player with crystal tune wheel £6.19.6, postage and packing 5/-.

The G.E.C. 14in. Cathode Ray Tube type 7203A has the following attractive features:—

(1) Improved tube life and reliability.

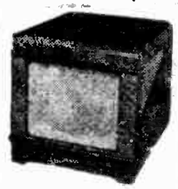
(2) A narrow beam angle *triode* gun giving:—
(a) Uniform focus over the entire screen area.
(b) Small spot size. (c) Freedom from astigmatism.

(3) A high reflectance aluminium backing to the fluorescent screen giving:—
(a) 70% increase in picture brightness. (b) High contrast daylight viewing. (c) Complete elimination of ion burn from both positive and negative ions.

Price
£14. 15. 0
P.Tax **£6. 18. 1**

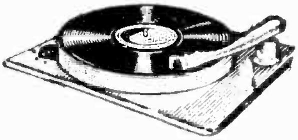
THE GENERAL ELECTRIC CO. LTD MAGNET HOUSE, KINGSWAY, LONDON W.C.2

12in. TV. CABINET—15/-



We are offering these at not much more than the cost of the plywood they contain. If not wanted for TV. many useful items can be made—record storage cabinet, H.F. loudspeaker case, book case, etc., etc. Price 15/-, carriage 3/6.

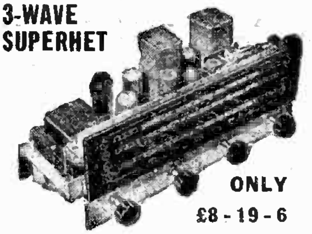
RECORD PLAYER £4-10-0



3-Speed Gramophone Motor
Latest rim drive 3-speed motor with metal turntable and rubber mat. Small mod. makes speed easily variable for special effects and dance work.
Hi-Fi Pick-Up
Using famous Cosmocord Hi-G turn-over crystal. Separate sapphire for each speed. Neat bakelite case with pressure adjustment.
Special Snip Offer This Month
The two units as illustrated £4 10/- or made up on board as illustrated £5 10/- plus 5/- post and insurance.

ELECTRONIC PRECISION EQUIPMENT LTD.
See page 263 for address

3-WAVE SUPERHET



ONLY £8-19-6

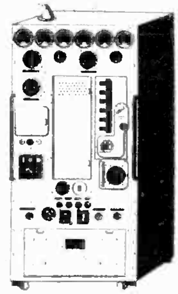
This is a 5-valve A.C./D.C. superhet covering the usual long, medium and short wavebands. It has a particularly fine clear dial with an extra long pointer travel. Osram valves are used and the chassis is complete and ready to operate. Chassis size 15 x 6 x 6in. Price £8 19 6, complete with 8in. or 6½in. speaker. Carriage and insurance 10/-. H.P. terms if required.

WHY NOT make up the 'Crispian' Portable? See our full page for details.

All parts including valve, paxolin panel, coil formers, etc., etc., to build regenerative receiver, given in September "Practical Mechanics," price 14/6 plus 2/- post.

NAVY MODEL TCK-7

Seen at Eastbourne by appointment.



We have a few only American transmitters still in original packing cases. Designed for the Navy, these are really beautifully made and most impressive, standing 5ft. high by 2ft. wide and finished in instrument crackle. All meters and controls are on the front panel. The transmitter tunes over the range 2 megacycles to 18 megacycles and it is designed for high speed precision communication without preliminary calling.

Frequency control and stability is particularly good, being better than .005% under the worst conditions. Power output is 400 watts on C.W. and 100 watts on phone. Tuning is very simple—a unit control mechanism—gives a direct reading in frequency.

Complete with valves and instruction manual. Price £95, ex works.

NOTE.—The transmitter will work off A.C. or D.C. with the appropriate power unit. Power units are not available at present.

THE "WEYRAD" SIGNAL GENERATOR

AN INSTRUMENT OF HIGH ACCURACY AT LOW COST

- Coverage 100 Kc/s-70 Mc/s (on fundamentals).
- Accuracy better than ±2% on all ranges.
- Large, clearly calibrated scale.
- Modulated or C.W. output.
- 500 c/s A.F. source.
- S.G.M.I—A.C. mains operation. Double wound, varnish-impregnated transformer, tapped 210/225/250 volts.
- S.G.B.I—All dry battery operated.
- All components are by well-known manufacturers ensuring maximum reliability.
- Both types in quantity production.
- Illustrated leaflet available, price 2d.

WEYMOUTH RADIO MANUFACTURING CO., LTD.
CRESCENT STREET, WEYMOUTH, DORSET

FOR VALVES—GUARANTEED NEW AND BOXED

0Z4	6/-	6F11	13/-	9D2	3/9	EBF80	11/6	PL82	11/6
1A3	6/-	6F13	14/-	9001	5/6	ECC81	8/6	PL83	13/-
1A5GT	6/6	6F15	14/-	9003	5/6	ECC84	12/6	PP225	5/-
1A7	11/6	6G6G	4/-	9004	5/6	ECH35	13/6	PY80	10/-
1C5	9/6	6H6	3/6	9006	6/-	ECH42	10/6	PY81	11/6
1C5GT	8/9	6J5GT	5/-	954	2/-	ECH81	13/6	PY82	10/6
1H5GT	10/6	6J5M	6/6	955	4/9	ECL80	10/6	QP21	7/6
1N5GT	10/6	6J6	7/6	956	3/6	EF22	8/6	SP22	6/-
1L4	6/6	6J7G	6/6	10C2	12/6	EF41	11/6	SP220	6/9
1LD5	6/9	6K6GT	6/6	10F1	12/6	EF42	13/6	U22	8/-
1R5	8/-	6K7G, GT	5/9	10F9	12/6	EF80	10/-	U329	13/6
1S5	7/6	6K7	6/9	10P13	11/6	EF86	13/6	U403	10/-
1T4	7/6	6K8G*	8/9	12A6	6/9	EL2	12/6	UAF42	12/6
1U5	8/-	6K8GT	9/6	12AH7	6/9	EL41	11/6	UB41	8/-
2X2	4/-	6L1	13/6	12AT7	9/-	EL84	12/-	UBC41	11/-
3A4	7/-	6L6G	9/-	12AU7	9/6	EM34	11/6	UCH42	11/-
3Q4	9/6	6L7M	7/6	12BA6	10/-	EM80	12/6	UF41	11/6
3Q5	10/-	6N7	7/-	12BE6	10/-	EY51	13/6	UL41	11/6
3D6	5/6	6Q7G GT	9/-	12H6	5/-	EZ40	10/-	UY41	10/6
3S4	8/6	6SA7GT	8/-	12J5	6/-	EZ41	11/-	VR21	3/-
3V4	8/6	6SG7	7/6	12J7	9/6	EZ80	12/6	VR53	6/6
4D1	3/-	6SH7	6/-	12K7	9/6	EH48	2/-	VR54	2/-
42	8/-	6SJ7GT	8/-	12K8	11/-	EY86	13/6	VR55	7/6
5U4G	8/6	6SK7	5/6	12Q7	9/6	EY91	7/-	VR56	6/-
5Y3GT	8/6	6SL7	8/-	12SC7	7/6	FW4/500	10/-	VR57	8/-
5Z3	8/6	6SN7	8/-	12SG7	7/6	GZ32	12/6	VR65	3/6
5Z4G	8/9	6SQ7	9/3	12SH7	5/6	H30	5/-	VR65A	3/3
6A7	11/6	6SS7	8/-	12SJ7	8/6	HL23DD	7/6	VR66	3/9
6A8GT	10/6	6U4GT	15/-	12SK7	6/6	HP210C	6/9	VR91	5/6
6AC7	6/6	6U5G	8/6	12SQ7	8/6	KL35	8/6	VR91SYL	7/6
6AG5	6/6	6U7G	9/-	12SR7	7/6	KT2	5/-	VR92	2/-
6AK5	6/6	6V6G GT	7/6	20D1	10/6	KT33C	10/6	VR105/30	7/6
6AL5	7/-	6X4	8/-	20L1	12/6	KT66	12/-	VR116	4/-
6AM5	5/-	6X5GT	7/9	25L6GT	8/6	KTW61	7/9	VR136	7/-
6AM6	7/6	7B6	9/6	25U4GT	10/-	KTW63	8/6	VR137	5/6
6AQ5	9/-	7B7	9/-	25Y5G	11/6	KTZ41	6/-	VR150/30	8/-
6AT6	8/9	7C5	8/6	25Z4G	9/-	LP220	6/9	VP23	8/-
6B4	5/-	7C6	9/-	25Z6GT	8/6	MHL4	5/6	VS70	3/-
6B8	4/-	7H7	8/-	35L6GT	9/-	MS/PEN	5/-	VT52	8/-
6BA6	8/-	7Q7	8/-	35W4	10/-	N78	12/6	VT501	6/-
6BE6	8/-	7R7	8/6	35Z4GT	9/-	N709	12/-	VU39	8/9
6BW6	9/-	7S7	9/-	35Z5	9/-	P41	9/-	VY64	9/-
6C4	7/-	7Y4	8/6	50L6GT	9/-	P215	5/-	VU111	3/6
6C5GT	7/6	75	10/6	AC6 PEN	6/6	PEN25	8/-	VU120A	3/-
6C6	6/6	77	8/-	ATP4	6/6	PEN46	8/6	W77	8/6
6C9	10/-	80	8/6	DH73M	10/-	PEN220A	4/-	W61	8/-
6D3	7/6	807	6/6	DM70	9/-	PCC84	13/6	X66	11/6
6D6	7/3	8D2	2/9	EABC80	13/6	PCF80	13/6	X78	12/6
6F6G	7/6			EAC91	10/-	PCF82	12/6	X79	12/6
6F6M	8/6			EAF42	12/6	PCL83	12/6	Y63	9/-
				EB41	8/-	PL81	13/6	12SC7	2/6
				EBC41	11/-			5R4GY	9/6

HEATER TRANSFORMERS

230 v. Input 2 volt .5 amp.... 4/3 ea.
230 v. Input 2 volt 3.0 amp. 7/9 ea.
230 v. Input 4 volt 1.5 amp. 5/- ea.
230 v. Input 4 volt 3.0 amp. 10/- ea.
230 v. Input 5 volt 2.0 amp. 10/- ea.
230 v. Input 6.3 volt .5 amp. 5/- ea.
230 v. Input 6.3 volt 1.5 amp. 6/- ea.
230 v. Input 6.3 volt 3.0 amp. 9/- ea.
230 v. Input 12 volt .75 amp. 5/- ea.
230 v. Input 6.3 volt 1.5 amp. and 5 volt 2 amp. .. 14/3 ea.

OUTPUT TRANSFORMERS

Multi Ratio, suitable for all ordinary receivers giving six single ratios... ... 6/6 ea.

CHOKES

20H. 250 ohms. 60 M.A. Clamp Construction .. 6/- ea.
10H. 200 ohms. 90 M.A. Clamp Construction ... 9/3 ea.
10H. 200 ohms. 150 M.A. Clamp Construction ... 13/- ea.
5H. 250 M.A. 200 ohms. Fully Shrouded ... ... 18/3 ea.
10H. 300 ohms. 40 M.A. Midget Clamp Construction ... ... 5/3 ea.

METAL RECTIFIERS

12 volt ½ amp. ... ... 1/6 ea.
2 volt 1 amp. ... ... 3/- ea.
250 volt 45 m.a ... ... 6/9 ea.
250 volt 75 m.a ... ... 7/6 ea.
300 volt 60 m.a ... ... 7/6 ea.
Full Wave 12 volt 1 amp.... 5/3 ea.
12 volt 2 amps. .. 8/6 ea.
12 volt 3 amps.... 13/6 ea.

TINNED COPPER WIRE All 4 oz. Reels.

16 S.W.G., 2/6; 18 S.W.G., 2/7; 20 S.W.G., 2/9; 22 S.W.G., 2/10; 24 S.W.G., 3/-; 26 S.W.G., 3/3; 28 S.W.G., 3/5; 30 S.W.G., 3/9.

ENAMELLED COPPER WIRE

All 4 oz. Reels.
18 S.W.G., 2/6; 20 S.W.G., 2/8; 22 S.W.G., 2/9; 24 S.W.G., 2/11; 26 S.W.G., 3/-; 28 S.W.G., 3/1; 30 S.W.G., 3/3; 32 S.W.G., 3/7; 34 S.W.G., 3/9; 36 S.W.G., 3/11; 38 S.W.G., 4/3; 40 S.W.G., 4/7.

OSMOR COILS, etc.

Full range of all Osmor components in stock.

Coil Packs

H.O. 50/5
MTS 52/6
LM 42/-
TRF 42/-
T.B. 52/6
Type B 52/6

C R T ISOLATION TRANSFORMERS

Type NR9

Ratio 1-1.25 giving a 25% boost on secondary. Particularly suitable for High Definition Receivers. Four types available to cover most tube heaters.
NR 9A 2 volt; NR 9B, 4 volt; NR 9C, 6.3 volt; NR 9D, 10.8 volt; NR 9E, 13.3 volt.
With Tag Panel and Solder Tags. 10/6 each.

Type NR12

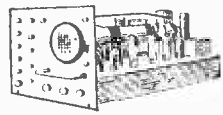
Mains input: 220-240 volts.
Multi output: 0-2-4-5.3-6.3-10 and 13 volts.
Input has two taps which increase output volts by 25% and 50% respectively.
This transformer is suitable for most Cathode Ray Tubes in Medium Definition Receivers.
The MOST versatile Low Capacity C.R. Transformer with Universal Output.
With Tag Panel and Solder Tags. 21/- each.

Type NR14

A most useful transformer for use with 2 volt Tubes with falling emission.
Input: 230-240 volts.
Output: 2-2¼-2½-2¾-3 volts at 2 amps.
With Tag Panel and Solder Tags. 17/6 each.

★ ★ ★ ★ ★ ★ ★

AMERICAN INDICATOR UNIT Type BC929A



Brand new, incorporating 3in. tube 3BP1, with mu-metal shield, two 6SN7GT, two 6H6GT, 6X5G, 2X2, 6G6G, nine potentiometers, 24v. aerial switch motor, transformer, and a host of small components. The whole unit, which measures only 8½in. x 8½in. x 13¼in., is brand new, enclosed in black crackle box, and can be supplied at Price 65/-, plus 5/- postage and packing.

MAINS TRANSFORMERS

3-WAY MOUNTING TYPE

MT1—Primary: 200-220-240v. Secondary: 275-0-275v. 80 M.A. 0-6.3v. 4 amp. 0-4v. 2 amp. Both tapped at 4v., 17/6 each.
MT2—Primary: 200-220-240v. Secondary: 350-0-350v. 80 M.A. 0-6.3v. 4 amp. 0-5v. 2 amp. Both tapped at 4v., 17/6 each.
MT3—Primary: 200-220-240v. Secondary: 30v. 2 amps. Taps at 3v., 4v., 6v., 8v., 9v., 10v., 15v., 18v., 20v., 24v., 17/6 each.
Postage 2/- each.

★ ★ ★ ★ ★ ★ ★

SPECIAL PURCHASE!

G.E.C. Cabinet Loudspeakers, Cat No. BC1955, 5in. P.M. Moving Coil Loudspeaker Unit, 2-3 ohms, with Volume Control. Price 55/-. Postage 2/6.

TELETRON, BAND III CONVERTER COIL SET

Mk. 2 CASCODE WITH CIRCUIT AND PRACTICAL WIRING DIAGRAM. Descriptive leaflet available, 3d. ea.

T.S.L. COMPONENTS FOR BERNARD'S F.M. TUNER

V.H.F. Unit. Gorler type UT340. 45/- plus 14/9 P.T.

Inter-stage I.F. Transformer. Gorler type UF376 (11748), 7/- ea.

Ratio Discriminator Transformer. Gorler type URF377. 10/6 ea.

T.S.L. High Stability Resistors. Type B. ½ w. 10%, 6d. ea. 1 w. 10%, 9d. ea.

Drilled Chassis, 10/6 ea.

T.S.L. F.M. Dial. Specially designed for use with UT340 V.H.F. unit. 37/6 ea.

Control Knobs. Bakelite type 4000. Brown with gilded centre plate. 1/6 ea.

TELETRON FERRITE AERIALS Long and Med. Wave, 12/6. Med. Wave, 8/6 ea.

6J5G 5/-
6J6GT 5/6

WHEN ORDERING PLEASE QUOTE "DEPT. P.W."

LOUD SPEAKERS

All PM Types less Transformer

ELAC 5" Unit 17/3
ROLA 6½" Unit 17/6
R. & A. 8" Unit 18/6
TRUVOX 6½" Wafer Unit 20/-
PLESSEY 12" Unit 37/6
LECTRONA 5" Unit 17/6
GOODMANS 6½" Unit 18/6
GOODMANS 8" Unit 19/6
R. & A. 10" Unit 25/6
GOODMANS 4" x 7" Unit 19/10
R. & A. 6½" Unit Mains Energised 600 ohms field 17/6
PLESSEY 8" Unit Mains Energised 600 ohms field 21/-

ALPHA RADIO SUPPLY CO.

5/6 VINCES CHAMBERS VICTORIA SQUARE LEEDS I.

TERMS: Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 9d.; 20/- add 1/-; 40/- add 1/6; £5 add 2/- unless otherwise stated. Minimum C.O.D. fee and postage 2/3.

MAIL ORDER ONLY

ACKNOWLEDGED FOR PERFECTION

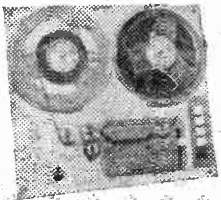
Stern's "Fidelity" Tape Recorder

ASSEMBLED & READY FOR USE £43

(Plus £1.10.0 Carr. and Insurance. £1 is refunded when packing case is returned to us.)
H.P. Terms £21.10.0 deposit and 12 monthly payments of £1.19.11

!! HOME CONSTRUCTORS !! OR — BUILD IT YOURSELF FOR £40

The actual assembly of the Recorder is simple, and only involves a few connections. The Truvox Tape Deck and the Quality Amplifier are supplied tested and ready for use, and all that is required to complete the Recorder is to connect the two together (a connection chart is supplied for this purpose) and secure them by the screws provided into the Attache Case. The items illustrated and described form the complete equipment and each are available for sale separately.

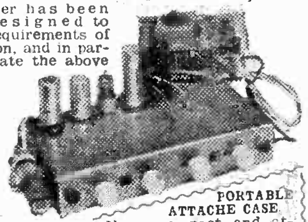


TRUVOX TAPE DECK MODEL Mk. III/TR7/u

This is Truvox's new "small" design being only 14in. x 13in. The whole instrument is built to close engineering limits resulting in the minimum of "wow" and "flutter" values. It will play the NEW PRE-RECORDED TAPES and takes all standard tapes up to 1,200ft.

MODEL TRF QUALITY AMPLIFIER

This amplifier has been expressly designed to meet the requirements of enthusiasts for fidelity reproduction, and in particular to CORRECTLY operate the above TRUVOX DECK. It is supplied complete with a matched Elliptical 3 ohm P.M. Speaker. It incorporates an efficient Tone Control arrangement and has a Magic Eye Level Indicator (Operative on Record). It can also be used as a general purpose Amplifier for high quality reproduction of gramophone records direct from a Gram Unit.



PORTABLE ATTACHE CASE

Neat, compact and attractively finished. It contains concealed pockets for Mike, Mains Lead and reel of tape.

SEND S.A.E. FOR DESCRIPTIVE LEAFLET INCLUDING PRICE DETAILS & H.P. TERMS

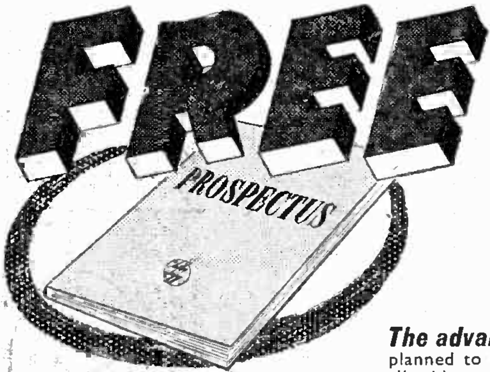
SCOTSBOY MAGNETIC RECORDING TAPE

Supplied complete with a 1,200ft. reel of Scotsboy Tape. In addition, the Recorder will take all standard makes of tapes.

MODEL MIC33/1 ACOS CRYSTAL MICROPHONE

A highly sensitive Mike which accurately matches the input arrangement of the Amplifier.

STERN RADIO LTD.
109 & 115, FLEET STREET, E.C.4
Tel.: FLEet 5812-3-4.



POST THE COUPON TODAY FOR OUR BROCHURE ON THE LATEST METHODS OF HOME TRAINING FOR OVER 150 CAREERS & HOBBIES

PRIVATE AND INDIVIDUAL TUITION IN YOUR OWN HOME

City and Guilds Grouped Certificates in Telecommunications; A.M. Brit. I.R.E. Examination, Radio Amateur's Licence, Radio and Television Servicing Certificates, General Radio and Television Courses, Radar, Sound Recording, etc. Also Courses in all other branches of Engineering and Commerce.

The advantages of E.M.I. training ★ The teaching methods are planned to meet modern industrial requirements. ★ We offer training in all subjects which provide lucrative jobs or interesting hobbies. ★ A tutor is personally allotted by name to ensure private and individual tuition. ★ Free advice covering all aspects of training is given to students before and after enrolling with us.

NEW LEARN THE PRACTICAL WAY

With many of our courses we supply actual equipment. Courses include: Radio, Television, Electronics, Draughtsmanship, Carpentry, Photography, and Commercial Art, etc.

Courses from 15/- per month

POST THIS COUPON TODAY

Send without obligation your FREE book.
E.M.I. INSTITUTES, Dept. 32K
43 Grove Park Road, London, W.4.
Phone: Chiswick 4417/8.

NAME ....

ADDRESS ....

....

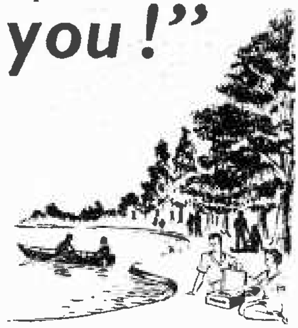
JUNE
SUBJECT(S) OF INTEREST ....

EMI INSTITUTES

The only Postal College which is part of a world-wide Industrial Organisation

IC18

"I'M SET TO GO PLACES... with you!"



THE SUPEREX "55" BATTERY PORTABLE is a first class receiver guaranteed to give good reception throughout the country. Equal in appearance and performance to any commercial model. Cabinet size 10¾in. x 8¾in. x 5in. All parts available separately.

- ★ *Four Valve Superhet*
- ★ *Long, Medium Wave*
- ★ *Large Elliptical Speaker*
- ★ *B7G 1.4v Miniature Valves*
- ★ *Simple Construction*

Price **£7.15.0** *plus 3/6 carriage.* **Send 1/6 for SUPEREX "55" CONSTRUCTION BOOKLET**

AN ELEGANT CABINET

to suit your pocket

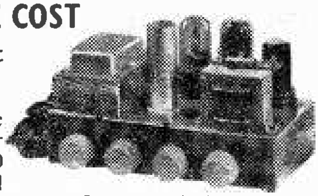
The SUPERIOR BUREAU

Very elegant in richly figured walnut veneer with internal panels in sycamore. Sloping radio panel size 16in. long x 10¾in. high. Uncut motor board size 15¾in. long x 13½in. back to front. Lid panelled in beige leatherette. Two large storage cupboards. Speaker chamber large enough to house 12in. speaker. Overall cabinet size 33in. high, 34in. long, 16½in. deep. Send for full details of this and other types in stock.

Price **£17** *plus 25/- carriage.*

QUALITY RECORD REPRODUCTION AT MODERATE COST

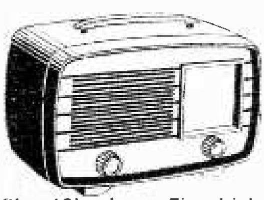
The S.R. 3-4 watt AMPLIFIER



High quality 3 valve 3 watt Amplifier for A.C. Mains 200/250 volt. Four engraved controls give a wide range of tone variation. Output transformer matched for any 3 ohm speaker. Chassis fully isolated. Valve line-up: 6SG7, 6V6, 6X5. Bronze crackle finished chassis. Overall size 8in. long, 4in. wide, 5in. high. Supplied built and tested. GUARANTEED FOR 12 MONTHS (90 days valves).

Price **£5.5.0** *plus 3/6 carriage.*

CABINET "SNIP"

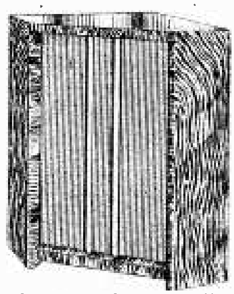


Attractive bakelite cabinet with long and medium wave, two-colour glass dial and two cream knobs. Ideal for T.R.F. constructors. Available in Walnut or Green. Size 12in. long, 7in. high, 5½in. deep. Complete with handle and back.

Price **15/6** *plus 2/6 postage.*

FROM ALL CORNERS

Here's greatest value!



A craftsman-built corner type speaker cabinet designed for any good quality 12in. speaker. Solidly constructed of 1in. thick veneered board which is expertly finished in highly figured walnut veneer or in natural finish light oak veneer. Size 31in. high, 28in. wide, 19in. back to front. Definitely a cabinet of distinctive design.

Price **£12.10.0** *plus 17/6 carriage.*

RADIO COMPONENTS

We carry a very wide range of Radio and Television components; also AM/FM Radio Chassis, Tuners and Hi-Fi Amplifiers by Dulci, Armstrong, McCarthy, T.S.L., Grampion and Whiteley. Quality speakers by Goodman, G.E.C., Wharfedale and Stentorian always in stock. SEND FOR LISTS.

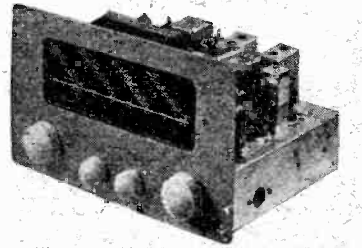
Superior Radio supplies

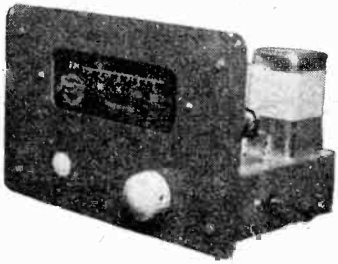
37 HILLSIDE, (HARROW ROAD) STONEBRIDGE, N.W.10. *Elgar 3644*

LOCATION: On the main Harrow Road between Harlesden and Wembley.
SHOP OPEN: 9 a.m. to 6 p.m. Monday to Saturday. 1 p.m. Thursday.
TERMS: Cash with order or C.O.D. Extra charge for C.O.D. U.K. and N. Ireland.

JASON FOR F.M.

An easy-to-build Tuner using four valves Type Z77/EF91. Providing leads are kept short and soldered joints are well made, good results are guaranteed. The useful range is at least 60 miles from the station. The Book also gives details of a Fringe Area version which has an aerial sensitivity of 5 micro-volts for good limiting. Book (Data Publications), price 2/-. All components (less valves), **£5-5-0.**





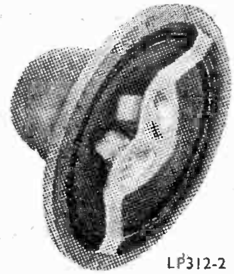
For the more experienced, the Medium Wave and F.M. Tuner shown above is available. This may be built either as a tuner or receiver. The Assembly is supplied with the centre holes blocked by easily removable plastic discs. F.M. sensitivity is 15 microvolts. Components (less valves) to build Receiver, **£11-10-0.** Tuner, **£10-10-0.**

Available from our usual stockists, e.g. :-

A. E. Knight, Aberdeen
Clyne Radio
Coventry Radio, Luton
Etrad, Crawley
D. R. Evans, Cardiff
Filmer, Bexley
Gower & Jones, Herne Bay
Home Radio of Mitcham
Lanes Radio, Brighton
Lasky's
Odeon Radio, Harrow
Radio Bargains, Battersea
Radio Sales, Bristol
Raidel Services, Croydon
Reliance Radio, Bexleyheath
Servistore, Muswell Hill
Smith's, Edgware Road
Telekit, Beckenham
Teleradio, Edgware Road
Tower Electrics, Leatherhead
T.R.S., Thornton Heath
Unicraft, Belfast
Watt's Radio, Kingston
West Midland Sound, Oswestry

S.A.E., please, for Component Price Lists.

THE JASON MOTOR & ELECTRONIC CO.,
328, Cricklewood Lane, London, N.W.2. SPE 7050.

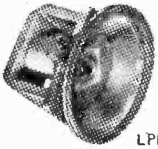


LP312-2

EXPAND AND

Laboratory Balanced. The TSL LORENZ LP312-2 is a main bass 12in. diaxial speaker combined with two LPH65 electro-magnetic high frequency TREBLE units permanently mounted coaxially across the front of the main bass speaker at such an angle to give full spherical binaural response. All are laboratory balanced and matched for perfect tone with a frequency range of 20 cycles to 22,500 cycles essentially level output. To ensure level frequency response the voice coils of the two treble speakers are fed through a specially designed crossover network which balances the frequency response of the three speakers as a combined unit.

IMPROVE ANY



LPH65

The TSL LORENZ LPH65 is the basic treble speaker used in the TSL LORENZ Sound System. Round in shape to ensure smooth melodious sound the plastic cone is fully tropicalised. Special features are the super high flux density magnet of 17,500 gauss and non-perforated back plate.

SOUND SYSTEM

SUPER HIGH FIDELITY THIS YEAR

Let your ears be your judge. . . crisp, clear, natural reproduction without coloration with TSL LORENZ speaker units. Ten years ahead in engineering and design this speaker unit will enable you to design and build up a sound system in your own home which will truly add the miracle of LIFE to the magic of music . . .

No Extra Cost. You get these extra features at no extra cost with every TSL LORENZ Sound system . . . Greater output and more sensitivity . . . heavy duty oversize speech coil . . . Super high flux magnet . . . Permanently flexible self-damped cone . . . Multi-parameter cone fully tropicalised . . . Sealed in air gaps . . . built-in centralising device for perfect gap alignment.

Improve your own H.F. Sound System. *For those devotees of high fidelity who possess bass speakers fitting one or more LPH65 treble units will greatly extend your range of super fidelity reproduction. They are, without a doubt, the most sensitive and efficient treble reproducers research has revealed to date. The non-perforated back plate ensures that the LPH65 can be used with any other speakers irrespective of make or type without interaction taking place.*

SPECIFICATION LP312-2

IMPEDANCE 15 ohms ; **FREQUENCY RANGE** 20-22,500 c/s ; **POWER RATING** 25 w. ; **PEAK POWER RATING** 40 w. ; **DIAMETER** Bass 12¼ inches Treble 2½ inches ; **DEPTH** Bass 7⅛ inches Treble 2 inches ; **BAFFLE OPENING** 10⅝ inches ; **SPEECH COIL DIAMETER** Bass 1.5 inches Treble ½ inch ; **FUNDAMENTAL RESONANCE** Bass 20 c/s Treble 1,600 c/s ; **FLUX DENSITY** Bass 17,500 gauss Treble 17,500 gauss ; **INTERMODULATION PRODUCTS** under 0.5% ; **CROSSOVER FREQUENCY** 2,000 c/s ; **FINISH**, Grey and blue vitreous anti-corrosion stove enamel. **RETAIL PRICE, £14.19.6.** (Not subject to Purchase Tax.)

SPECIFICATION LPH65

HIGH FREQUENCY CONE-HORN TYPE TREBLE UNIT

IMPEDANCE 5.5 ohms ; **FREQUENCY RANGE WITH SUITABLE HIGH PASS FILTER CONDENSER** 2,000-22,500 c/s ; **POWER RATING AS A SINGLE UNIT** 3 w. ; **PEAK POWER RATING AS A SINGLE UNIT** 5 w. ; **DIAMETER** 2¼ inches ; **DEPTH** 2 inches **BAFFLE OPENING** 2⅛ inches. **PRICE, 39/6.** (Including Purchase Tax.)

TSL LORENZ

Exclusively distributed throughout Great Britain and the Commonwealth by

Details of Bass-Reflex enclosures for the TSL LORENZ LP312-2 may be obtained from :—

TECHNICAL SUPPLIERS LTD., HUDSON HOUSE, 63, GOLDHAWK RD., LONDON, W.12. *Tel: SHE 2581, 4794.*

'AVO' *Precision* ELECTRICAL TESTING INSTRUMENTS

Registered Trade Mark

A dependably accurate instrument for testing and fault location is indispensable to the amateur who builds or services his own set.

The UNIVERSAL AVOMINOR

(as illustrated) is a highly accurate moving-coil instrument, conveniently compact, for measuring A.C. and D.C. voltage, D.C. current, and also resistance; 22 ranges of readings on a 3-inch scale.

Size: 4⅝ins. x 3⅞ ins. x 1⅝ins.
Nett weight: 18 ozs.
List Price: **£12 : 0 : 0**

Complete with leads, interchangeable prods and crocodile clips, and instruction book.

MODEL 1
D.C. VOLTAGE: 0 to 500 volts.
A.C. VOLTAGE: 0 to 500 volts.
D.C. CURRENT: 0 to 500 mA.
RESISTANCE: 0 to 20,000 Ω.
Total resistance of meter: 200,000 Ω.
SENSITIVITY: 400 Ω/V.

MODEL 2
D.C. VOLTAGE: 0 to 1,000 volts.
A.C. VOLTAGE: 0 to 1,000 volts.
D.C. CURRENT: 0 to 500 mA.
RESISTANCE: 0 to 200,000 Ω.
Total resistance of meter: 4 MΩ.
SENSITIVITY: 4,000 Ω/V.

The D.C. AVOMINOR

is a 2¼-inch moving coil meter providing 14 ranges of readings of D.C. voltage, current and resistance up to 600 volts, 120 milliamps, and 3 megohms respectively. Total resistance 100,000 ohms.

Size: 4⅛ins. x 3⅞ins. x 1⅛ins.
Nett weight: 12 ozs.
Complete as above
List Price: **£5 : 5 : 0**

Write for a free copy of the latest Comprehensive Guide to "Avo" Instruments.

Sole Proprietors and Manufacturers:—
AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO., LTD.
Avocet House, 92/96, Vauxhall Bridge Rd., London, S.W.1. VICtoria 3404 (9 lines)

RX161. 160/220 mc. 2 EF54, 1 EC54, 1 EC52, less valves, **6/-**. RX71, 10 mc. I.F. less valves, 9/6. U.S.A. Hand Generator X Dinghy Tx. **15/-**. Hoover 24 volt Blower Motor, **15/-**. RT40 APNIX U.S.A. Altimeter, less valves and dynamotor. New, **15/-**. X-WD Throat Mic., new, boxed, **4/6**. Heater Transformers, 6.3 volt 1.5 amp., **7/6**. 200 KC Crystals, **8/-**. Hour Meter X-Govt., 50 c/s A.C. mains, **15/-**. Londex 230 v. A.C. Relays, **8/6**. High resistance Ear Pieces, 4,000 Ω, per pair, **6/-**. L.R. Headphones with headband, **8/-**. New Modulation Transformer 2-1, XBC536, **6/-**, Relays G.P.O. types, 6,500 Ω, **8/6**. Siemens H/S. 100 100 Ω, **8/6**. Silicon diode, **2/-**. Germanium diode, **2/-**. Pye Plug and Socket, **1/6** p.v. V.Holders, 1.0 **6d.** Br Oct., **6d.** B7G, **10d.** Screen and Can, **1/6**. Cer. 807 type, **1/-**. RK34 type, **1/6**. I.F. Strip, 12.5 mc, 3 meg Band width 8 SP61, 1 EA50, less valves, **12/6**. With valves, **27/6**. 8+8 mfd. 450 volt Elec. Condensers, **2/6**. 1 mA Meter Rectifier, **4/6**. Packard Bell Amplifier, complete with valves and handbook, **12/6**. Reflector Gun Sight in wood case, **£1**. 16 Bank Switchbox, **8/6**.

VALVES

6AG7 9/- 6J6 5/- EF50 4/-

SP61	2/6	SP41	2/6	EA50	2/-
D1	2/-	955	5/-	954	3/-
VU111	3/-	VU120	5/-	VU39	8/6
6V6	8/6	5Z4	8/6	5U4G	8/6
6K8	11/-	6K7	6/-	6X5	7/6
6SL7	7/6	6SN7	9/-	6J5	5/-
6J7	7/6	6N7	8/6	EF36	4/6
EF39	7/-	EBC33	7/6	EL32	4/-
EF37A	9/-	EC52	5/-	EF54	5/-
CV66	4/-	P61	6/-	6B4	4/-
6SK7	4/6	6SH7	7/6	6SA7	8/-
Pen46	5/6	Pen220	3/6	6C4	7/-
6AG5	7/6	6AK5	8/6	1T4	7/-
1S5	7/6	1R5	8/6	1A3	7/-
1L4	7/-	3A4	7/-	3S4	8/6
3V4	8/6	EY51	13/6	9BW6	9/-
R19	12/6	CV63	6/-	EL50	9/-
RK34	2/6	CV286	7/-	CV287	7/-
CV201	8/-	2X2	3/6	150/30	7/-
105/30	7/-	75/30	7/-	807	6/-
12SH7	5/6	Pen25	6/-	U22	7/6
S130	6/-	VT501	6/-	80	8/6
6H6	4/-	6AC7	7/-	AR8	7/-

VINERS

(MIDDLESBROUGH)

26, EAST ST., MIDDLESBROUGH.

TEL.: (MID) 3418.

R 1155

Covers 18.5/7.5 mc, 7.5/3.0 mc, 1.500/600 KC, 500/200 KC, 200/75 KC. Complete with valves.

FIRST £6 GRADE

Carriage 10/-.

Power unit for use on 230-250 A.C. main. Complete with 2 valves on 8 x 6 Chassis.

£4 Carriage 5/-.

TA12G TX.

Reduced. This Month's Bargain.

£4 . 10 . 0

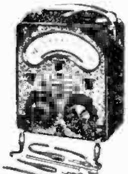
RF 24 Units. Brand new in makers' cartons, **15/-**.
PVS Sleeved Wire, 22 s.w.g., 10 colours, **2d.** per yard. X-RAF Heavy Duty 24 volt 60 amp. Switch, **1/6**. Transformers, all 230 v. A.C., 50 c.p.s. mains, 14/20 volt 20 amp., **£3**. 14/17 volt 20 amp., **£3**. 3.5/9 v./17 v. 4 amp., **£1.2.6**. 9 v./17 v. 1.5 a., **13/6**. 350-250-0-250-350 v. 6.3 v. 3 a., 4 v. 2 a., **£1**. Condensers Electrolytic 450 volt wkg. 8 mfd., **2/6**. 8+8, **3/6**. 16 mfd., **3/-**. 16+8 mfd., **3/9**. 16+16, **4/6**. 32+32 mfd., **6/-**. **CONDENSERS,** Assorted, 100 for **15/-**. Ass'd Resistors, ¼, ½, 1, 2 watt. All our selection, R.E.P. Coil Stock, also Denco, Osmor High Stab Resistors, 2%, 1/-: 1%, **1/6**. Welwyn Vit. Resistors, 5 watt, **1/6**. Potentiometers, all valves, to 2 meg., **2/6** each.

HOME RADIO OF MITCHAM

187, LONDON ROAD, MITCHAM, SURREY MIT. 3282

for TEST GEAR

AVO



Model 8. A multirange instrument with high sensitivity. Ranges .25 mV to 2,500 volts, .5 μA to 10 amps., 0 to 20 megohms.

PRICE £23-10-0.

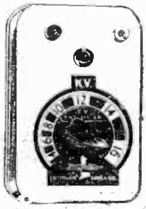
Model 7. 50 ranges with 1,000 o.p.v. sensitivity.

PRICE £19-10-0.

AVOMINOR A.C./D.C. A small accurate instrument with 22 ranges and 3in. scale.

PRICE £10-10-0.

E.H.T. TESTER



Don't guess E.H.T. —test it. 3-16 kV. A.C. and D.C. for line fly-back or transformer E.H.T. Boxed with full instructions. 52/6 post paid.

TAYLOR

Model 77A

Multirange meter. Volts D.C. 0-3,000. Volts A.C. 0-750. Current 0-15 amps. Resistance 0-5 megohms.

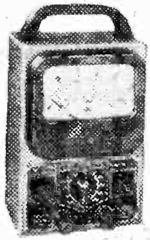
PRICE £15-0-0.

ADVANCE

P.1 Signal Generator. 100 kcs. to 100 mcs. in 6 bands. Accuracy 1%. Continuously variable output. A.F. mod.

PRICE £22-5-0.

PULLIN



SERIES 100 Test set. 10,000 ohms per volt. 21 Ranges A.C. and D.C. 10 to 1,000 volts. 100 μA to 500 mA. Resistance up to 1 megohm.

PRICE £12-7-6.

We carry all these instruments and many others in stock and will be pleased to send full details on receipt of stamped, addressed envelope marked "Test Gear."

Train for a wonderful future in —

ELECTRONICS

Train to meet the need for pioneers in this expanding field

Every day the demand for the expert in electronics grows. Radio, television, radar and the whole field of industrial automation are rapidly expanding, and the trained specialist assures for himself a well-paid career in this quickly developing profession. Here is your opportunity to enter for

4-year course in
ELECTRONIC ENGINEERING

Intended for good Science sixth-formers who are capable of training into future team leaders in scientific applications. Final qualifications are B.Sc. and City and Guilds' Full Technological Certificate in Telecommunications Engineering. This course is recognised by the Institution of Electrical Engineers. At least 18 E.M.I. Scholarships are offered for the 1956 course which commences on October 2nd.

3-year course in
TELECOMMUNICATIONS

Entrance standard G.C.E. Ordinary level or equivalent. This course trains Assistant Development Engineers to City and Guilds' Full Technological Certificate level. Opportunities for practical attachments to E.M.I. Laboratories and Workshops are provided. Details of special Scholarship Scheme available for next course commencing September 11th.

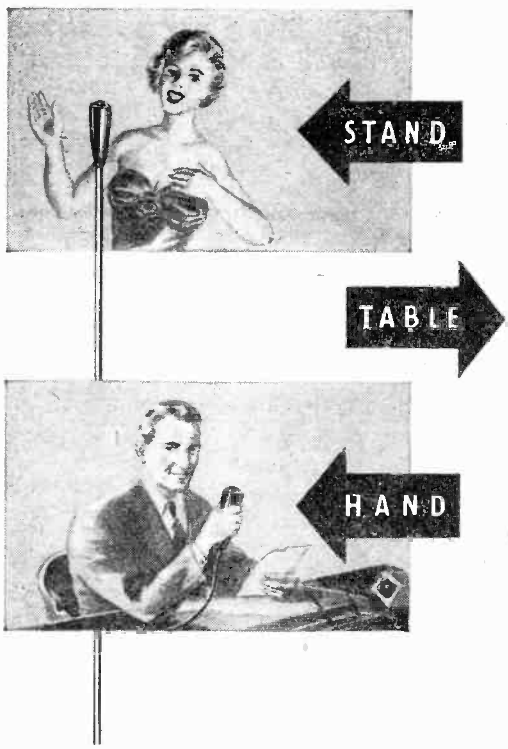
E.M.I. INSTITUTES

Dept. 32, 10, Pembridge Square, London, W.2. Telephone : BAYswater 5131/2.

The College associated with a world-wide electronics industry, including "His Master's Voice," Marconiphone, Columbia, etc.

THE ACOS MIC 36

The ACOS MIC 36 crystal microphone performs as well as it looks. It is omnidirectional, highly sensitive, and has a substantially flat response from 30 to 7,000 c/s. It retails at £3.3.0 without switch or £3.8.0 with one, and is widely chosen for tape and disc work, P.A. and amateur radio.



acos always well ahead

ACOS devices are protected by patents, patent applications and registered designs in Great Britain and abroad.

COSMOCORD LIMITED • ENFIELD • MIDDLESEX • Tel: ENField 4022

PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXII, No. 594, JUNE, 1956

EDITOR : F. J. CAMM

24th YEAR OF ISSUE

COMMENTS OF THE MONTH

BY THE MONTH

Careless Manufacture

MANUFACTURERS of complete receivers often boast of their inspection departments and the skill with which every part and the complete receiver is tested. It comes, therefore, as a surprise to read in a magazine issued by a radio retailing association that large numbers of sets are delivered to retailers in a faulty condition. One dealer, we are told, in one month had to carry out repairs to new receivers which cost him £162 18s. 0d. Not all of this can be due to damage in transport, because most manufacturers to-day have their own transport delivery service. The association has reached the conclusion that in the absence of some other satisfactory explanations it must be assumed that sets leave the factories in faulty condition and the conclusion is that the testing is either inadequate or not properly supervised. It is pointed out that the public will not accept a faulty receiver, and there is no reason why a dealer should do so. Complaints from dealers are on the increase and they may refuse to accept receivers which are defective instead of putting them in order themselves. The manufacturer is hardly likely to remedy this state of affairs whilst the dealer is prepared to put right defects.

The radio trade is having a thin time due to higher wages, increased rating assessment, and the reduced profits brought about by hire-purchase tax rates.

CAR RADIO

WE have had numerous requests for articles on car radio, and the first of such articles appears in this issue. It describes the construction of an efficient receiver which has been tested over a long period. We should be glad to have constructional details of other car radio receivers which have been constructed by readers and found satisfactory. Such articles should contain a list of components, be accompanied by circuit and wiring diagrams, and the text should extend to about 2,000 words. Photographs, where possible, should be sent. Such articles will be paid for on a generous scale.

ARTICLES WELCOMED

WE welcome articles of a practicable nature submitted by readers. Such articles will be promptly considered and paid for. We are not in need of theoretical articles. Constructional articles, especially those dealing with receiver construction, are given preference. Such articles, as mentioned above, should contain all necessary information to enable the receiver or component to be constructed by other readers. Intending contributors should, in the first place, send a précis of the proposed article to see whether the subject is acceptable and does not collide with similar articles already in hand.

"BEGINNER'S GUIDE TO RADIO"

A SECOND Edition of the "Beginner's Guide to Radio" has just been published. Notwithstanding a large first edition, it rapidly went out of print, and there has been an insistent demand ever since. Teachers are using it as a basis of a radio course and students all over the world are finding it an ideal first course in radio. It is an amplified version of the series of articles which originally appeared in this journal and which proved extremely popular. Copies are available from any bookseller at 7s. 6d., or by post for 8s. from the offices of this journal.

SPECIAL NOTICE : PRICE INCREASE

WE greatly regret that the price of this journal, in common with the remainder of our Practical Group of Journals, is increased to 1s. 3d. as from this issue. This step, which has been taken with the greatest reluctance, had been deferred until the continued rise in the cost of paper and production left us with the only alternative of reducing the number of pages, and this we decided would not meet with the approval of our readers. We are certain that all readers will agree that, at its new price, the journal is excellent value for the quantity and quality of our editorial content.—F. J. C.

THE PRINTING DISPUTE

The printing dispute, which has prevented publication of this journal since the issue dated March, 1956, has been settled, and we shall now be able to publish normally.

We greatly regret the inconvenience to our readers which this dispute has caused, but readers, we are certain, will appreciate that this break in publication has been due to circumstances beyond our control.

By "QUESTOR"

Broadcast Receiving Licences

THE following statement shows the approximate num ber of Broadcast receiving licences in force at the end of February, 1956, in respect of wireless receiving stations situated within the various postal regions of England, Wales, Scotland and Northern Ireland. The numbers include licences issued to blind persons without payment.

Region	*Total*
London Postal	1,333,947
Home Counties	1,305,373
Midland	1,032,347
North Eastern	1,349,811
North Western	1,030,202
South Western	843,137
Wales and Border Counties ...	529,916
Total England and Wales ...	7,424,733
Scotland	949,761
Northern Ireland	206,759
Grand Total	8,581,253

Frequency Control

AS from May 1st all TV and F.M. receivers in the U.S.A. must be certified as adhering to specific radiation limits on the basis of tests made "on a sufficient number of production units . . .", if used in the band from 30 to 890 Mc/s. Radiation at frequencies below 25 Mc/s such as those from sweep, colour subcarrier, and 21 Mc/s I.F. circuits, must meet specified limits in all new TV receivers made after June 30th, 1956.

Obituary

THE death has occurred, after a short illness, of Mr. H. C. Van de Velde, who relinquished his position as senior executive of The Marconi International Marine Communication Co., Ltd., last summer. Mr. Van de Velde, who retained a consultative interest in the company's affairs, was on a tour of its Mediterranean and African establishments when he was taken ill in Johannesburg and removed to a nursing home, where he died on January 14th, aged 65.

Mr. Van de Velde had had a long association with the Marconi organisation and with radio, and had held senior posts in Marconi's Wireless Telegraph Co., Ltd., and The Marconi International Marine Communication Co., Ltd., for thirty-six years.

He was responsible for the installation of the first wireless station at Croydon Airport, and played a considerable part in organising wireless communication on commercial air routes. His gift for organisation and administration led to his appointment in 1929 as joint sales manager of Marconi's Wireless Telegraph Co., Ltd., and three years later he became assistant general manager. He was promoted to deputy general manager in 1934 and to general manager a year later. He was a Freeman of the City of London.

Radio Telescopes

ACCORDING to Dr. M. Ryle, of the Cavendish Laboratories, Cambridge, the total number of radio telescopes in use in the world is at least 1,936. This was stated at a meeting of the Royal Astronomical Society, and was the result of an intensive sky survey. The majority of radio sources are not identified with any visible object, though 500 of them have accurately known positions. More than 30 were found to be very large and may be galaxies in collision.

Radio Thermostat

YET another use for a small radio tansmitter and receiver has been reported from America. Here a thermostat has been linked with a small, crystal controlled transmitter, and when the temperature falls below a certain setting the transmitter transmits a signal which is picked up by the receiver, and the radiated impulse is then made to operate radiators or other equipment.

Tape Recorder on Himalayas

BESIDES proving the great courage and endurance of the climbers, the recent attempt by the French Himalaya Expedition to conquer the giant Makalu peak also provided striking testimony to the ability of the E.M.I. portable tape recorder (Model L/2) to operate perfectly under the most extreme climatic conditions.

Often working in sub-zero temperatures, this lightweight and compact recorder performed with its usual high standard of quality and reliability throughout the long periods spent in the world's most formidable mountain range.

The E.M.I. machine was immensely valuable to the expedition for making on-the-spot recordings

The E.M.I. recorder on the Himalayas. See paragraph above.

of scientific and technical data which should prove of great benefit to future expeditions.

Blind Basket Maker Makes Tape Recorder

FOR three years 37-years-old Ernest Harling has worked in his spare time to make his own tape recorder ; but he will never see the result of his labours—for he is totally blind. Ever since he had his voice recorded during a visit to Southend, he has been determined to make a machine of his own. His technical knowledge has been gained by reading books translated into braille.

Mr. Harling, who lives at 62, Merrow Street, Camberwell Gate, London, S.E., has been working for over 20 years as a basket maker at the London factory of The Royal School for the Blind, Leatherhead. He has been blind since the age of two years.

Architect for BBC's New Welsh Broadcasting Headquarters

THE BBC announces that Sir Percy Thomas and Son, F/A.R.I.B.A., have been appointed architects for the new Welsh broadcasting headquarters to be built at Baynton House, Llandaff, near Cardiff. The new headquarters will be a studio centre providing for both the sound and television activities of the BBC's Welsh services.

Professor G. W. O. Howe

IT has been announced by the Institution of Electrical Engineers, London, that the recipient of the 34th award of the Faraday Medal is Professor G. W. O. Howe, D.Sc., LL.D., M.I.E.E.

The Faraday Medal is awarded by the Council of the Institution for notable scientific or industrial achievement in electrical engineering or for conspicuous service rendered to the advancement of electrical science.

Professor Howe, who is Emeritus Professor of Electrical Engineering at the University of Glasgow and a director of The Mullard Radio Valve Co., Ltd., has received the award for "his pioneering work in the study and analysis of high-frequency oscillations and on the theory of radio propagation ; and for his outstanding contributions to engineering education."

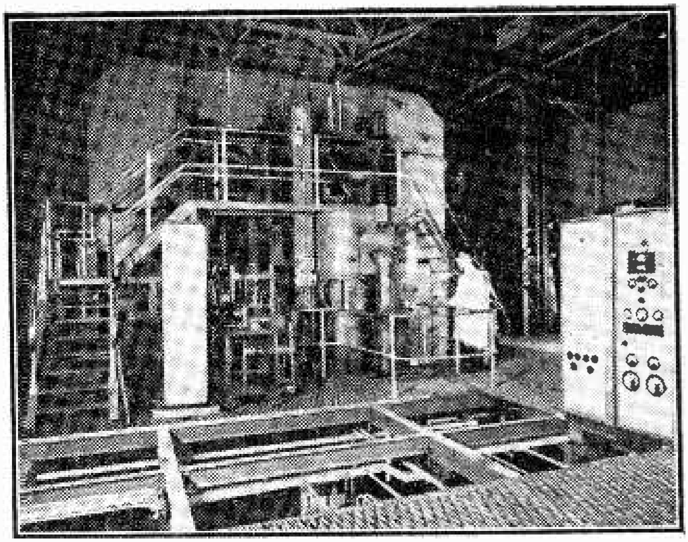
The actual presentation to Professor Howe took place on the occasion of the Kelvin lecture on April 26th at the Institution's headquarters in London.

Particle Accelerator for B.I.C.C.

BRITISH INSULATED CALLENDER'S CABLES, LTD., are now installing a two million volt particle accelerator at their research laboratories at 38, Wood Lane, London, W.12. This is one of the first particle accelerators to be installed in the United Kingdom for purely industrial researches.

The accelerator is of the Van de Graaff type, housed within a pressure container operating at about 300lb./square inch. It is a universal apparatus which can be adapted to supply high-energy beams of electrons, positive ions, neutrons or gamma rays.

The installation will be used for general research into the effects of high-energy irradiation on materials used in cable and capacitor manufacture. In particular, it will be employed for continuing the researches on the effect of irradiation on polyethylene, on which the company has carried out considerable work during the last few years.



A general view of the electromagnetic separator at the atomic energy research centre at Harwell.

Record Entry for R.T.E.B. Examinations

THE total entry for the Radio Servicing Certificate Examination, the Practical Test of which was held on Saturday, May 12th, is 822. This shows an increase of approximately 60 per cent. on the 1955 entry, which was the highest previously recorded.

The Practical Test was held at 41 centres throughout the U.K.

The number of entries for the Television Servicing Certificate Examination is only 137, which is again an increase on previous years. The condition of entry to this examination is the holding of a Radio Servicing Certificate, which consequently limits the number of entrants.

Both these examinations are conducted jointly by the City and Guilds of London Institute and the Radio Trades Examination Board.

B.I.R.E.

B.I.R.E. The following meeting will be held during May, 1956 : London Section. Wednesday, May 23rd. at 6.30 p.m. At the London School of Hygiene & Tropical Medicine, Keppel Street, Gower Street, London, W.C.1. "The Measurement of the Velocity of 'Light' by Electronic Methods." A paper to be read by K. Froome, Ph.D.

Ekco Equipment for "Fairey Fireflash"

IT may now be revealed that Ekco electronic equipment, developed and produced by E. K. Cole, Ltd., plays an important role in the "Fairey Fireflash" guided weapon system, which is now in production for the R.A.F.

A Hi-Gain PRE-SELECTOR

DETAILS OF A USEFUL TWO-STAGE SWITCHED TUNER

By V. M. Meadows

FOR the short-wave enthusiast, intent on receiving that elusive Dx broadcast or amateur station, a good high-gain pre-selector is virtually a necessity these days with the crowded bands and the need to sort out those weak transmissions. Most communication receivers already have one R.F. stage as part of the circuit, while many have none at all. Both these types of receivers will greatly benefit from the addition of one or more tuned R.F. stages.

A correctly designed pre-selector basically acts as a voltage amplifier, the small voltages delivered to the input by the aerial being greatly amplified, tuned, and passed on to the receiver. Thus, the receiver selectivity and sensitivity is greatly enhanced and, where used with a receiver having no R.F. stage at all, will completely eliminate second channel interference. With the item of equipment about to be described in detail, a gain of some 20db, as shown on the "S" meter in use with a receiver already having one R.F. stage, was obtained. The unit has been designed to operate over the frequencies normally covered by communication receivers. Band I covers 10 to 30 metres; Band II, 30 to 75 metres and Band III, 75 to 200 metres.

Circuit

By using switch 1, which should be a high-grade component having ceramic insulation, provision for accommodating three aerials, and the ability to switch from one to the other at will, is made. More aerials could be provided for, of course, if the reader is lucky enough to have them, by using a switch having more contacts. Switch 2 allows the operator either to by-pass the unit altogether or to switch the aerial through the pre-selector, and, as an added alternative, the aerial may be disconnected completely. It is often necessary to by-pass the unit especially when reception of a strong local station is being carried out, i.e., on 160 metres, or one of the powerful European broadcast stations. Disconnecting the aerial is often of great assistance where a 100 kc/s

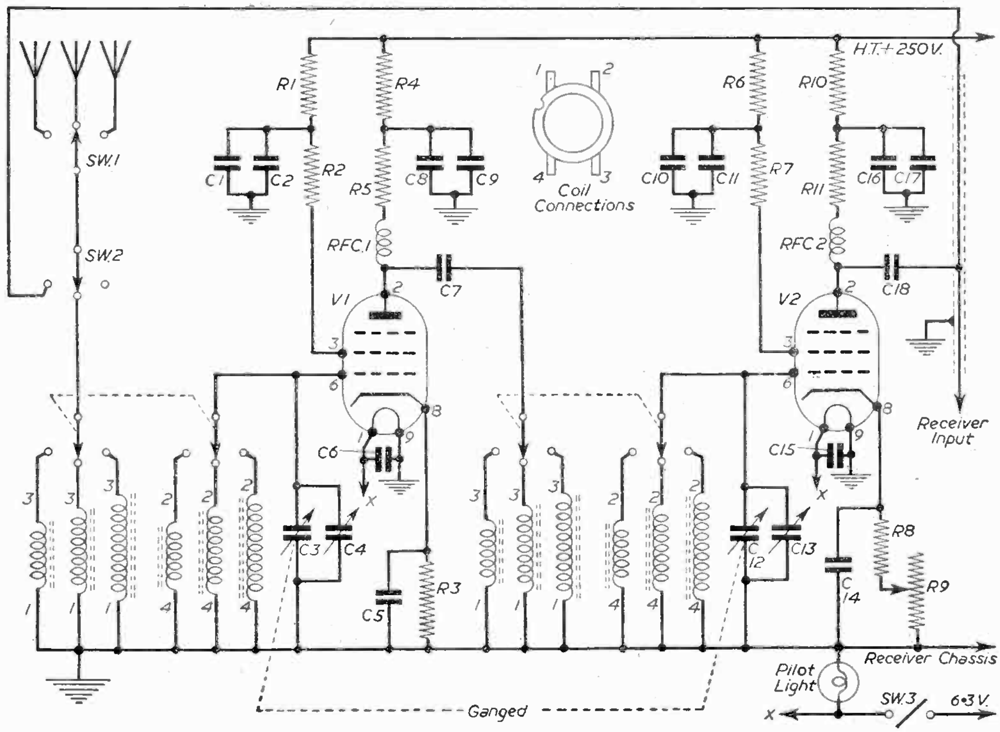


Fig. 1.—Theoretical circuit of the pre-selector.

crystal oscillator is being used in conjunction with the receiver, for in this position no possible error can occur with beats from local stations, especially on the broadcast bands.

The whole of the coil switching shown in the circuit is, of course, one component—a four-pole, three-way switch—this being supplied by the manufacturer of the coils if so desired. The coils themselves are of extremely high Q (see component list), and the inset to Fig. 1 shows the connections with the corresponding numbers on the diagram itself. It will be seen that both stages are tuned and each uses the well-known EF54 R.F. pentode. For those interested, the "surplus" equivalent of the EF54 is the VR136 which can be obtained at very reasonable prices on the market. All resistors used throughout the design are of the ½ watt type.

The variable condensers C3 and C12 are ganged and mounted above the chassis. Likewise, C4 and C13 are also ganged, and these serve as the band-spread or peak control, this being necessary in order to fine tune the pre-selector. C6 and C15 shown connecting between the "live" side of each valve heater and chassis ensures that freedom from modulation hum, especially at the higher frequencies, is ensured.

With the wide range of frequencies covered by this unit, it is essential that adequate by-passing on both screens and anodes is carried out so that maximum efficiency at all frequencies is achieved. Hence it will be noted that both 0.01μF condensers for the low-frequency end of the coverage and 0.001μF condensers for the high-frequency portion have been included. Both the R.F. chokes are wired direct to the anodes and the junctions of the anode and screen resistors and condensers should be mounted on tag strips securely bolted to the chassis walls.

The first stage has been designed to work at maximum efficiency and is without gain control, whilst the second stage has a gain potentiometer, R9, wired in the cathode line. If preferred, however, both stages may be simultaneously controlled by changing R3 from 300Ω to one of 100Ω and wiring this resistor direct to the centre tag of R9.

Output to the receiver is taken from the anode of V2, via C18, and thence through a short length of co-ax cable, the outer metal braiding of which should be earthed at both ends, to the receiver aerial input terminal. Likewise, the pre-selector by-pass connection from switch 2 to the receiver input should also be co-axial cable.

The power requirements may be obtained in most cases direct from the receiver, it only being necessary to bring the power leads through the receiver rear chassis wall either via a rubber grommet or by means of a plug and socket arrangement. Alternatively, for

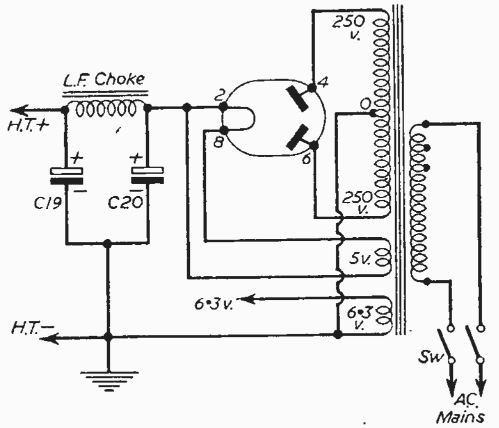


Fig. 2.—Details of a suitable power pack.

those who do not wish to adopt this means of supplying power to the pre-selector, the power pack may be built on the same chassis thus providing the unit with its own power supply. A suitable power pack for this purpose is shown in Fig. 2.

An on/off switch, shown as switch 3 on the circuit diagram, is mounted on the front panel and merely breaks the heater supply. If, however, an integral power unit is included on the same chassis, this single-pole single-throw switch will have to be changed for one of the double-pole single-throw types, each pole being wired across the A.C. mains input to the power supply. The pilot light has been included for obvious reasons, nothing being more disconcerting than to find that the unit has been left on all night—as the writer discovered before including this necessary addition to the circuit.

With the valve type used herewith no external screening is required above the chassis, the valves

LIST OF COMPONENTS

Resistors
R1—50kΩ ½-watt.
R2—10kΩ ½-watt.
R3—300Ω ½-watt.
R4—10kΩ ½-watt.
R5—5kΩ ½-watt.
R6—50kΩ ½-watt.
R7—10kΩ ½-watt.
R8—100Ω ½-watt.
R9—5kΩ Pot. wire wound.
R10—10kΩ ½-watt.
R11—5kΩ ½-watt.

Valves
EF54 (VR136).

Coils, W/Change Switch
Roding Laboratories, types 4/2, 5/2, 7/2.

R.F. Chokes
Teletron Co.

Switches, Co-ax Cable, Valve bases
Single pole, 3-way, Yaxley type (2).

Instrument Case, Panel and Chassis
Kendall & Mousley, Ltd., Type "9."

Condensers
C1—0.01μF, 350 v. wkg., Tubular.
C2—0.001μF, Mica.
C3—500pF Variable.
C4—25pF Variable.
C5—0.01μF, Mica.
C6—500pF, Mica.
C7—100pF, Ceramic.
C8—0.01μF, 350 v. wkg., Tubular.
C9—0.001μF, Mica.
C10—0.01μF, 350 v. wkg., Tubular.
C11—0.001μF, Mica.
C12—500pF Variable.
C13—25pF, Variable.
C14—0.001, Mica.
C15—500pF, Mica.
C16—0.01μF, 350v. wkg., Tubular.
C17—0.001μF, Mica.
C18—100pF, Ceramic.

PRE-SELECTOR POWER PACK
Mains Transformer
Ellison type MT162.

L.F. Choke
H. L. Smith & Co. Type 101J.
Valve 5Y3.

Condensers
C19—16μF, 350 v. wkg., Electrolytic.
C20—8μF, 350 v. wkg., Electrolytic.

themselves already being totally enclosed in a metal container. Below chassis, however, a metal screen should be affixed to run the entire width except for a small gap to allow for the fitment of the wavechange switch, and a corresponding gap at the rear of the chassis to allow the H.T.+ and L.T.+ lines to pass through from one stage to the other.

Constructional Notes

The coils should be mounted under the chassis, near to the wavechange switch, three at each side of the central screen referred to above. To mount these coils, simply drill a ¼in. hole through the chassis, file a small guideway (see base of coil), and having placed the coil in position, affix to the chassis by means of the Spire clip provided.

Care should be taken that all leads carrying R.F. are as short and direct as possible and never pressed close to the chassis itself, as this only results in excessive R.F. eddy currents being set up around the circuit and chassis.

All controls should, of course, be mounted on the front panel, and the aerial input and the pre-selector output sockets on the rear chassis wall. The whole unit should be enclosed in an appropriately sized metal case.

It preferred, of course, only the second stage need be constructed by those requiring a one-valve pre-selector. Alternatively, those readers building the complete unit, as shown in Fig. 1, may care to complete the second stage in the first instance and, having made sure by operating the equipment as a one-valve unit that this is working in a satisfactory manner, then go on to complete the unit by adding the first stage as shown.

Power Pack

This is shown in Fig. 2, and is meant to be completed on the same chassis as the two R.F. stages previously discussed. It is a purely conventional A.C. pack using the 5Y3 full-wave rectifier. Where space is at a premium, however, one of the smaller valve rectifiers may be preferred. The B8A base EZ41 comes to mind, this little valve giving up to 60mA current, ample for the two R.F. pentodes. If this alternative is used, note should be taken of the fact that the EZ41 has a 6.3 volt heater, the unsmoothed H.T. being taken from the cathode.

All components for the power unit are currently available and are shown in the component list.

Pre-selector Operation

In operation the high-gain pre-selector will be found to provide more than adequate gain for most purposes, therefore judicious use must be made of the gain control. The selectivity and sensitivity of the receiver with which the equipment is used will be improved out of all proportion to the time and cash outlay spent. Furthermore, by means of the various controls shown, the operator is able to select any aerial at will or to switch the unit in or out of circuit as the needs dictate. This last facility is most instructive as to the gain of this particular pre-selector.

Pontop Pike V.H.F. (F.M.) Station

THE BBC took another step forward in its plan to extend V.H.F. coverage on December 20th, when the V.H.F. equipment at Pontop Pike, near Newcastle-on-Tyne, and at Wenvoe, near Cardiff, was brought into service.

Wenvoe is at present transmitting only the Welsh Home Service, so Pontop Pike is the first V.H.F. (F.M.) station to be brought into service in permanent form since Wrotham was opened in May. It is the first of the newly-built stations to be completed since the BBC's V.H.F. development plan was announced in July, 1954—Wrotham was already operating on an experimental basis by that date. It is on the same site as the Pontop Pike television station.

The transmissions are horizontally polarized and are on the following frequencies: North of England Home Service, 92.9 Mc/s; Light Programme, 88.5 Mc/s; Third Programme, 90/7 Mc/s. The effective radiated power on each programme service is 60 kW.

There are in all six V.H.F. transmitters, each of 5 kW. output power, which operate in pairs, one pair for each programme. They are housed in the same building as the television transmitters.

The V.H.F. transmitters use the "FMQ" frequency modulation system and duplicate FMQ transmitter drive units fed simultaneously with the appropriate programme are provided for each programme service. Automatic changeover arrangements ensure that either drive may be selected with the other acting as spare.

The "FMQ" system of frequency modulation consists essentially of a quartz crystal oscillator connected through a quarter-wave network to a balanced modulator, the susceptance of which is varied by the modulating signal, and this in turn varies the frequency generated by the crystal oscillator. The crystal is specially cut to avoid the generation of spurious frequencies within the operating range. The chief advantage claimed for this system of frequency modulation is that the circuits are simpler than those of other systems, and are therefore more reliable and easier to maintain. The output of the crystal oscillator is multiplied by three stages of frequency doubling and one tripling stage to produce the required carrier frequency.

There are four stages of amplification at carrier frequency in the transmitters proper. These follow closely the design of the amplifiers in the earlier transmitters installed at the BBC's Wrotham station, the first two stages being of conventional push-pull type using open lines for the anode circuits, while the last two are coaxial line, single-ended, earthed-grid amplifiers.

The six transmitters are operated as three pairs, one pair for each of the Home, Light and Third programmes. The outputs of one transmitter of each of the three pairs are combined and connected to one half of the slot aerial. Similarly the outputs of the other three transmitters are combined and fed to the other half of the aerial via a separate feeder. Thus all three programmes are radiated by both halves of the aerial, thereby ensuring continuity of service in the event of failure of either half of the system.

The V.H.F. aerial system is carried on the same mast as the television aerials and consists of a cylinder in which there are 32 slots arranged in eight tiers of four giving a power gain factor of 6/1. The cylinder, which consists of prefabricated slotted quadrants of aluminium sheet bolted together, is 6ft. 9in. in diameter and 90ft. long and is built round the square section lattice steel mast with its centre 296ft. above ground level.

PRACTICAL AMPLIFIER DESIGN

A NEW SERIES 3.—TUNED AMPLIFIERS

By R. Hindle

(*Continued from page 172 March issue*)

Complete constructional details for various types of tuned amplifier. A series of articles forming a sequel to the theoretical series published some time ago.

Superhet Design

THE reader will have been encouraged, it is hoped, by the earlier, simple designs, to consider something a little more ambitious, and attention is now turned to the amplifier design problem particularly associated with the superhet receiver. A design for a two-stage I.F. amplifier has, therefore, been developed and, as this is to be worked along with the audio designs already described, some form of detection has to be incorporated, though discussion of such a circuit is outside the immediate scope of this series. The gain of such a two-stage amplifier is considerable and to use it for broadcast reception, even if fitted with an effective manual gain control, is unpleasant unless A.V.C. is provided, as in the present design.

The theoretical circuit is given in Fig. 14, from which it will be seen that the usual transformer coupling between stages is used. One of the difficulties in straight receiver design is the provision of an adequate number of tuned circuits for the required selectivity and bandwidth, the reason being that to gang such circuits so that they can be tuned simultaneously is well-nigh impossible and it is equally impossible to tune a multiplicity of circuits individually by hand. The proposition is reasonable enough if the receiver is to operate on one station only because the tuned circuits can be individually set up with great care in the laboratory and, in fact, this is exactly what the superhet principle permits. The frequency changer stage changes any signal that it is required to receive into a standard frequency, the intermediate frequency, and subsequent circuits can be set up to this frequency and can be left so permanently. These circuits can be designed for the required selectivity and, particularly attractive, the characteristic will remain constant over the whole tuning range, unlike that of a straight receiver that varies over the range and is at optimum at only one received frequency. They can be designed also for the required bandwidth, using the principle previously described, but there is a practical difficulty in setting up bandpass circuits with closer than critical coupling due to the tendency to unsymmetrical response and so generally, for ordinary broadcast and particularly for home constructor use, the response characteristic is usually kept short of the theoretically possible flat top. Nevertheless, the results are much better than with a circuit using fewer but more selective circuits.

Intermediate Frequency

The choice of frequency to be used depends on many factors. First, it must be outside the range of frequencies that are to be received and, in fact, must not coincide with the frequency of any signal that is likely to be picked up, whether wanted or unwanted, or there will be break-through to the I.F. stages causing interference with the station tuned in. The frequency must not be too low or it will be more difficult to get adequate bandwidth and there will be upper audio frequency cutting or, on the other hand, it must not be too high or more tuned stages will be required to give adequate selectivity. In the earlier days of the superhet receiver 110 kc/s was a popular choice and proved to be very suitable for domestic purposes. Quite likely it would still be in vogue but for the attraction of listening on the short waves. It will be remembered that at the mixer stage the incoming signal is mixed with a local oscillation such that the difference in frequency is equal to the intermediate frequency. Normally, the local oscillation has a frequency above the wanted signal but it could equally well be below. So, for a given frequency of local oscillation, there are two signal frequencies to which the I.F. stages will be equally responsive, one

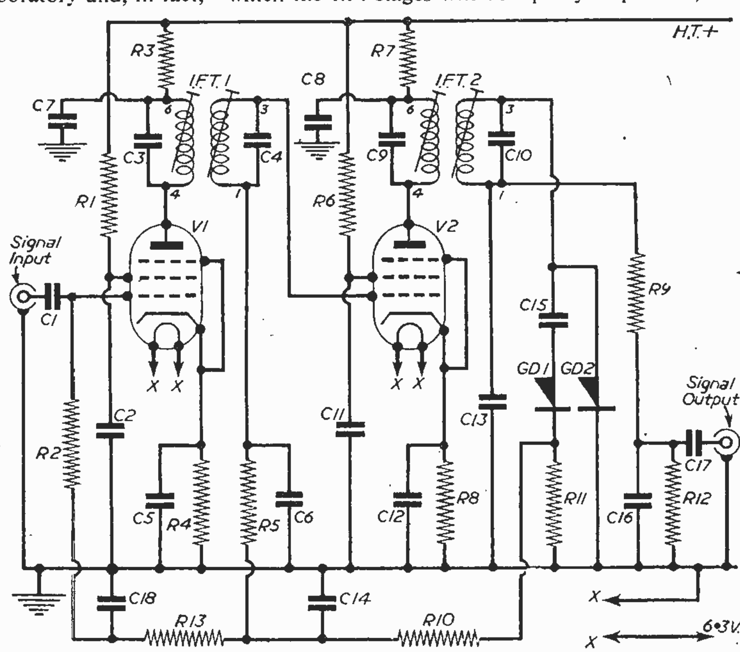


Fig. 14.—I.F. circuit diagram.

below the local oscillation, i.e., the wanted signal, and one above the local oscillation, and if there is a signal present at the frequency changer grid of the second frequency this signal will appear at the output as an interfering signal and no amount of selectivity in the I.F. amplifier will get rid of it. This is known as second-channel interference.

The intermediate frequency chosen has considerable bearing on the amount of second-channel interference; the lower the I.F. and the nearer are the two channels to which the I.F. will be responsive and consequently the greater will be the difficulty in separating the wanted from the second-channel station in the circuits prior to the frequency changer. In the case of the 110 kc/s I.F. mentioned above the wanted frequency and the interfering second-channel frequency are 220 kc/s apart and so far as the medium waveband is concerned, with frequencies of the order of 1 Mc/s, that separation is a reasonable percentage of the carrier and consequently there was little difficulty in discriminating against second-channel in the R.F. tuned circuits. This is not the case, however, with the short waveband now incorporated in receivers; 220 kc/s is small compared with, say, 20 Mc/s, and consequently second-channel interference was experienced unless a number of R.F. tuned circuits were used before the frequency changer.

For the above reasons frequencies below the long waveband have now been abandoned and the next suitable frequency falls between the long and the medium waveband; experience has lead to the standardisation of 465 kc/s for normal domestic receivers receiving the usual long, medium and short waveband amplitude-modulated stations and in this present design we shall follow suit. The design problem is, then, for a two-stage amplifier operating on a middle frequency of 465 kc/s with a bandwidth suitable for sound reception.

COMPONENT LIST

C1, 13—100 pF (Dubilier type 400).
C2, 5, 6, 7, 8, 11, 12, 17, 18—.1μF 250 v. (Dubilier type 410).
C3, 4, 9, 10—Included in I.F. transformers.
C14—.05μF 250 v. (Dubilier type 410).
C15—50 pF (Dubilier type 400).
C16—300 pF (Dubilier type 400).
R1, 6—33 KΩ
R2, 10, 13—1 MΩ
R3, 7—4.7 KΩ
R4, 8—100Ω } **½ w. (Dubilier type BT).**
R5—680 KΩ
R9, 12—10 KΩ
R11—47 KΩ
V1, 2—6BA6. Brimar.
GD1, 2—GD5. Brimar.
I.F.T. 1, 2—Miniature. Osmor.
Two valveholders. B7G with screen.
One coaxial plug and socket.
One tagstrip, 3 tags plus earth.
Two tagstrips, 2 tags plus earth.
Coaxial cables, wire, sleeving.

Components

There is no question of ganged tuning and the more energetic constructor could consider making his own transformers, but it is a laborious business and most will prefer to use commercial components, particularly as these can be obtained pre-aligned to the correct frequency so that very little adjustment will be needed after construction. This is well worth while

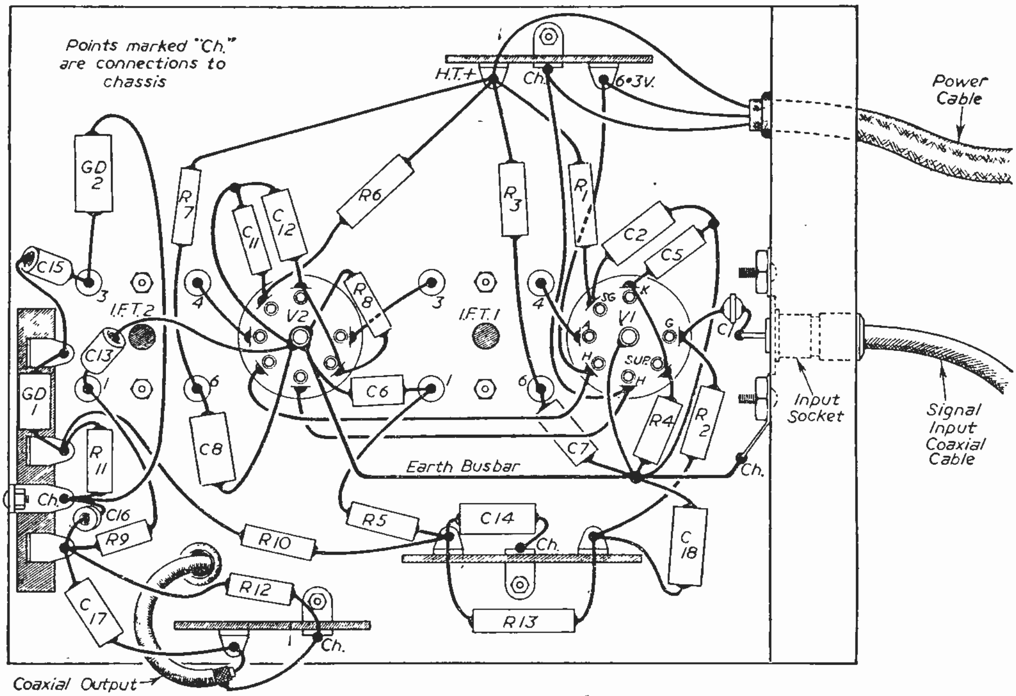


Fig. 16.—Wiring diagram for Fig. 14.

when the constructor has no signal generator because his main difficulty will be finding the correct frequency if he has to start from scratch. In keeping with the other designs Osmor miniature I.F. transformers are used and the constructor when ordering should make the special point that he wishes to have them pre-aligned unless he wishes to do the job the hard way.

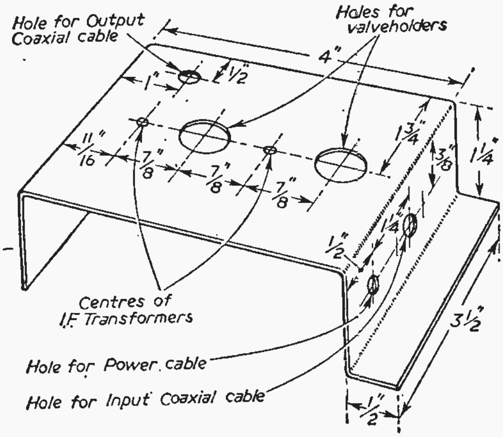


Fig. 15.—Details of chassis.

Modern miniature valves are again used and as A.V.C. is to be incorporated they have to be variable-mu types. The 6BA6 is chosen for each stage. A double-diode could be used for the detector and A.V.C. rectifier but just for a change germanium diodes are actually specified; the Brimar type GD5 being chosen.

In order to guard against instability, very likely with a design offering such gain unless construction is carried out carefully, two steps are taken. First, a very compact and clean layout is given and second the stages are decoupled at the H.T. feed position; R3, C7 and R7, C8 are the appropriate components. A.V.C. decoupling is provided by R13, C18. The detector circuit is similar to that used with the more conventional valve diode but the values of the loads (R12, 10 KΩ in the audio circuit and R11, 47KΩ in the A.V.C. circuit) are reduced to suit the germanium components.

The chassis also conforms to the style used previously in this series, the dimensions being given in Fig. 15, on which also the simple details of drilling are indicated. The centre position of the components to be mounted on the chassis are specified but not the details of the drilling. Components do vary somewhat and it is wiser to take them from the components themselves. The holes for the valveholders (⅝in.) should be drilled in the positions indicated and the holders dropped into the holes; they should then be rotated until the pins are in the relative positions indicated in the wiring diagram (remembering that the wiring diagram shows the underneath view) and the positions of the small mounting holes marked through the components. Besides the centre hole for each I.F. transformer in the position indicated (¼in.) six further holes are required, two for the fixing bolts and four for the connections, which should well clear the soldering pins when the components are mounted to ensure against an unintentional short. The positions for the tag-strips will be seen from the wiring diagram.

Wiring

The greatest of care must be taken in wiring this chassis. The result is very compact and it is impossible to indicate the exact route taken on a wiring diagram which, for the sake of clarity, must be opened out. Signal leads, in particular, must be as short as possible and, in fact, the I.F. transformer pins 3 and 4 were bent over carefully until they met the appropriate valve pins and soldered direct, without any connecting wire. If this is done care must be taken to avoid damaging the components and to avoid a short to the chassis.

A busbar of 18-gauge tinned copper wire is provided for earth, and this connects to the chassis at only one point, at one of the fixing bolts of the input coaxial socket. The other end of the busbar is anchored to the centre ring of the second valveholder. All the components associated with V1 that require earthing are tied to the same point on this busbar.

Technical Writing Awards

PREMIUMS awarded for articles published in the public technical press during 1955 were presented at a luncheon given by the Public Relations Committee of the Radio Industry Council at the Café Royal, London, on Thursday, March 8.

Mr. Arthur Clarkson, vice-chairman of the Public Relations Committee, presided and Mr. C. H. T. Johnson, chairman of the Radio Communication and Electronic Engineering Association, presented the awards. Mr. A. H. Beck, one of the joint authors of a premium-winning article who was joint author of a prize-winning article in 1953, responded for the recipients.

One premium of 25 guineas was awarded for each of the following articles:

"'Memory' Systems in Electronic Computers," by A. W. M. Coombs (British Communications and Electronics, March, 1955).

"An Infra-Red Radiation Pyrometer," by R. A. Bracewell (Electronic Engineering, June, 1955).

"Progress in High Power Ultrasonics," by Alan E. Crawford (British Communications and Electronics, August and September, 1955).

"A Novel Gas-Gap Speech Switching Valve," by A. H. Beck, T. M. Jackson and J. Lytollis (Electronic Engineering, January, 1955).

Two premiums were awarded jointly in respect of the following three articles:

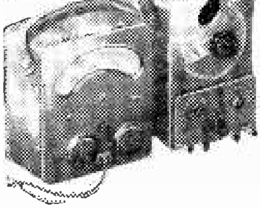
"A Frequency Modulator for Broad-Band Radio Relay Systems," by I. A. Ravenscroft and R. W. White (Post Office Electrical Engineers' Journal, July, 1955).

"Equipment for Measurement of Inter-Channel Crosstalk and Noise on Broad-Band Multi-Channel Telephone Systems," by R. W. White and J. S. Whyte (Post Office Electrical Engineers' Journal, October, 1955).

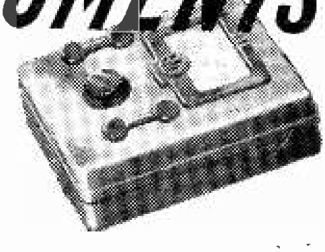
"An Instrument for the Measurement and Display of V.H.F. Network Characteristics," by J. S. Whyte (Post Office Electrical Engineers' Journal, July, 1955).

The total number of articles submitted in 1955 was 62, compared with 24 in 1954, 37 in 1953 and 39 in 1952, the first year of the scheme.

Using TEST INSTRUMENTS



Part 16 of a Series of Articles Dealing with the Practical Application of Standard Test Equipment



(*Continued from page 190 March issue*)

The Grid-dip Oscillator (58)

ALTHOUGH few models of the grid-dip oscillator are produced commercially, the versatility and relative constructional simplicity of this type of instrument are undoubtedly the chief factors responsible for its popularity among serious experimenters and constructors.

A stable and well-made specimen of this instrument might well aid the solution to many of those paradoxical tuned-circuit problems, particularly from the V.H.F. and TV aspects. Moreover, what a lot of time wasting and guessing can be avoided simply by turning a knob and reading the resonant frequency corresponding to a newly constructed V.H.F. or TV aerial straight off a dial or from a graph. Then, again, there is the possibility of being able to check the alignment of a radio set without actually connecting it to the power supply!

There is no doubt about it, the grid-dip oscillator is, indeed, a versatile instrument, for apart from possessing the power to perform the above-mentioned operations with extreme ease it is capable of aiding with other equally as exacting tests without any bother at all.

The experimenter who is not conversant with the grid-dip oscillator and its mode of operation should be excused the amazement of learning that the instrument is far from complex, but simply features something like three capacitors, a resistor, a tuned-circuit and a valve, plus, of course, a means of indication, such as a microammeter or tuning indicator (eye).

Basically the grid-dip oscillator is nothing more than a simple one-valve oscillator which is capable of being accurately tuned over the frequency range necessary for the tests in hand and which has the addition of a sensitive indicator (usually a microammeter) for the purpose of registering *changes* in oscillator grid current.

We should note from the start that the indicator is not required to measure the magnitude of oscillator grid current, but is only required to indicate a grid current change. This is essentially because a characteristic of any oscillator is that its grid current reduces when its tuned circuit (coil and capacitor) is coupled to another circuit tuned to the same frequency.

Here, then, represents the mode of function of the instrument. Put in another way, we can say that a reduction of grid current takes place when the tuned circuit of the oscillator is loaded by an external circuit. The degree of grid current reduction depends on the extent to which the oscillator is loaded, and maximum loading in this connection occurs, of course, when the resonant frequency of the external circuit equals the oscillator frequency—if the reader has had anything to do with transmitters this point will be fully appreciated.

The degree of coupling between the oscillator and the external circuit will also obviously influence the magnitude of deflection in the indicator. We cannot, of course, expect to load the oscillator from an external circuit which is situated at the other side of the room. Clearly, the external circuit has to be brought within the range of the oscillator coil, but a word of warning here—if the external circuit is too tightly coupled (if it is placed too close to the oscillator coil) the oscillator might be muted completely, indicated by a total collapse of grid current. This may or may not be a good thing, depending on the tests being made, but too tight a coupling is generally to be

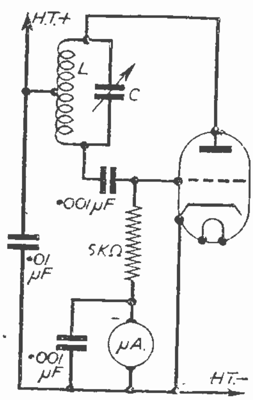


Fig. 74. — A grid-dip oscillator using a Hartley oscillator.

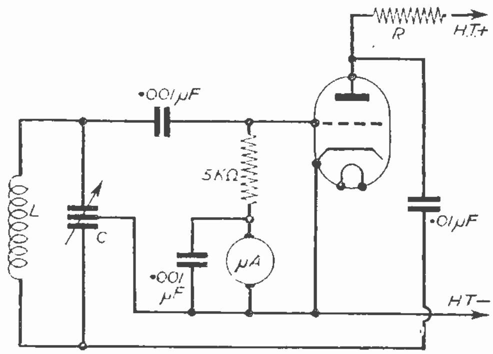


Fig. 75—A grid-dip oscillator using a Colpitts oscillator.

avoided as it is liable to detune the oscillator in relation to its calibration.

Experience is required in this connection, but this is quickly obtained on a newly constructed instrument when the resonant frequency of everything in sight comes under investigation!

In practice it is desirable to use the smallest coupling possible, consistent with usable deflection in the grid current indicator. Under this condition maximum

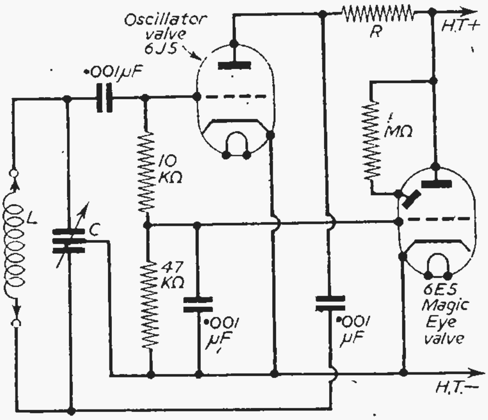


Fig. 76.—A method of using a "magic eye" valve to indicate a change in oscillator grid current.

accuracy is achieved, not only because the oscillator is less influenced by the circuit under test but because a small coupling has the effect of giving a sharper dip on the indicator. It is interesting also to observe that the sharpness of the dip at resonance is dependent on the goodness or "Q" of the external circuit. A circuit of high "Q" provokes a more pronounced and sharper dip than a low "Q" circuit under conditions of equal coupling.

The Circuit (59)

Now that we have a general idea of what the grid-dip oscillator does and how it works, let us have a look at a typical circuit. The circuit given at Fig. 74 shows a conventional Hartley oscillator with a micro-ammeter in the grid circuit. It will be noticed that the values of the grid time-constant components are not quite standard, but these are purposely arranged so that the grid resistor can have a value considerably lower than normal, as a means of permitting greater values of grid current to be indicated on the meter than would otherwise be possible. This, of course, permits the use of a less sensitive meter, and one having a full scale value of 200 microamps is often sufficient.

The valve is a simple triode and can be either mains or battery operated. If a battery valve is used, a completely self-contained portable instrument can be produced.

The most important part of the whole circuit is the tuned circuit comprising a tapped coil L and a variable capacitor C. This section has to be built as rigidly as possible as a means of avoiding calibration error as the instrument is handled.

If the instrument is required to tune over a wide range of frequencies it is essential to be able to change the coil easily and quickly, for it cannot be expected to cover the entire broadcast and TV ranges on a single coil. It is, in fact, desirable to make two or even three units to cover (a) the long and medium-wave broadcast bands, (b) the short wavebands, and (c) the V.H.F. bands, including F.M. and television. When this arrangement is adopted it is still necessary to make coil changes on each unit, so that they will cover sections of the appropriate bands without causing cramping on the calibrated tuning dial.

In view of the fact that it is, in any case, necessary to make coil changes, the Colpitts circuit is frequently made use of in grid-dip oscillators.

This circuit, as shown in Fig. 75, differs only from the Hartley by the tuned circuit L and C. Whereas a tapped coil is required in the Hartley circuit, a two-terminal coil with the electrical centre tap provided by a split stator tuning capacitor is used in the Colpitts arrangement.

This makes the production and mounting of coils much easier. Moreover, the Colpitts circuit functions quite happily at frequencies as high as 200 Mc/s, thereby rendering the instrument of use for testing at Band III (the commercial TV band) frequencies. The upper frequency limit of the instrument is, of course, dependent on the choice of valve, for while a standard 6J5 triode would operate on the long, medium and short wavebands, something after the style of the American 955 acorn triode would be desirable to reach the TV and V.H.P. spectrum.

Construction (60)

Although this series is not primarily concerned with the construction of test instruments, we feel that a few words in this connection on the grid-dip oscillator would not be out of place, and would undoubtedly be of assistance to the newcomer in this field.

As intimated earlier, the successful design features a mechanically stable tuned circuit: this applies particularly to instruments which are for use on the V.H.F. bands. The layout of the components should permit the use of the shortest possible lengths of circuit-connecting wires, and the coil holder should be situated so that no more than an inch or two of 20 s.w.g. wire is necessary to connect the coil-holder sockets to the tuning capacitor.

The circuit is best built into a small, all-metal box with the coil holder externally mounted on one side, so that when the coil is plugged in it extends beyond the metal and can be used to couple direct to the circuit under test. It is often a good idea to design the instrument in the form of a large probe with the coil mounted at one end, and if it is battery operated the

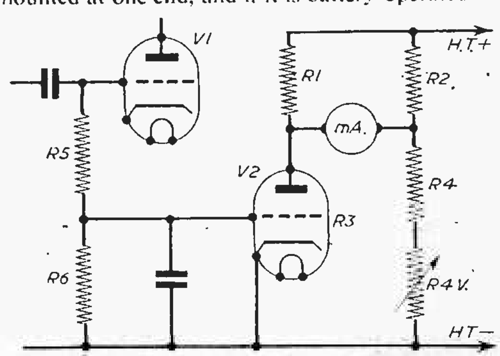


Fig. 77.—Amplifying a change in oscillator grid current by means of a valve bridge circuit.

batteries can be stored at the rear end of the probe.

The tuning dial can be calibrated in terms of frequency if only one or two ranges (coil changes) are required on one unit (instrument). If, on the other hand, a single unit is designed to cover a number of ranges by appropriate coil changes, it is much better to use a dial which is marked off in degrees, such as 0 to 180 degrees, and then plot a graph for each range by calibrating the dial positions against frequency. A recommending factor for this latter method is that new graphs can easily be produced if an additional range is added to the instrument, or if the tuned circuits undergo modification.

The indicating meter should be of suitable size to fit in the side of the instrument box. The amount of power given by the oscillator governs the sensitivity choice of meter. If the instrument features a mains-operated valve a meter up to 2 milliamperes is often quite suitable, and if a relatively high anode voltage is used (say, 250 volts), it may even be found necessary to shunt a meter which has a sensitivity greater than 2 milliamperes.

With a portable battery-operated probe type instrument, however, a 100-200 microampere meter may be demanded in order to get a reasonable grid current indication or deflection. Whatever type is employed it is always placed in series with the oscillator grid leak as indicated on the circuits.

A "magic eye" tuning indicator valve can be used in place of a sensitive moving-coil meter. This method of indication is often favoured, because such a valve is probably less costly than a 200 microampere meter—this being the relative sensitivity attributed to a magic eye used in a grid-dip oscillator—and it is more or less impossible to damage a magic eye by overloading. A complete grid-dip oscillator featuring a magic eye as an indicating device is shown at Fig. 76.

If a meter of limited sensitivity is used one is often tempted to over-couple the oscillator coil to the external circuit under test as a means of obtaining a greater dip of grid current. We have already seen that this practice is liable to lead to calibration errors.

So that one will not be tempted to use the over-coupling artifice when a meter of limited sensitivity is used the meter sensitivity can be synthetically increased by the use of a D.C. amplifier or bridge circuit. An arrangement after this style is shown at Fig. 77. Here a bridge network is created by R1, the anode resistance of the valve V2, R2 and R4 and R4V in series. The bridge is balanced by adjusting R4V. This balance is disturbed, of course, when the anode resistance of the valve alters due to the alteration in potential across R6. The potential developed across R6 depends on the flow of oscillator grid current in R5-R6, valve V1 being the oscillator valve. An alteration of grid current thus provokes a somewhat amplified deflection in the milliammeter.

Next month we shall investigate methods of calibrating the grid-dip oscillator, and look with more detail into its mode of applications.

(To be Continued)

Radio Components Show

RECENT advances in the applications of transistors and printed circuitry are reflected in many of the components which were seen at the annual exhibition of the Radio and Electronic Component Manufacturers' Federation at Grosvenor House, London, from April 10th to 12th. This issue went to press before the Show opens and therefore we can only give an indication of the lines which will be followed by various exhibitors.

A range of sub-miniature electrolytic capacitors has been designed with connections brought out at one end for easy connection into the printed circuit (T.C.C., Dubilier, Hunt, London Electrical Manufacturing Co., Plessey).

A number of sub-miniature transformers for use with transistor circuits has been produced, and one of these, believed to be the smallest transformer in the Show, measures only ¼in. by ¼in. by ⅜in. (Fortiphone).

Many examples are to be shown of copper-clad laminates for printed circuits (H. Clarke & Co., Bakelite) as well as complete printed circuits for a number of applications including the "front end" of a TV set, a four-valve battery portable, cross-over networks, TV aerial filters and a transistor computor panel (T.C.C.).

Printed circuits will be seen incorporated in a sound level meter (Dawes Instruments) and a high-fidelity audio amplifier (T.C.C.).

The first transistorised power amplifier and the first transistorised single stage pre-amplifier made in the United Kingdom will be exhibited (Lustraphone) and also a hearing aid, with transistor, smaller than a matchbox (Fortiphone).

Designed especially for use with printed circuits is a new range of sub-miniature mica capacitors which will operate in conditions of high temperature and humidity (London Electrical Manufacturing Co.) and a range of sub-miniature pre-set plug-in potentiometers (Egen Electric).

For the first time a loudspeaker is being fitted with a universal impedance speech coil (Whiteley Electrical) which will facilitate matching at 3, 7½ or 15 ohms.

A new 10½in. by 6½in. elliptical loudspeaker is made with multiple mounting centres so that it can be interchanged with any British and most foreign speakers (Reproducers & Amplifiers).

There will also be a small battery-operated 7in. record player for 45 r.p.m. discs including a low current motor. This is intended for portable use and can be operated in conjunction with a battery valve or transistor amplifier (Garrard).

One firm (Truvox) whose interest in tape recorders has hitherto been confined to components is showing its first complete tape deck. Although very compact—it measures only 15¼in. by 8⅜in. by 14in.—it is able to take 7in. 1,200 ft. or 1,800 ft. thin tape reels without overhang. To eliminate any possibility of accidental erasure, it is arranged that pressure on the brake button switches the recorder to "play back."

One firm renowned for its vast range of switches of all types, sizes, fixings and ratings includes a micro-switch with an operating pressure as low as ¾ oz., and a movement of only 0.010in. This type of switch has on test and in use performed millions of operations (Bulgin).

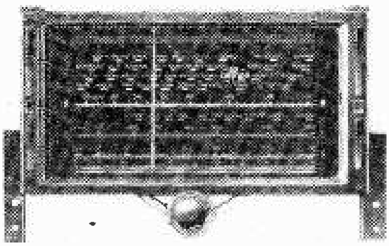
Excellent insulation resistance, power factor and stability characteristics have made the plastic film capacitors a valuable addition to the range of fixed condensers. They can be hermetically sealed, made smaller in size than the paper dielectric type and will operate up to a temperature of 125 deg. C. (Dubilier, T.C.C., Suflex, Hunt).

Why be swamped by the B.B.C?

In areas with high signal strength the new B.B.C. high-powered Band I transmitter may render the contrast control of your receiver almost inoperative. The B.B.C. advise an Attenuator. The OSMOR Attenuator is the only Variable Attenuator and will reduce the signal exactly to the *required* level. Easily fitted—just plug in. Reduction ratios variable 2-1 to 10-1. AN *ESSENTIAL* with all types of Band III Converters. 15/-, from your Dealer—or direct.

BAND I FILTER
Rejects B.B.C. from I.T.A. aerial
and improves picture
10/- With Instructions FITTED IN 2 MINUTES

The OSMOR NEW DIAL ASSEMBLY



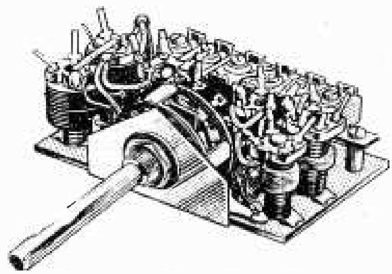
This is a really attractive horizontal 3-colour slide rule, precision-built assembly. Complete with 6-band Perspex scale 9in. x 4⅝in., for chassis-mounting L., M. and S. wavebands with Station names; S.W.1, S.W.2 and Trawler bands. The vernier drive has a ratio of 18-1 search, and 50-1 reverse. Positions for two dial bulbs. Calibrated specially for Osmor coils and Coilpacks. Scale Length 7 in. Type 5 Price, **24/6.**

ESCUTCHEON FOR ABOVE, BRONZE FINISH METAL 4/-

The OSMOR NEW 'Q' PACK

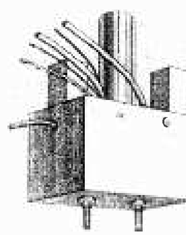
Incorporating the very latest type Super 'Q' potted coils in M.W. and L.W. bands and ensuring really maximum performance with utmost selectivity. Wavebands: L.M.S., L.M., L.M. Trawler, M. Traw. S., M.S.S.

52/6 Including Purchase Tax



I. T. A. CONVERTERS—London, Litchfield, Manchester. Circuits, Wiring Diagrams and Full constructional information. A very efficient Band III Converter for all TV sets (including TRF). Approximately one hour to build!

Guaranteed no break-through of Band I. Will convert any Band III Channel to any Band I Channel. A.C. or A.C./D.C. Excellent results assured.



Type A for Home Constructors. Kit, **£3.5.0.** TYPE B, ready wired, **£4.** Postage and pkg. 3/-.

THE OSMOR NEW STATION SEPARATOR (PRICE 10/-) WILL PROVIDE CLEAN CUT PROGRAMMES

All components for the SEVEN-FIVE SUPERHET available, including punched chassis.

FREE We keep right up to date in building the latest circuits published in PRACTICAL WIRELESS—"Wireless World" and "Radio Constructor" and we stock the components specified, including a design for F.M. TUNER, Band III TELEVISION CONVERTERS, VARIOUS SUPERHET CIRCUITS (using miniature valves). 5 & 6 valve superhet 3 valve (plus rectifier) T.R.F. Circuit, Battery/Portable Superhet. T.R.1196 Conversion. Coronet Four, OSMOR Bat./Mains Portable, 3-speed Autogram. Amplifiers. Whistle Filters. F.M./A.M./Gram. Switching Circuit, and many others.

Send 7½d. in stamps for circuits, fully descriptive literature together with coil and coilpack leaflets, component lists, chassis drawings and templates.

Ultra Small Ceramic Neg. Tem. Co-eff. Capacitors for V.H.F., etc., from 1 pF. ± 0.5 pF. to 10,000 pF ± 100% − 20% **10d.** each.
Ultra Small and Standard ¼ watt resistors 10Ω ± 10% to 10 m. ± 20% **6d.** each.
Full list of types, co-eff. and values on application.

418, BRIGHTON RD., CROYDON, SURREY

OSMOR RADIO PRODUCTS LTD.

Telephone: CROydon 5148/9

Get your new BRIMAR MANUAL

The **LATEST EDITION** has **272 Pages** of **VALVE** and **TELETUBE DATA CIRCUITRY & SPECIAL COMPONENTS**

still only 5/-

SUMMARY OF CONTENTS

Valve ratings and base connection symbols.

Classified lists of nearly 300 valves, teletubes and selenium rectifiers.

Germanium diode section including ratings in various circuits.

Brimistors section.

Radio engineering formulae and NEW circuits.

Brimarize section. Valves and teletubes.

Up-to-date substitution list of American types.

Equivalents and C.V. numbers.

Details of Trustworthy types.

Valuable information on Transistors.

Send 5/- for your copy to: Publicity Dept.

Standard Telephones and Cables Limited FOOTSCRAY SIDCUP KENT Footscray 3333

R.S.C. MAINS TRANSFORMERS (FULLY GUARANTEED)

Interleaved and impregnated. Primaries 200-230-250 v. 50 c/s Screened.

TOP SHROUDED DROP THROUGH

250-0-250 v. 70 mA, 6.3 v. 2.5 a 13/9
250-0-260 v. 70 mA, 6.3 v. 2 a, 5 v. 2 a... 16/9
300-0-300 v. 70 mA, 6.3 v. 2.5 a 16 9
350-0-350 v. 80 mA, 6.3 v. 2 a, 5 v. 2 a ... 18/9
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 22/9
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 22/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a... 22/9
350-0-350 v. 100 mA, 6.3 v. 4 a, C.T. 0-4-5 v. 3 a 23/9
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a... 29/9

FULLY SHROUDED UPRIGHT

250-0-250 v. 60 mA, 6.3 v. 2 a, 5 v. 2 a, Midget type 2½-3-3in. 17 6
350-0-350 v. 70 mA, 6.3 v. 2 a, 5 v. 2 a ... 19/9
250-0-250 v. 100 mA, 6.3 v.-4 v. 4 a, C.T. 0-4-5 v. 3 a 26/9
250-0-250 v. 100 mA, 6.3 v. 6 a, 5 v. 3 a, for R1355 conversion 31/-
300-0-300 v. 100 mA, 6.3 v.-4 v. 4 a, C.T. 0-4-5 v. 3 a 26 9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a, 23/9
350-0-350 v. 100 mA, 6.3 v.-4 v. 4 a, C.T. 0-4-5 v. 3 a 27/9
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a 33/9
425-0-425 v. 200 mA, 6.3 v. 4 a, C.T. 6.3 v. 4 a, C.T., 5 v. 3 a. Suitable Williamson Amplifier. etc. ... 49/9
450-0-450 v. 250 mA, 6.3 v. 6 a, 6.3 v. 6a, 5 v. 3 a. 69/9

E.H.T. TRANSFORMERS

2,500 v. 5 mA, 2-0-2 v. 1.1 a, 2-0-2 v. 1.1 a for VCR97, VCR517, etc. ... 36 6

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c s, 130 v. 50 mA. 6 v. 3 a 14/9

SMALL POTTED MAINS TRANSF.

Removed from New Ex-Govt. units, Primary 0-200-230-250 v. Secs. 250-0-250 v. 60 mA, 6.3 v. 2 a, 5 v. 2 a. Size 3¼ x 4¼ x 3in. **11/9**

FILAMENT TRANSFORMERS

All with 200-250 v. 50 c s primaries 6.3 v. 1.5 a. **5/9**; 6.3 v. 2 a. **7/6**; 0-4-6-3 v. 2 a, **7/9**; 12 v. 1 a, **7/11**; 6.3 v. 3 a, **8/11**; 6.3 v. 6 a, **17/6**; 12 v. 3 a or 24 v. 1.5 a, **17/6.**

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1¼ a, **11/9**; 0-9-15 v. 3 a, **16/9**; 0-3.5-9-17 v. 2/3 a, **15/9**; 0-3.5-9-17.5 v. 4 a, **18/9**; 0-9-15 v. 5 a, **19 9**; 0-9-15 v. 6 a, **22/9.**

SMOOTHING CHOKES

250 mA 5 H 100 ohms 11/9
150 mA 7-10-250 ohms 11/9
100 mA 10 H 200 ohms 8/9
80 mA 10 H 350 ohms 5/6
60 mA 10 H 400 ohms 4/11

OUTPUT TRANSFORMERS

Midget Battery Pentode 66; 1 for 3S4, etc. 3/9
Small Pentode, 5,000Ω to 3Ω 3/9
Standard Pentode, 5,000Ω to 3Ω ... 4/9
Standard Pentode, 7 8,000Ω to 3Ω ... 4/9
Standard Pentode, 10,000Ω to 3Ω ... 4/9
Multi-ratio 40 mA. 30 : 1, 45 : 1, 60 : 1, 90 : 1, Class B Push-Pull ... 5/6
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω. 15/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω 16/9
Push-Pull 15-18 watts, 6L6, KT66 ... 22/9
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 or 15Ω 47/9
Williamson type exact to spec. ... 85/-

SILVER MICA CONDENSERS. 5, 10, 15, 20, 25, 30, 35, 40, 50, 100, 120, 150, 200, 230, 300, 400, 500, 1,000 (.001 mfd.), 2,000 pfd. (.002 mfd.), **6d.** each; **3 9** doz. One type.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Input 200-250 v. A.C. Output 120 v. 40 mA. Fully smoothed and rectified supply to charge 2 v. accumulator Price with louvred metal case and circuit, **29/6.** Or ready for use, **8 9** extra.

MANUFACTURERS' SURPLUS MAINS TRANSFORMERS. Primaries 200-250 v. 50 c/s. Fully shrouded upright mounting 425-0-425 v. 150 mA, 6.3 v. 3 a, 5 v. 3 a, **29/11.** Clamped type 250-0-250 v. 70 mA, 6.3 v. 2.5 a. **9/9**, post 2/-. 325-0-325 v. 100 mA, 6.3 v. 2.5 a, 5 v. 2 a, **19/9.**

EX-GOVT. TRANSFS., 230/250 v. 50 c/cs. 8.8 v. 4 a, **9/9**; 460 v. 200 mA, 6.3 v. 5 a, **25/9.**

EX-GOVT. SMOOTHING CHOKES

250 mA, 10 H 50 ohms 14/9
150 mA, 10 H 100 ohms 11/9
150 mA, 6-10 H 150 ohms Trop. ... 6/9
100 mA, 10 H 150 ohms Tropicalised ... 3/11
L.T. type 1 amp, 2 ohms 2/9

EX-GOVT. METAL BLOCK (PAPER) CONDENSERS

4 mfd. 500 v., **2/9**; 8-8 mfd. 500 v., **6/9**; 8 mfd. 500 v., **5/9**; 15 mfd. 500 v., **6/9**; 4 mfd. 400 v. plus 2 mfd. 250 v., **1 11.**

EX-GOVT. E.H.T. SMOOTHERS

.5 mfd. 2,500 v. Blocks, **3/9**; .5 mfd. 3,500 v. cans, **3/3.**

CONTROL PANEL with six position, 3 wafer Yaxley switch, pointer knob, 2 S.P.S.T. switches, various plugs and sockets. Only **1/6.**

EX-GOVT. VALVES (NEW)

1T4	7/9	EF39	5/9	EBC33	7 9
1R5	7/9	6V6GT	6/9	6AT6	7 9
1S5	7/9	6X5GT	7/9	EF36	4 9
3S4	8/9	6L6G	11/9	EF80	8/11
5U4G	9/9	807	7/9	EL32	3/9
5Y3G	8/11	12A6	7/9	EL91	5 9
5Z4G	9/9	15D2	4/9	KT44	8 9
6K7G	5/9	25Z4G	9/9	KT66	11 9
6K8G	9/9	35Z4GT	9/9	SP41	1 11
6SN7GT	9/9	6L6G	11/9	SP61	2/9
6F6G	7/9	MH4	4/9	PX25	14 9

RF26 UNITS BRAND NEW, CARTONED. Only **29/6.** Carr. 2/6.

EX-GOVT. UNIT RDF1. Brand new, cartoned. Complete with 14 valves, including 5Z4, E.H.T. rectifier, Mains Trans. Choke, etc. Only **28/9.** carr. 7/6.

RADIO SUPPLY CO. (Leeds) LTD.

32, THE CALLS, LEEDS, 2.

(For Terms see full page advert.)

On Your Wavelength

BY THERMION

Dates

A LOT of important things happened in the months of March and April. For example, on March 1st, 1901, a wireless service was inaugurated in the Hawaiian Islands, and on that same date, in 1925, there was the first demonstration of amateur wireless telegraphy. Two days later, in the year 1847, Doctor Alexander Graham Bell, the inventor of the telephone was born, and the first use was made of wireless in life-saving at sea on March 3rd, 1899. On March 3rd, 1923, the Glasgow Station was opened, and on March 9th, 1930, the first dual transmission from Brookmans Park took place. On March 13th, 1932, the first programme from Broadcasting House took place, and the first high-powered directional aerial was used at Clifden on March 23rd, 1906. Much earlier, on March 27th, 1899, communication was established with Wimereux and the South Foreland Lighthouse, and on March 30th, 1930, the BBC commenced its first television broadcast.

The inventor of the Morse Code, Samuel Morse, died on April 2nd, 1872, and on April 7th, 1927, there was the first demonstration of television, by the American Telephone and Telegraph Company. The tragic *Titanic* sunk on April 15th, 1912, the first occasion when radio was used to summon assistance. King George V first broadcast on April 23rd, 1924. This was at the opening of the Wembley Exhibition when King Edward VIII, then Prince of Wales, also spoke. On April 25th, 1900, the Marconi International Marine Communication Company, Ltd., became incorporated and on April 25th, 1874, Marconi was born. On April 29th, 1932, there was the first demonstration of ultra-short-wave television by Baird.

The months of March and April are rich in other important dates in radio and television. I do hope that someone is keeping or compiling a diary of radio and television dates, as they are now becoming important, and it is often necessary to ascertain when a particular event occurred. For example, some time ago, I was asked to establish the dates when commercial radio took place in this country. It took the BBC a long time to provide me with this information.

Death of the Triode ?

THE triode valve almost universally employed in radio receivers in the early days is now practically obsolete, and so are the components associated with it. The old detector 2LF receivers have died with the triode. This seems to me in some respects a little sad, because some of the early triodes were quite efficient. Now and again, I receive letters from readers who wish to build some of the early receivers, and I am forced to point out that they would have to search the radio shops over a wide area in order to collect the necessary components.

The Show—A Suggestion

THE National Radio Show which will be held this year on August 22nd to September 1st will, as in former years, take place at Earls Court. There is, therefore, plenty of time for the exhibition organisers to endeavour to get together some of the earlier home-constructed and commercial receivers which made history. In the early twenties new circuits, or allegedly new circuits, were being produced week by week. All claimed to produce staggering results. Nearly every one of these receivers violently reacted, were unstable, unselective and most of the valves were microphonic, giving forth a beautiful blue glow, at anything over 50 volts H.T. Do you remember that monstrosity the reflex circuit ? I doubt whether anyone got it to work satisfactorily in its original form. Can you remember the bright emitter valves, requiring a six-volt accumulator ? Do you remember the Xtraudion and Dextraudion dull-emitter valves with low consumption? We were not too concerned with quality and selectivity in those days, for not so many stations were on the air. I think it would be an excellent idea to set aside a stand at the next show for the exhibition of some of these early receivers and I would undertake to co-operate with the organisers in getting some of these earlier receivers together. I would also undertake to give a talk on these receivers, and explain their disadvantages, which led to the modern high-efficiency receiver. If any readers have any of these old sets stowed away in the loft, I should be glad if they would get into touch with me.

Wanted—A National Amateurs' Association

ONE of the surprising things about radio is that whilst amateurs founded the industry and provided its personnel, no one formed an association entirely devoted to amateurs interested in reception only. The club movement was very strong in the early days, and just before the war there were over 1,000 clubs in active operation in this country. There has always, of course, been the RSGB which caters chiefly for the amateur transmitters, but the amateur transmission movement has always been comparatively small, and has considerably dwindled. A National association of radio amateurs run on proper lines could be an effective voice in discussions with the BBC and the Post-Master General. Indeed, great use could have been made of amateurs, every one of whom could have been a local monitor of BBC reception and considerably augmented their own research department. The industry, however, having firmly founded itself, proceeded to jettison the amateur. It decided to cease making components for them, as a result of which the few firms which remained loyal to the amateur movement continue to do excellent business. Why does not the Radio Society of Great Britain step in here and form another society, whose members are interested only in reception ? It has the organisation, the experience and the prestige. The amateur transmitting movement has been steadily declining for a number of years. Here is a chance for the RSGB to enlarge its membership greatly with benefit to the industry as well as to itself and to wireless amateurs generally.

A Compact Stabilised High Voltage Supply

CONSTRUCTIONAL DETAILS OF SIMPLE BENCH SUPPLY

By Hugh Guy

POWER supplies are all too often a much neglected feature of the radio amateur's equipment, being regarded as something of a necessary evil, an accessory to the functioning of the latest electronic masterpiece. Admittedly most constructors possess a power supply of sorts which can be connected to the piece of equipment under test, but seldom does one find a specially made unit, that is small and compact and economical in use, built to fulfil a variety of high tension requirements, and providing just the right output voltage.

It is with a view to filling this gap that the following constructional details are offered, giving information on the building of a simple shunt stabilised power supply providing any high-tension voltage between 140 and 200 volts, being fed only with 6.3 volt A.C. from a heater transformer supplying the test-bench.

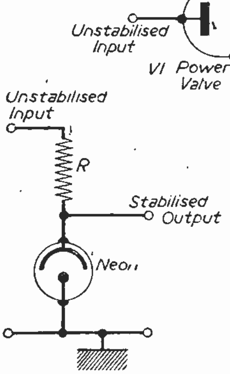


Fig. 1.—Neon stabiliser.

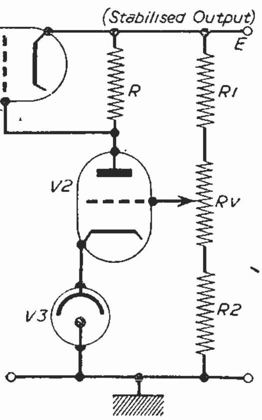


Fig. 2.—Simplified series regulator.

Uses of the Supply

The unit was developed mainly for testing circuits of low current drain, such as pre-amplifier and tone-control circuits where the effective H.T. voltage after decoupling in the anode circuits would be in the range 150-200 volts. It consists basically of a power unit followed by a two-stage voltage stabiliser.

The complete H.T. supply therefore facilitates the quick checking of such circuits which are constructed in " breadboard " fashion, their heaters being supplied by the output from a separately housed heater transformer. Such an arrangement is ideal for the testing of a variety of circuits prior to their proper construction and installation in the equipment for which they are intended, be it tape-recording apparatus, hi-fi equalising pre-amplifiers, or in the T.V. field, anything from timebases to Band III converters.

Power Supply Details

A particular feature of the power supply is the absence of the customary bulky H.T. transformer. The unit was in fact designed for compactness around a heater transformer, and Fig. 4 shows the manner in which it was utilised.

The transformer is used the wrong way round, being supplied with 6.3 volts from a bench-supply heater transformer to its L.T. side. This is stepped up to give appproximately 240 volts on the H.T. side. Since such a transformer rarely has a centre tap it is necessary to use a bridge rectifier connected in the manner shown to give a full wave rectified output at the reservoir condenser C.

If it were left in this form, such a circuit would give an off-load voltage of approximately 350 volts. This voltage would drop very sharply when connected to a load, its level depending on several factors, including the value of the load, the reservoir condenser size, the type of rectifier in use, and the regulation of the transformer itself. The necessity for some sort of stabilisation is therefore fundamental to such a supply, and to include a control to enable the output voltage to be varied is a simple matter, and considerably increases the unit's versatility.

Voltage Stabilisers

At this point it is convenient to discuss the different types of stabilising arrangements customarily employed, in order to appreciate the advantages of the circuit chosen. Broadly speaking three types of

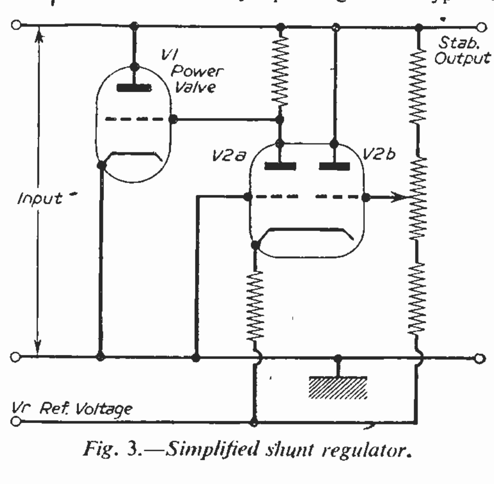


Fig. 3.—Simplified shunt regulator.

stabilising circuit are used to ensure a constancy of voltage over a range of varying loads. They are, the gas-discharge tube or neon stabiliser, the series-regulated stabiliser, and the shunt regulated stabiliser.

Neon Stabiliser

This is the simplest type and is probably well known to the amateur (see Fig. 1). It relies for its operation on the fact that a neon discharge tube operates with a steady voltage drop across its terminals and is, within limits, independent of the current it draws. However, this current must be restricted and the resistor R is included for this purpose. Both the load current and the neon current must flow through this resistance, and the device is therefore not suitable for large load currents. A further disadvantage lies in the fact that the voltage thus obtained is fixed, being determined by the characteristics of the neon in use.

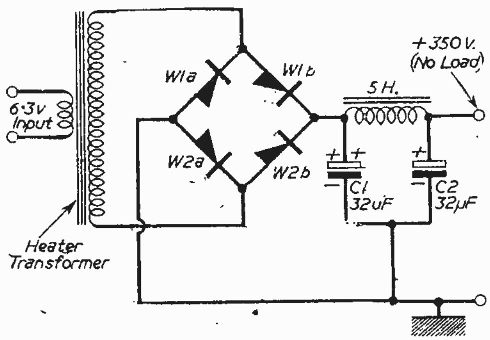


Fig. 4.—Power supply.

Such stabilisation is widely used for single stage devices ; the local oscillator of a communications superhet receiver is a typical example.

Series Regulator

The second type of stabiliser uses the voltage reference provided by the neon tube, in conjunction with a high gain D.C. amplifier, to control the anode impedance of a power valve, usually a triode, through which the load current is flowing. Fig. 2 shows the arrangement.

The neon valve V3 is connected in the cathode circuit of a D.C. amplifying stage V2, thereby maintaining the cathode potential constant. Any variations of the output voltage E are fed via the potentiometer chain R1, Rv and R2 to V2 grid. They appear amplified at V2 anode, and are fed directly to the control grid of V1, the power valve which is in series with the load circuit.

When the output voltage E rises above its nominal level, the anode current in V2 increases, causing a drop, or negative going signal to appear at V1 grid. This has the effect of decreasing the current flowing through V1 and hence also the output voltage E, which is the product of this current and the load resistor R. The operation occurs in reverse when the output falls below its nominal level.

The principal disadvantage of such a stabiliser is the large H.T. voltage required. It is obvious that for a +250 volt output, some 100 volts being required to appear across the series stabilising power valve, a power unit capable of delivering +350 volts D.C. on full load must precede the stabiliser.

Shunt Regulator

Reverence to the simplified diagram of Fig. 3 shows the principal connections.

This time the power valve is connected in parallel with the supply to be stabilised and in the absence of an external load draws the full load current. As the external load is increased, so the current is diverted from the power valve V1 to the load, and thus the current taken from the power unit is always the same. The power valve and its associated D.C. amplifier merely acts as a sensitive current diverter. The terminal voltage of the supply must therefore be constant, since the total current drawn is steady.

Any change in the output voltage, whether steady or transitory, is fed to V2b grid, and appears amplified at V2a anode which is coupled directly to the power valve. A long-tailed pair amplifier is used to preserve correct phasing or polarity of the change ; an increase in the H.T. causes V1 grid to go less negative, thereby increasing the anode current drawn by V1 and reducing the total H.T. voltage.

To stable reference voltage Vr used by this circuit is supplied by an external bias supply (although if it is decided to make the pack described below completely self-contained a method of developing the bias internally is given later).

Apart from the inconvenience of providing this reference voltage for the shunt stabiliser the latter has one or two advantages over the other types mentioned. One consideration lies in the total H.T. voltage required ; as implied above, only as many volts as are actually required at the output need be developed by the supply feeding the stabiliser. A second factor affects the life of the power valve. Unlike its rival, the shunt stabiliser dissipates less power when the external load current rises.

The third point is really only applicable to the form of the supply in question : It would not have been possible to use a L.T. transformer to feed the power supply if a series stabiliser, requiring some 350 volts D.C. after rectification, had been contemplated, because quite simply a 240 volt to 6.3 volt transformer will obviously only provide 240 volts A.C. when fed with 6.3 volts A.C. to the secondary.

Stabiliser Circuit

The final form taken by the stabiliser section is given in Fig. 5 where it is noted that slight differences from that of Fig. 3 occur. The D.C. levels at the various points in the circuit prevent direct connections being made from the long-tailed pair to the power valve for example, and the resistances serve to reduce these levels to those appropriate for the power valve grid circuit. The two condensers are

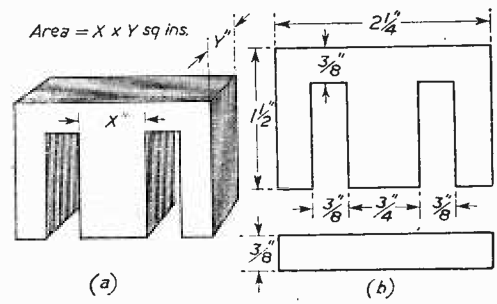


Fig. 6.—Core area and suitable laminations.

included to assist in reducing the ripple voltage on the H.T. rail to negligible proportions : C1 couples any alternating component of voltage to the grid of the long-tailed pair with no attenuation. After amplification this ripple voltage is again capacitively coupled to the power valve grid, in such a direction as to reduce considerably the ripple at the anode, and hence on the H.T. rail.

The D.C. level at V2 grid may be varied by means of the 250 K. carbon potentiometer. The D.C. amplifier, responding to any such variation, will alter the bias on V1 grid, and by this means the anode current is readjusted. The net effect is to cause a change in the H.T. potential, and a smooth control of output from 140 volts to 220 volts is possible.

This type of regulating circuit usually includes a resistance connected between the regulator and the power supply, but the internal impedance of the particular supply used was found to be quite adequate in itself without having to increase it artificially.

Component Details

The stable reference voltage is supplied by a battery, which is intended to be mounted inside the case or cabinet in which the unit is housed. Since the current drain on this reference has been designed to be a minimum (2½ mA. approximately) the battery may be of the type used in personal portable receivers and deaf aids. The reference voltage is 67.5 volts to permit the use of such a battery, and the Ever-Ready "Battrymax" 67.5 volt unit (Number B112) or similar type is recommended. The small current drain will permit quite a long battery life. Even when the battery voltage starts to fall off, the control will enable the output voltage to be reset to its original level, extending the useful life of the battery well beyond its normal period.

The use of 5 per cent. tolerance high stability resistors is advocated for all the fixed components except the 10 K. grid resistor which need only be of the ordinary ¼ watt carbon type. This measure will assist in reducing the inevitable voltage drift that occurs during, and for a short while after, warming up.

The valves used are of the type normally found in any constructor's collection. The power valve is a 6V6 beam tetrode, whilst the long-tailed pair is a 6SL7 double triode. Both these valves are mounted on octal bases and the connections are given on the right.

Alternatively, a really compact unit can be designed round the miniature equivalent of these two valves. The 6V6 has an oval-based equivalent in the 6BW6, whilst the 12AX7, may be substituted for the 6SL7.

This, then, is the stabiliser circuit dealt with in detail. Extra refinements, such as arrangements for fitting fuses, metering and switching facilities, are largely matters to suit individual tastes, but reference will be made on their mode of connection later for those readers wishing to incorporate them.

Power Supplies

In its present form the unit is quite suitable for stabilising any type of D.C. supply that has an output of 150 volts when 55 mA. load current is being drawn. If the output voltage is greater than this for such a load current then a series resistor, as mentioned earlier, must be connected between the power pack and the stabiliser unit to reduce this voltage, which we will call V, to 150 volts.

The necessary value of resistance R to do this can be calculated from :

$$R = \frac{V-150}{0.055} \text{ ohms}$$

If, for example, V were 200 v., then R would be 900 ohms approximately.

The wattage rating of such a resistor would, at a minimum, have to be W, where

$$W = (V-150) \times 0.055 \text{ watts.}$$

Using this formula the resistor in the above example would dissipate 2.75 watts and, therefore, allowing a safe margin at least a 3-watt resistor should be used, whilst a 5-watt component would be preferable, reducing the possibility of overheating.

However, the stabiliser was really intended for use with the L.T. transformer power supply mentioned at the beginning of the article and so further details of this unit are appended below.

Heater Transformers

There are certain restrictions to using a heater transformer for a H.T. supply and in each case they are determined by the core on which the transformer is wound.

First and foremost is the cross-sectional area of the core to be considered as this governs the volt-ampere rating of the transformer. If the output of an available heater transformer is known to be about 3 amps at 6.3 volts then this will be suitable.

(To be continued)

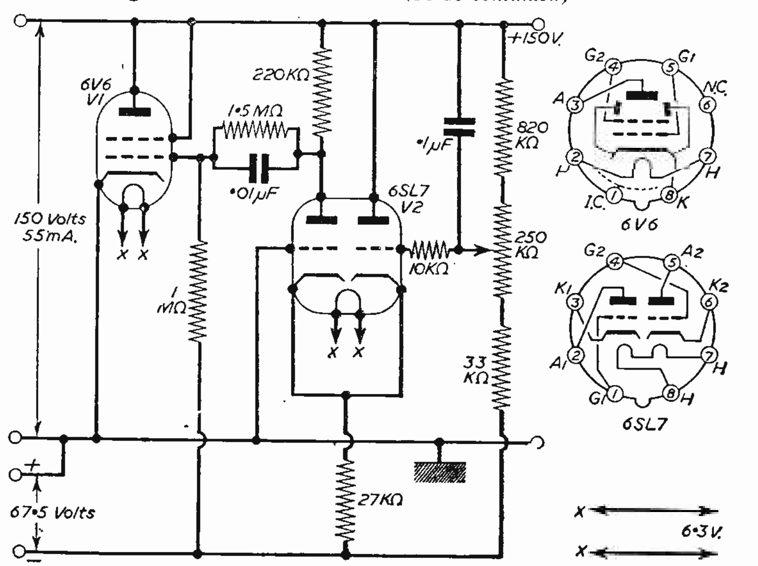
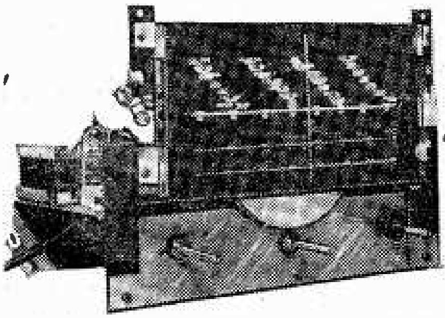


Fig. 5.—The circuit of a practical stabiliser.

MAKING THE "Seven-Five" SUPERHET



A PRE-ALIGNED RECEIVER WITH PUSH-PULL OUTPUT

(Continued from page 185, March issue)

IT should be noted that the valve heater run is earthed only at *pin* 3 of V1, this pin being the common heater-cathode point of the valve (X78).

Pre-alignment Testing

Although the alignment of this receiver is very easy, there are one or two checks which should be preferably made before it is actually undertaken. For those who have a voltmeter, the voltages given in Table 1 should be verified as soon as the speaker has been connected and the set switched on, the proper mains tapping on the transformer having been selected, of course. These figures are typical, and although some small variations are inevitable, the actual voltages obtained should be of this order. If the meter used is a very cheap model the voltages read will on the whole be rather lower than those given, particularly the screen readings and the anodes of the triode sections of V3 and V4.

TABLE OF VOLTAGES

Valve	Anode	Screen	Cathode
X 78	Hexode : 240 v.	100 v.	— Measure as 2 v. across R28
	Osc. : 100 v.		—
EBF 80	200 v.	90 v.	—
ECL 80	Triode : 65 v.	190 v.	3.5 v. (across R14)
	Pentode : 200 v.		7.2 v. (across R14 & R15)
U 78	250-250 R.M.S.	—	255 v. (across C23)

The above voltages were measured with a 1,000Ω/voltmeter on the 500 v. range, except for cathode readings.

Now, with no aerial connected and the volume well advanced, the normal speaker liveliness should be apparent, but there should be no appreciable hum. If a loud hum is heard, the trouble lies in the balance of the triodes of V3 and V4, assuming that actual wiring and other gross faults are not present. The values of R19 and R20 have already been discussed and are fairly critical. Even with the 5 per cent. tolerance components specified, it sometimes happens that the tolerances are both in such directions that the total error exceeds that permissible for proper working. It is unlikely for this to happen, but if the hum is heard, the balance should be suspected.

For those constructors who wish to get the exact balance condition, a note will be made at the end of the text; but it should be repeated that with the values specified for the resistors concerned, no difficulty will normally arise.

Alignment

The I.F. transformers are ready aligned and should not be disturbed. Switch to M.W. and set the scale to 247 metres (Light). The station will probably be heard close to this setting; in any case adjust trimmers T5 and T2 (Fig. 5) to bring it to maximum loudness. Tune up to 464 metres (Third) and adjust core C5 to bring this station to the proper marking. Then turn back to 247 m. and readjust T5, T2 and core C2. Repeat this process until no improvement results at either end.

Switch to L.W. and repeat this process, adjusting T4, T1 and C1 on a station around 1,000 metres, and C4 on any other around 1,800 metres.

It must be admitted that alignment on S.W. is not so easy without instruments; however, it will probably be found that a good performance is obtained without any adjustment whatever, and those without recourse to instruments should be content with this. Those who possess a signal generator can, of course, line up in the usual

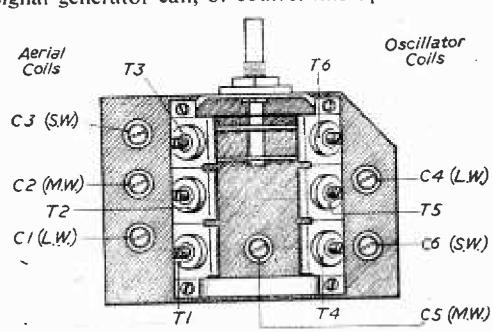


Fig. 5.—Details of the coils and trimmers.

way; the appropriate trimmers and cores are marked T3, T6, C3 and C6.

Although the I.F. transformers are pre-aligned, those possessing a generator or fixed 465 kc/s aligner may, of course, use this as an I.F. check before setting the coil pack.

Note on Balance

In the prototype, the actual measured values of R19 and R20 were 116 kΩ and 157 kΩ respectively, found by means of a 250 kΩ potentiometer wired between the anodes of the triodes and set for proper balance. For those who would care to set up in this way and have the means to select the equivalent fixed resistors afterwards, the following note is appended.

Replace R19 and R20 with a small carbon nominal 250 kΩ control, the slider going to C15, keeping all leads very short. Inject any steady A.F. signal (say, 400 c.p.s.) into the grid of V3A and listen with a pair of high-resistance phones wired across a resistor of about 20 ohms in the centre-tap lead to the output transformer. Adjust the control for a minimum output of the A.F. signal in the phones.

Each part of the control on either side of this setting of the slider may now be measured accurately, and fixed resistors selected to replace it.

A Possible Fault

It is possible, although not very likely, in the present circuit layout for the paraphase stages to multivibrate and so produce what is a harsh-sounding hum. This can be eliminated by shunting R14 with a 0.1 μF condenser, and such a precaution might well be taken in any event.

It might also be pointed out that in this particular case we are unable to supply a detailed point-to-point wiring diagram. Fig. 4 below gives the layout which was adopted in the original model, together with the position of the main components, and it should be a simple matter to wire up from this and the theoretical circuit.

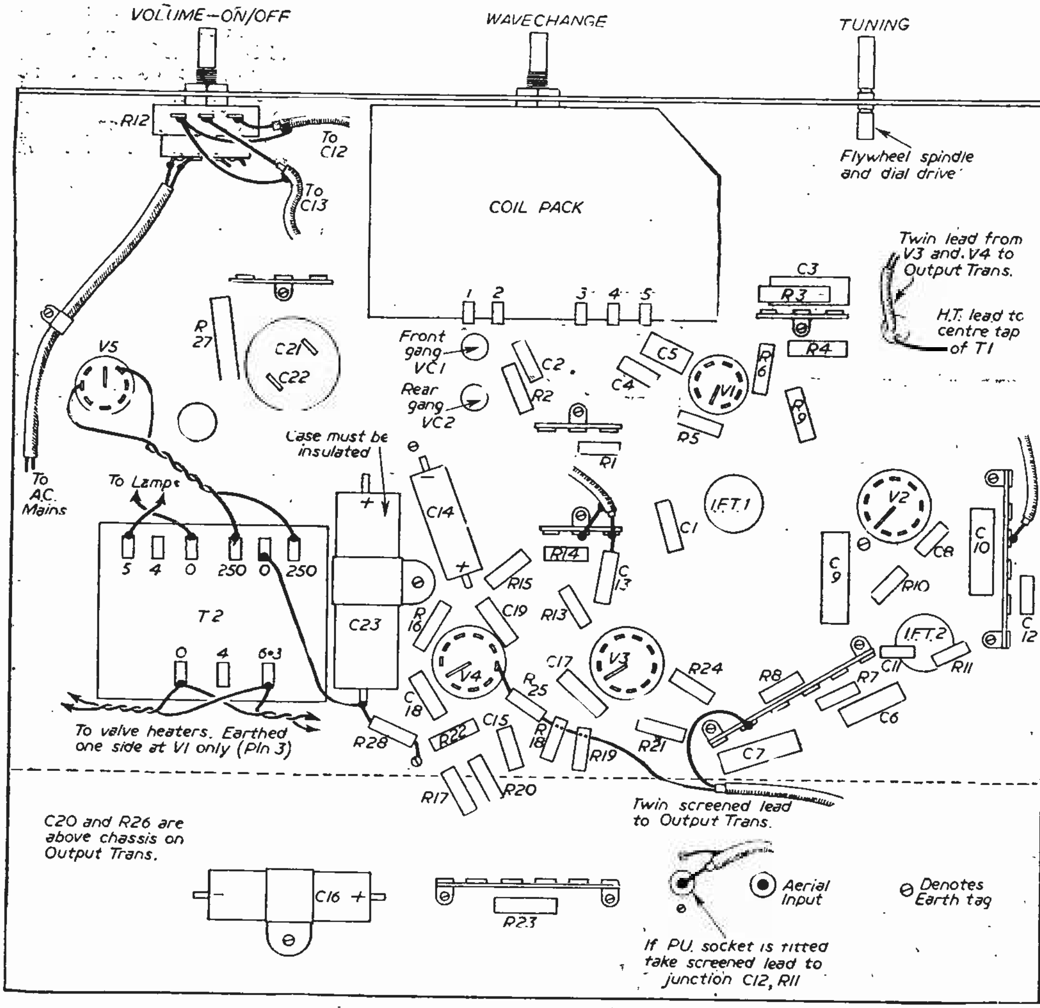


Fig. 4.—Wiring details and main component layout.

C.R.T. ISOLATION TRANSFORMER

Type A. Low leakage windings. Ratio 1 : 1.25 giving a 25% boost on secondary. 2 v., 10/6 ; 4 v., 10/6 ; 6.3 v., 10/6 ; 10.8 v., 10/6 ; 13.3 v., 10/6. Ditto with mains primaries, 12/6 each.
Type B. Mains Input 220/240 volts. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. Low capacity, suitable for most Cathode Ray Tubes. With Tag Panel, 21/- each.
Type C. Low capacity wound transformer for use with 2 volt Tubes with falling emission. Input 230/240 volts. Output 2-2½-2¾-3 volts at 2 amps. With Tag Panel, 17/6 each.
NOTE.—It is essential to use mains primary types with T.V. receivers having series-connected heaters.

TRIMMERS, Ceramic. 30, 50, 70 pf., **9d.** 100 pf., 150 pf., **1/3** ; 250 pf., **1/6** ; 500 pf., 750 pf., **1/9.**
RESISTORS. All values. 10 ohms to 10 meg., ¼ w., **4d.** ; ½ w., **6d.** ; 1 w., **8d.** ; 2 w., **1/-.**
HIGH STABILITY. ½ w., 1%, **2/-.** Preferred values 100 ohms to 10 meg.
5 watt / 10 watt / 15 watt **WIRE-WOUND RESISTORS** 25 ohms—10,000 ohms .... 1/3 / 1/6 / 2/-
15,000 ohms—50,000 ohms, 5 w., **1/9** ; 10 w., **2/3.**
KNOBS, GOLD ENGRAVED.—Walnut or Ivory, 1½in. diam., **1/6** each. Not engraved, **1/-** each.

RECORDING TAPE

1,200 ft. on standard fitting 7" Plastic reels. Brand new boxed 17/6.

O/P. TRANSFORMERS. Heavy Duty 50 mA., **4/6.** Ditto, tapped primary, **4/9.** Multiratio, push-pull, **6/6.** Tapped small pentode, **3/9.**
L.F. CHOKES 15/10 H. 60/65 mA., **5/-** ; 10 H. 120 mA., **10/6** ; 15 H. 150 mA., **12/6.**
MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped 4 v. 4 a., 5 v. tapped 4 v. 2 a., ditto 250-0-250, **21/-.**
HEATER TRANS. Tapped prim., 200/250 v. 6.3 v. 1½ amp., **7/6** ; tapped sec. 2, 4, 6.3 v., 1½ amp., **8/6.**
VCR97 TESTED FULL PICTURE, £2.
COPPER PLATED AERIAL RODS. ½ x 12in. push fitting, **3/-** doz., p. & p. 1/-. Aerialite Earth rods, **4/-.**
ALADDIN FORMERS and core, ¼in., **8d.** ; ⅜in., **10d.** ¾in. **FORMERS** with Cans and Core. ⅞in. sq. x 1⅝in. and ⅝in. sq. x 2⅛in., **2/-** ea.
TYANA.—Midget Soldering Iron. 200/220 v. or 230/250 v., **14/11.** Solon Midget Iron, **24/-.**
MIKE TRANSF. Ratio 50 : 1, **3/9** ea.
MAINS DROPPERS. 3 x 1¼in. Adj. Sliders, .3 amp. 750 ohms, **4/3.** .2 amp., 1,000 ohms, **4/3.**
LINE CORD. .3 amp., 60 ohms per foot, .2 amp., 100 ohms per foot, 2 way, **6d.** per foot, 3-way, **7d.** per foot.
LOUDSPEAKERS P.M. 3 OHM.
5in. Goodmans, **17/6.** 7in. x 4in. Goodmans, **21/-.**
6in. x 4in. Rola, **19/6.** 8in. Elac, **22/6.**
6½in. Goodmans, **18/6.** 10in. R. & A. **30/-.**
6½in. ditto w/Trans., **21/-.** 12in. Plessey **30/-.**
8in. M.E. 2.5 k. or 2 k. field, tapped O.P. transf., **24/6.**
CRYSTAL DIODE, G.E.C., **2/-.** Circuit Book, **1/-.**
HIGH RESISTANCE PHONES. 4,000 ohms, **17/6** pr.

GARRARD 3 SPEED AUTOCHANGERS
Hi-Fi model 75 BRAND NEW.
Our price **£8-19-6,** carriage 5/6.

SWITCH CLEANER Fluid, squirt spout, **4/3** tin.
TWIN GANG TUNING CONDENSERS. .0005 mfd. midget with trimmers, **8/6** ; 375 pf. midget, less trimmers, **6/6** ; .0005 Standard size with trimmers and feet, **9/-** ; less trimmers, **8/-** ; ditto, soiled, **2/6.**
SPEAKER FRET. Woven Plastic TYGAN. Walnut tone. 12in. wide, **2/-** per foot. **Expanded metal,** Gold 9½ x 12in., Silver, 15¾in. x 9¼in., **2/-** each.

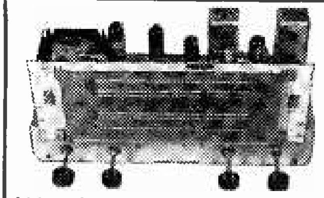
VALVES

A SMALL SELECTION FROM OUR STOCKS

All Boxed — New & Guaranteed

8/6	5/6	1/6	6/6	10/6
1R5	6B8	EA50	6AL5	5Z4
1T4	9D2	**2/6**	6J5	12AT7
1S5	EF50	2X2	6K6	EBC41
3S4	Equip.	E1148	6K7G	EBF80
3V4	SP61	EB34	EB91	ECH35
5U4	SP41	**3/6**	HVR2	ECL80
6AM6	EF92	3D6	(near)	ECH42
6AT6		6H6M		EF41
6J7	**7/6**	**7/6**	**7/6**	EF80
6K8	6BE6	6V6G	EL32	EL41
6SL7	6BW6	6X4	HVR2A	EZ40
6SN7	6F6	6X5	PEN25	KT33C
6V6GT	6K7GT	807	U22	MU14
EBC33	6K7M	EF39	VP23	PL81
EF50	6SA7			EY51
Sylv. Red				

12K8, 12Q7, 12K7, 35L6, 35Z4
Special Price—37/6—The Set



ALL WAVE RADIOGRAM CHASSIS

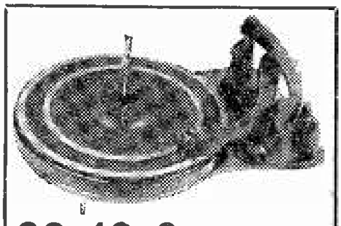
THREE WAVEBANDS — **FIVE VALVES**
S.W. 16 m.—50 m. — LATEST MULLARD
M.W. 200 m.—550 m. — ECH42, EF41, EBC41,
L.W. 800 m.—2,000 m. — EL41, EZ40.

12 month Guarantee.

A.C. 200/250 v. 4-way Switch ; Short-Medium-Long-Gram. A.V.C. and Negative feedback. 4.2 watts. Chassis 13½ x 5½ x 2¼in. Glass Dial 10 x 4½in. horizontal or vertical available. 2 Pilot Lamps, Four Knobs, Walnut or Ivory. Aligned and calibrated. Chassis isolated from mains. **10 gns.** Carr. & Ins., 4/6.

JUST RELEASED. HIGH GAIN MODEL. FM-AM CHASSIS. Seven Mullard Valves and Tuning Heart. 3 Wavebands, Magic Eye Tuning. A.V.C. and Negative Feedback, giving 4 watts undistorted output. Radiogram switching.
Price 20 Gns. Packing and Carriage, 10/-.

MATCHED SPEAKERS FOR BOTH CHASSIS
8in., **19/6** ; 10in., **25/-** ; 12in., **30/-.**
3in. Tweeter, **12/6.** With crossover filter.



£8-19-6 Post Free.

Brand new Plessey 3-speed Autochanger Mixer Unit for 7, 10 and 12in. Records. Twin Hi-Fi Xtal Head with Duopoint sapphire stylus. Plays 4,000 records. Spring mounting. Baseboard required 15½ x 12½in. Height 5½in. Depth 2in. Super Quality.

AMPLION. 3-speed Single Record unit with Acos 37 Turnover Head, each Sapphire Stylus plays 2,000 records. Starting Switch Automatically places Pick-up on records, 7in., 10in. or 12in. Auto Stop. Baseplate 12 x 8½in. Height 2¾in. Depth 1⅞in. Price £7.15.6, post free.

B.S.R. MONARCH. 3-speed Motor and Turntable with selecting switch for 33, 45 and 78 r.p.m. records. 100-120 v. and 200-250 v. A.C. 50 cps. Also **B.S.R. MONARCH** Lightweight Pick-up with Acos Xtal turnover head, separate Sapphire stylus for L.P. and Standard records. **SPECIAL OFFER, THE TWO ! £4.15.6,** post 2/6.

T.V. PRE-AMP. (McMICHAEL). Tunable Channels 1 to 5. (Will Amplify Output of your Band 3 Converter.) Midget size, High Gain Fringe Model. B.V.A. Valve, Full instructions. Ready for use. (H.T. 200 v., L.T. 6.3 v., .3 amp. required.) BRAND NEW, **25/-** each. **SPECIAL MAINS POWER PACK** for above, **25/-** extra.

CRYSTAL MIKE INSERT. Famous make, precision engineered. Size only 1⅛ x 3/16in. Bargain Price **6/6.** No transformer required.

F.M. TUNER COIL KIT. 22/6. H.F. coil, Aerial coil, Oscillator Coil, two I.F. Transformers 10.7 Mc/s. Detector transformer and heater choke. With circuit and component list, using four 6AM6. Chassis and Dial, **19/6.**

TELETRON BAND III CONVERTER

For London, Midland and Northern Transmissions.
Suitable all T.V. makes. T.R.F. or Superhet. Ready wound coils, two EF80 valves, all components, punched chassis, circuit diagram, wiring plans. COMPLETE KIT for mains operation 200-250 v. A.C. **£3.10.0.**

AS ABOVE less POWER PACK. Requires 200 v. 20 mA. H.T. 6.3 v. .6 a. L.T. **£2.5.0.**
Mains Transformer to above Spec. ... **10/6**
Min. Westinghouse Rect. ditto ... **8/6**
B.B.C./I.T.A. crossover unit **7/6**
Punched and drilled chassis **3/9**
Larger chassis for Mains Model ... **6/-**
Teletron Coilset with plans **15/-**
Full plans and circuit details ... ... **6d.**

Volume Controls

Long spindles. Guaranteed 1 year. All values 10,000 ohms to 2 Meg.
No Sw. S.P.Sw. D.P.Sw.
3/- 4/- 4/9

80 ohm CABLE COAX

Semi-air spaced Polythene insulated. ¼in. dia. Stranded core. Losses cut 50% **9d.** yd.
STANDARD ¼in. Coax. **8d.** yd.

COAX PLUGS ... **1/-** **DOUBLE SOCKET** ... **1/3**
SOCKETS ... **1/-** **OUTLET BOXES** ... **4/6**
BALANCED TWIN FEEDER, yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/-. 80 ohms only.
WIRE-WOUND POTS. 3 WATT. Pre-Set Min. T.V. Type. All values 25 ohms to 30 K., **3/-** ea., 50 K., **4/-.** (Carbon 50 K. to 2 m., **3/-.**)
WIRE-WOUND 4 WATT. Pots, 2½in. Spindle. Values, 100 ohms to 50 K., **5/6** ; 100 K., **6/6.**
CONDENSERS. New stock. .001 mfd. 7 kV. T.C.C., **5/6.** Ditto, 20 kV., **9/6** ; 100 pf. to 500 pf. Micas, **6d.** ; Tubular 500 v. .001 to .01 mfd., **9d.** ; .05, .1, **1/-** ; .25, **1/6** ; .5, **1/9** ; .1/350 v., **9d.** ; .1/600 v., **1/3** ; .1 mfd 2,500 volts **5/6.**
CERAMIC CONDS., 500 v., .3 pf. to .01 mfd., **10d.**
SILVER MICA CONDENSERS. 10%, 5 pf. to 500 pf., **1/-** ; 600 pf. to 3,000 pf., **1/3.** **DITTO** 1%, 1.5 pf. to 500 pf., **1/9** ; 515 pf. to 1,000 pf., **2/-**

I.F. TRANSFORMERS 7/6 pair

465 Kc/s Slug tuning Miniature Can, 2¼in. x ¾in. x ¾in. High Q and good bandwidth. By Pye Radio. Data sheet supplied.

NEW ELECTROLYTICS, FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/275 v.	2/-	100/25 v.	2/-	8+16/450 v.	5/-
2/450 v.	2/3	8+8/500 v.	4/6	16+16/450 v.	5/6
4/450 v.	2/-	16+16/500 v.	6/-	16+24/350 v.	4/6
8/450 v.	2/3			32+32/350 v.	4/6
8/500 v.	2/9	**CAN TYPES**		32+32/450 v.	6/6
16/450 v.	3/6	Clips	3d.	64+120/275 v.	7/6
16/500 v.	4/-	16/500 v.	4/-	64+120/350 v.	11/6
32/500 v.	5/6	32/350 v.	4/-	100+200/275 v.	12/6
25/25 v.	1/9	60/350 v.	5/6		
50/25 v.	1/9	250/350 v.	5/6	1,000+1,000/6 v.	6/3
50/50 v.	2/-	500/12 v.	3/-		

Screw Base Type 512. 8/500 v. **3/-** : 16/500 v. **4/-.**

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK VOLTAGES. K3/25 2 kV., **4/3** : K3/40 3.2 kV., **6/-** ; K3/45, 3.6 kV., **6/6** ; K3/50 4 kV., **7/3** ; K3/100 8 kV., **12/6** : **MAINS TYPE.** RM1, 125 v., 60 mA., **4/-** ; RM2, 100 mA., **4/9** ; RM3, 120 mA., **5/9** ; RM4, 250 v. 275 mA., **16/-.**
COILS Wearite, "P" type, **3/-** each. Osmor Midget "Q" type adj. dust core, **4/-** each. All ranges.
H.F. CHOKES, iron cored. 14 M.H., **3/-** each.

ALUMINIUM CHASSIS. 18 s.w.g. undrilled With 4 sides, riveted corners and lattice fixing holes, 2½in. sides. 7 x 4in., **4/6** ; 9 x 6in., **5/9** ; 11 x 7in., **6/9** ; 13 x 9in., **8/6** ; 14 x 11in., **10/6** ; 15 x 14in., **12/6** ; 18 x 16 x 3in., **16/6.**

FULL WAVE BRIDGE SELENIUM RECTIFIERS. 2, 6 or 12 v. 1½ amp., **8/9** ; 2 a., **11/3** ; 4 a., **17/6**
CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amp., **13/6** ; 4 amp., **21/-.**
ACID HYDROMETER. New Ex Govt. Unbreakable. Packed in metal case 7 x 1¼in. dia., **4/6.**
WAVECHANGE SWITCHES.
5 p. 4-way 2 wafer, long spindle **6/6**
2 p. 2-way, 3 p. 2-way, short spindle ... **2/6**
2 p. 6-way, 4 p. 2-way, 4 p. 3-way, long spindle **3/6**
3 p. 4-way, 1 p. 12-way, long spindle ... **3/6**
VALVEHOLDERS. Pax. Int. Oct. 4d., EF50, EA50, 6d, B12A, CRT, 1/3. Eng. and Amer. 4, 5, 6, 7 and 9 pin, 1/-. **MOULDED** Mazda and Inct. Oct. 6d., B7G, B8A, B8G, B9A, 9d., B7G with can 1/6, VCR97 2/6, B9A with can 2/6.
CERAMIC. EF50, B7G, B9A, Int. Oct. 1/-. B7G with can 1/9.
BLACK CRACKLE PAINT, air drying, **3/-** tin.

We have no connection with any other firm. Please address all Mail Orders correctly as below.

RADIO COMPONENT SPECIALISTS 307 WHITEHORSE RD., WEST CROYDON

OPEN ALL DAY—(Wed. 1 p.m.) *10 page list 3d.*

Tel. THO 1665, Buses 133 or 68 pass door. **48-hour postal Service.** *P. & P., 1/- £2 orders post free. (Export Extra.) C.O.D. Service 1/6*

TRANSMITTING TOPICS

RUBBER CRYSTALS

By O. J. RUSSELL, B.Sc.(Hons.), G3BHJ

THE "Rubber Crystal" has long been a "dream" of amateurs. In fact, of course, various forms of rubber crystal have been achieved. Some of these methods are, in fact,of great practical interest. This not only because of the revived interest in single sideband circles of means of slightly varying crystal frequencies, but also because of the fact that QRM problems make means of "rubberising" crystals important to the V.H.F. man, quite apart from the L.F. operators. L.F. operators who wish to dodge QRM usually use a V.F.O., of course, but nowadays the practice of "NET" operation has not only revived the use of crystals for operating nets upon spot frequency, but has also revived the need for a "rubber" crystal to enable the "net" frequency to be varied slightly to avoid QRM, while retaining the reliability of crystal control to fix the net position. Few V.F.O.s are capable of the precision required for setting precisely to a net frequency, and the crystal is ideal for this purpose.

To explain why QRM problems are also met by V.H.F. men, it is necessary to point out that large numbers of surplus crystals made for the Services to a very high precision are used for crystal control of V.H.F. gear. Due to the fact that for the two-metre band a relatively limited number of these "channel" frequencies exist, it is quite common for several amateurs to purchase the same frequency crystal for their V.H.F. oscillators. This results in the quite common phenomenon of V.H.F. QRM! Despite the "wide open spaces" of 2 megacycles available on 2 metres, where with the limited activity (relative to the usual H.F. bands) QRM should be non-existent, it is quite commonplace in two-metre operation to get heavy QRM from stations sharing the same crystal frequency. This phenomenon can often be noticed in the London area where the two-metre population is high, and can occasionally be troublesome when rare DX excites a high level of activity. This, of course, is due to the high precision to which the Service crystals were ground, and makes the provision of "rubberising" a desirable expedient.

However, some expedients that are not truly "rubberising" may be briefly mentioned. The old standby was to slip a thin piece of paper—cigarette-paper was greatly esteemed by the old-timers —between the crystal and one of the plates. This does effectively increase the operating frequency (by a few kilocycles at 7 Mc/s), as it decreases the effective airgap capacity across the crystal. A further dodge (to lower the frequency this time) was to rub one surface of the crystal with pencil lead so as to coat it uniformly with graphite. Soft solder also serves much the same purpose, while a more refined method used with modern gold-plated crystals is to electroplate a thin coating of copper on top of the gold layer. Very appreciable lowering of the oscillation frequency can be achieved by such means.

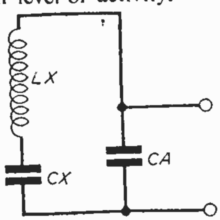


Fig. 1.—The equivalent circuit of a Quartz crystal. Lx may be several Henries, while Cx may be as little as .01 pF. Ca includes the effect of the holder plate capacity and is several pF.

Not Permanent

However, such devices generally are semi-permanent, and although not as irrevocable as grinding the crystal, are not easily adjustable. The "variable airgap" method was the most successful employed in the past for shifting crystal frequency by knob control, and could very well be adapted by a mechanically-minded amateur to provide a shift of several kc/s at 3.5 Mc/s. To see how this operates, Fig. 1 shows the "equivalent circuit" of a typical crystal plate. The crystal can be represented as a tuned circuit with inductance L_X and capacity C_X plus a parallel capacity C_A representing the capacity of the plates of the crystal holder and airgap. However, if by electrical measurement the crystal parameters are determined for a typical 7 Mc/s crystal, the inductance L_X may come out at several HENRIES, and the capacity C_X at a hundredth of a pico-farad! Thus, as these H "equivalent" values indicate, large variations of the parallel capacity C_A have very little effect upon the oscillation frequency. The similarity of the crystal frequency redrawn as in Fig. 2 to the popular Clapp circuit shows that the same reasons for stability of oscillation apply to both. However, the crystal represents "equivalent" values that are quite impossible to attain with physical coils and condensers. The Clapp-Harries circuit in fact represents a simulation of the crystal equivalent circuit by coils and condensers as far as such an approach is practicable.

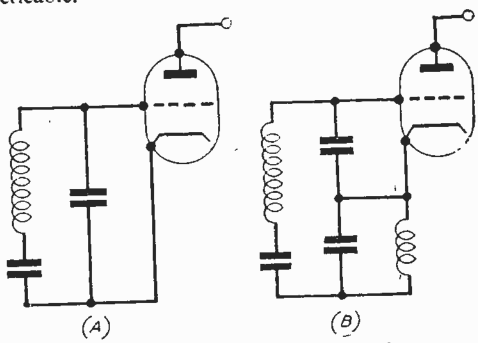
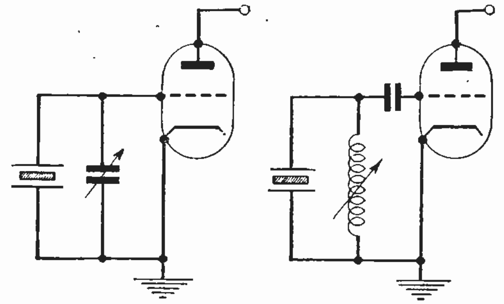


Fig. 2.—The similarity of the equivalent crystal circuit (a) to the Clapp-Harries oscillator circuit (b) is clearly shown.

This leads to the fact that apart from varying the parallel capacity CA by varying the airgap of the crystal holder, it is also possible to lower the frequency of a crystal oscillator by shunting the crystal with a small variable capacitor as shown in Fig. 3. For the same reason that the Clapp-Harries oscillator fails to oscillate if the condensers from grid to ground are too large, the crystal oscillator will not oscillate if the "outboard" variable condenser is made too large. For the usual run of crystals a 25 pF variable may be used, although in some cases as much as 50 pF may be used. This will enable a small but useful



Figs. 3 and 4.—The oscillation frequency of a crystal may be shifted slightly by the above methods.

shift of one or two kc/s to be made with a typical 3.5 or 7 Mc/s crystal, to lower frequencies.

By the same principle, it is possible slightly to increase the frequency of oscillation of a crystal by shunting it with a variable inductance. A "roller-coaster" inductance in the small sizes used in some surplus gear might be used, but a slug-tuned coil may also be used as illustrated in Fig. 4.

Tuned Variation

The reader may now appreciate the final step to the full-dress "rubberised" crystal circuits. By shunting a tuned circuit across the crystal that can be actually tuned through the crystal frequency, it is well known that the effective parallel reactance varies from inductive to capacitative. The tuned circuit, in

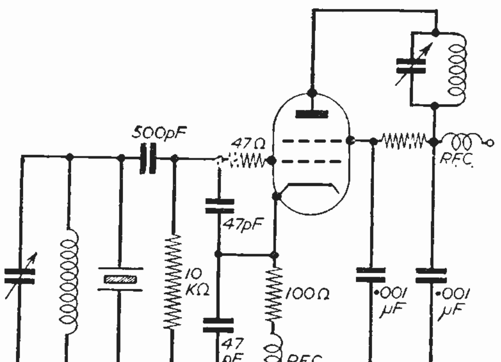


Fig. 6.—A cathode tap variation upon the basic circuit of Fig. 5.

fact, behaves as an inductance when tuned to a frequency higher than the crystal, and as a capacitance when tuned to a lower frequency. By such means the fullest possible variation of crystal frequency may be achieved.

The reader should note that for the operation of these circuits X-cut crystals are generally required. However, the majority of the crystals supplied for amateur use are X-cut crystals. Surplus crystals utilise many of the newer cuts, and these are not likely to be suitable without considerable experimentation. The writer employed a Q.C.C. 3.5 Mc/s crystal and

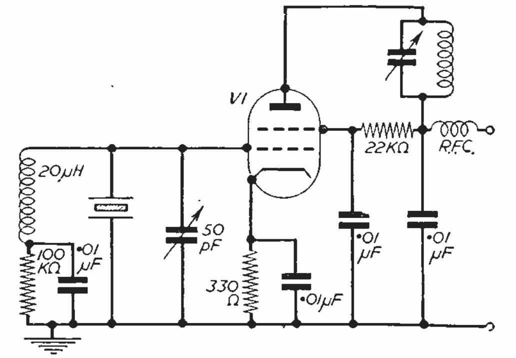


Fig. 5.—A more elaborate circuit for "rubberising" a crystal.

obtained good operation in "rubberised" oscillation tests. It is believed that both the Brookes and Q.C.C. crystals supplied specifically for amateur use are X-cut types and will give good operation in such circuits. For rubberised circuits AT-cut crystals are, however, prone to spurious frequencies, so that ability to oscillate in these circuits does not necessarily mean that all is well. This, of course, does not reflect upon the excellence of AT and similar cuts of crystal—they are merely unsuited for this particular form of circuit.

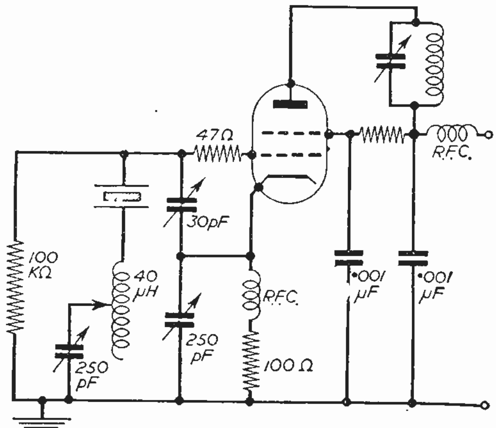
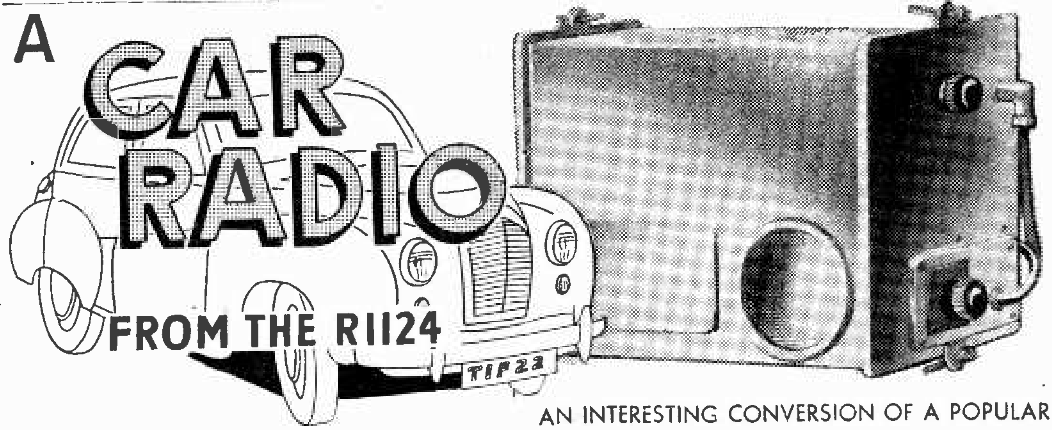


Fig. 7.—An elaborate and flexible circuit enabling circuit parameters to be separately adjusted for optimum performance. This is recommended as the circuit enabling a good degree of frequency shift to be obtained from miscellaneous crystals.

A CAR RADIO FROM THE R1124



AN INTERESTING CONVERSION OF A POPULAR EX-GOVERNMENT RECEIVER

By J. Stebbings

THE ex-A.M. receiver R1124 is very good value on the surplus market, since it can be obtained in excellent condition, complete with valves, for 15s., or 4s. without valves. It is a six-valve superheterodyne covering 30-40 Mc/s and has a narrow band intermediate frequency of 7.0 Mc/s. Tuning is by six-position switch and preset capacitors. The R1466 is identical except for the tuning system, which in this case is a three-gang variable capacitor. The writer purchased one of this type, complete with valves, for 10s. in order to obtain a spare set of valves. We must point out, however, that we are unable to give the addresses of any firms who may have these in stock at any particular moment.

The chassis slides into an outer container measuring 12in. × 9in. × 6in., having a removable panel for access to the preset capacitors. The front panel carries the tuning spindle and a multi-way socket. Aerial and earth sockets are at the rear.

The valves have seven-pin British bases and, as the 13 volt 0.2 filaments are connected in parallel, the set is particularly suitable for conversion to a car radio. The top of the chassis is stepped with the valveholders in line on the lower level, and the two R.F. and three I.F. coil cans on the higher level. One side of the chassis is hinged to give easy access to the interior and to a long tag board covering the whole of the hinged side.

The Original Circuit

The original circuit is shown in Fig. 1. L1 is the aerial coil tuned by any one of the 0-30 pF preset tuning capacitors selected by one pole of the five-pole six-way channel selection switch. Only two positions of this switch are shown in the circuit diagram for the sake of simplicity. V1 is an R.F. amplifier transformer coupled by L2 to the frequency changer V2. Both the primary and secondary windings of L2 are tuned. The R.F. coil cans L1 and L2 are easily located on the top of the chassis. L3, the oscillator coil, is wound on a ceramic former which is attached to the six-way switch assembly below the chassis.

There are two intermediate-frequency amplifiers V3 and V4 operating at 7.0 Mc/s; L4, L5 and L6 are the coupling transformers. Automatic volume-control is applied to V1, V3 and V4. V5 is a R.F. pentode detector, and one of the output transformers T1 is in its anode circuit. V6 is a medium-impedance triode amplifier giving a second output by way of T2. There are two WX6 Westectors and one WX12, the original functions of which are not clear to the writer, but the A.V.C. line originates in this part of the circuit.

All components in the set bear numbers except those mounted on the tag board. A circuit number reference chart for this board is stuck to the opposite side of the chassis. The original circuit numbers are shown in Fig. 1.

Method of Conversion

As a bench mains power pack was available it was decided to carry out the conversion with the aid of a signal generator stage by stage from the L.F. end, in the workshop. A power supply from the car battery was then made up followed by the installation of the receiver and aerial in the car.

Owing to the high intermediate frequency of 7.0 Mc/s it was not considered possible to introduce variable tuning on the medium and long wavebands, so a switched tuning system was retained. This has certain advantages provided foreign stations are not required. The six channels each tuned to a different BBC station should normally provide sufficient coverage when travelling; and the positive station selection makes tuning with the car in motion extremely simple.

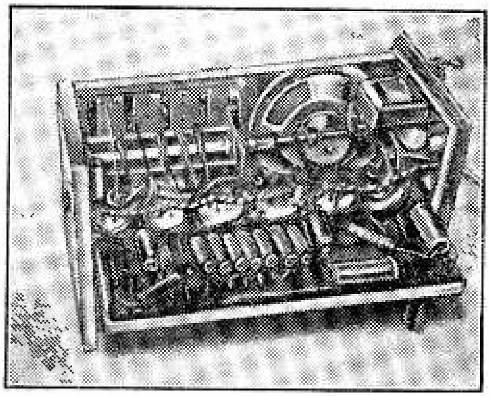
The New Circuit

Fig. 2 shows the complete new circuit. A start was made at the L.F. end on V5 and V6. The writer was rather hazy about the detailed workings of the original circuit for these stages, and so the line of least resistance was taken and the stages rewired on more conventional lines. Those readers who have a greater knowledge of circuitry might be able to make better use of the original layout.

In the new circuit the original 4D1 valve (originally V6) becomes a low-frequency triode amplifier V5. This is coupled to a new output pentode V6 for which a 7D8 having a seven-pin base was purchased.

The detector and A.V.C. rectifiers are germanium crystal diodes. It was at first hoped that two of the original WX6 Westectors should prove suitable, but as they are designed for a maximum frequency of 1.5 Mc/s, their efficiency proved to be too low at 7.0 Mc/s.

Apart from changing the R.F. coils, only minor modifications were necessary to the stages V1, V2, V3 and V4. These will be listed in detail later. The oscillator coil did not require alteration, since additional tuning capacitance reduced the frequency sufficiently. The new oscillator frequency is lower than the intermediate frequency and the single coil covers the required range of 5.5-6.8 Mc/s for the



Underside of the converted receiver.

medium waveband and the long-wave Light Programme. It will be noticed from Fig. 2 that the new aerial and H.F. coils are of the type which has the medium- and long-wave windings, together with a single coupling winding mounted on one former. This type was chosen to simplify the switching required to change from medium to long wave. The original six-way switch assembly was used and the only alteration necessary was to the spacing of the wafers (Fig. 4).

Wiring the New L.F. Stages

A start on the removal of unwanted components was made by detaching the potentiometer R26 and the transformers T1 and T2. C26 and C30 were removed with T1. The 2+2 μF block C19 and C20 with R29 attached was removed from the side of the chassis. The yellow and black lead attached to C20 was marked "A.V.C. line" for future identification.

Next, the components occupying the end nine rows of the tag board at the front end were removed, starting with the Westector W3 and finishing with C15 and R15. These parts can be identified from Fig. 3. R31 was left in place to avoid disturbing adjacent capacitors, but the lead from it to R21 and R22 was removed. R32 and R33 were also detached.

The red H.T. positive line along the tag board was identified and marked; a brown lead to the cathode of V6 and a green lead to its grid were also identified for future use. The white leads from the cathodes of V3 and V5 to the power socket were next removed. Finally, R30 and R35 attached to the cathode of V5 were removed.

The rewiring of V5 and V6 presented little difficulty. The new low-frequency volume control was mounted on the front panel above the chassis and a six-way tag strip was mounted vertically in the space previously occupied by T2 alongside L6. The two germanium crystal diodes, the

COMPONENTS

Capacitors	One 100 ohms
One 50 pF	One 150 ohms
Three 100 pF	Three 200 ohms
One .002 μF mica 350 v.	One 800 ohms
Five .01 μF mica 350 v.	Two 10 k
Seven .1 μF 350 v.	One 22 k
Two 8 μF 350 v.	One 50 k
One 16 μF 350 v.	One 100 k
Resistors (½ watt)	Five .25 MΩ
	Two .5 MΩ
	One 1.0 MΩ

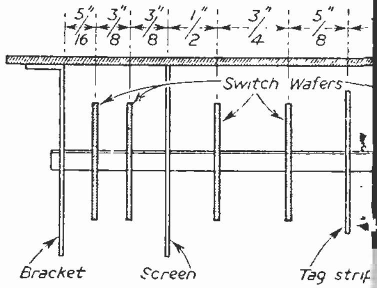


Fig. 4.—Details of th

Switch Position	BBC Service	Frequency (kc/s)	O Fr
1	Light	200	
2	North	692	
3	Welsh	881	
4	West	1,052	
5	Midland	1,088	
6	West	1,457	

* Actual I.F. used—6,890 kc/s.

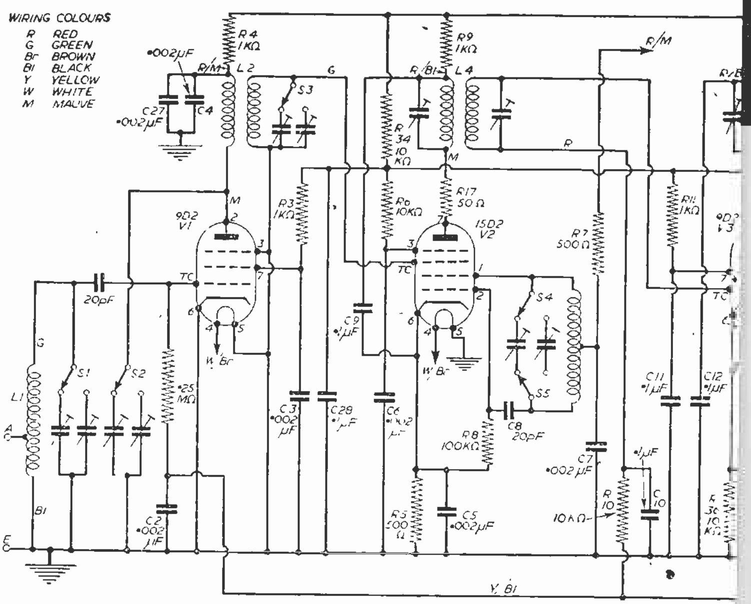
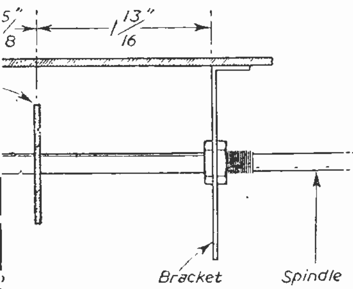


Fig. 1.—Theoretical circui

50 pF and 100 pF capacitors, and the 0.1 MΩ and 0.5 MΩ resistors were soldered to this six-way tag strip. The mauve lead from the top of L6 was convenient for reconnection, and the red lead from L6 which passed down below the chassis was led up again outside the can through a hole drilled in the chassis top.

The A.V.C. filter resistors 1.0 MΩ, 0.5 MΩ and the 0.1 μF capacitor together with the remainder of the components for V5 and V6 were mounted on the hinged tag board in the space previously cleared.

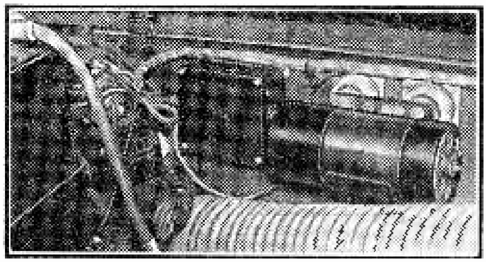


...e switch assembly.

The removal of unwanted components left the side of the chassis next to the selector switch assembly clear. It was decided to fit a small loudspeaker in this space which measured 5½in. × 4¾in. Unfortunatey this was just too small for a 5in. diameter speaker, but a slot was cut in the top of the chassis to allow the rim to project through above it. (The depth of the speaker from front to back had to be less than 2in. to avoid fouling the spindle of the channel selector switch.) Four large holes were cut in the chassis with a tank cutter. The output transformer was mounted below the chassis on the front panel.

...E 1

...scillator ...equency *(kc/s)	R.F. Trimmers (pF)	Oscillator Trimmers (pF)
6,690	200/400	200/500
6,198	200/400	200/500
6,009	100/200	200/500
5,838	50/100	200/500
5,802	50/100	200/500
5,433	0/30	200/500



The rotary generator mounted under the dashboard.

The 7D8 output valve employed has an optimum load of 8,500 ohms requiring a transformer with a ratio of 53 to 1 for a three-ohm speaker. An alternative which has not been tried is the 7D5 with an optimum load of 7,000 ohms and requiring a bias resistor of 410 ohms. By changing the valve-holder to an international octal a 12A6 could be used with a bias resistor of 370 ohms. The same output transformer would be suitable for these alternative valves.

Alterations to R.F. and I.F. Stages

Apart from changing the aerial and H.F. coils the following modifications were required to the R.F. and I.F. circuits :—

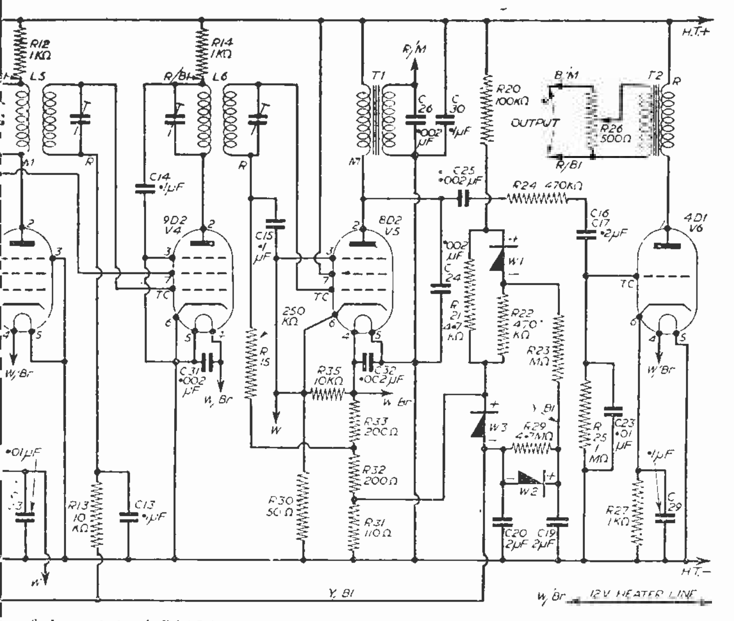
(1) A 200 ohm bias resistor with a 0.1 μF capacitor in parallel were inserted between the cathode of V1 and the chassis.

(2) A 0.1 μF capacitor was wired in parallel with C5 on the tag board.

(3) The white lead from the cathode of V3 to the socket was removed. The original bias resistor R36 having a value of 10k was replaced with one of 200 ohms.

(4) Bias to V4 was provided by the insertion of a 200 ohms resistor with a 0.01 μF capacitor in parallel between the cathode pin and the chassis.

(5) The red and mauve lead from the socket to R7 on the tag board



...of the original R1124.

COMPONENTS

One 2 MΩ Potentiometer
Two Germanium diodes
Aerial and H.F. coils (Long and Medium Wave)—Astral Radio Products
L.F. Choke—"High Cycle" ex R1355
R.F. Choke—screened ex R1155.
D.F. components
Generator—12 volt input, 250 volts 85 mA output
Loudspeaker
Speaker transformer (see text)

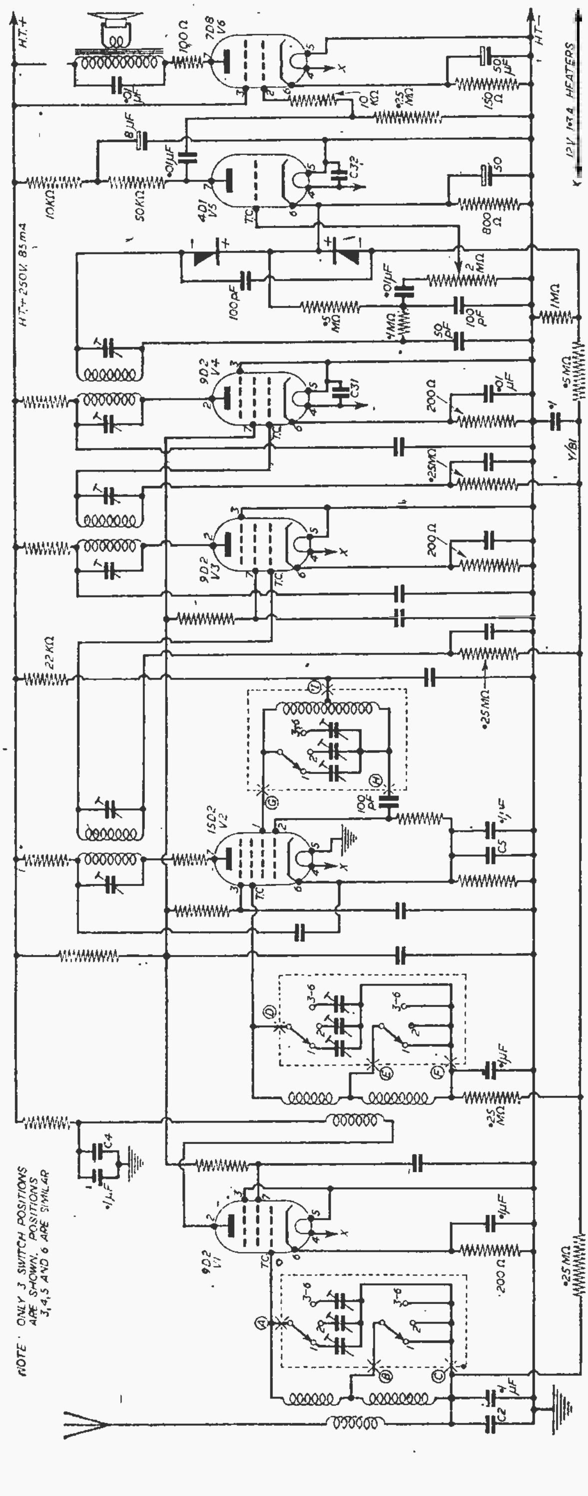


Fig. 2.—Circuit of the revised car radio receiver.

was removed. A 22k resistor was connected between the junction of R7 and C7 and H.T. positive.

At this stage it was possible to test the receiver with a 30-40 Mc/s signal at the aerial terminal and to check the alignment of the I.F. coils at 7.0 Mc/s. A temporary three-core flex was connected to the chassis, filament line and H.T. positive for connection to a bench power pack. The supply required is 250 volts, 85 mA and 12 volts 1.3 A.

Continuing the alterations :—

(6) R10 and R13 on the tag board were each replaced with a 0.25 MΩ resistor.

(7) The yellow and black lead from R10 (on the tag board) to C2 (on the rear panel) was broken and a 0.25 MΩ resistor inserted.

(8) A 0.1 μF capacitor was wired in parallel with C2.

(9) A 0.1 μF was wired in parallel with C4 on the tag board.

(10) C8 was replaced with a 100 pF capacitor.

When mounting new components on the tag board, care was necessary to ensure that they did not foul the existing wiring or components when the hinged side of the chassis was closed.

New Coils and Tuning Capacitors

The six-way switch assembly was carefully removed from the chassis and a note made of the connections which had to be severed. The original coils L1 and L2 were replaced with the new aerial and H.F. dual-range coils.

All but two of the 0/30 pF preset trimmers were removed from the switch assembly, the switch wafers were respaced according to Fig. 4, and new trimmers were mounted in three rows for aerial H.F. and oscillator tuning. Table 1 shows the stations tuned by the writer's receiver together with the corresponding oscillator frequencies and nominal trimmer values. It will be noted that the actual intermediate frequency used differs slightly from the nominal 7.0 Mc/s. No I.F. break through at the chosen frequency has been experienced. Readers should have no difficulty in deciding the value of aerial and H.F. trimmers for other stations.

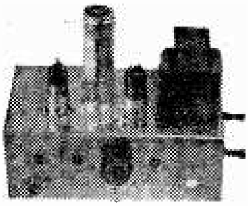
In Fig. 2 all wiring enclosed in the dotted rectangles is on the switch assembly and was done before replacing the unit in the chassis. Nine connections A-I had to be made to external circuits together with an earth connection for the screen between the first two wafers.

AVC decoupling components (0.1 μF and 0.25 MΩ) for V2 were wired in circuit.

Final Alignment and Bench Testing

The conversion work now being complete the receiver was connected to the bench power pack for the alignment of the I.F.

(*Continued on page 257*)



BAND 3 T/V CONVERTER—183 M/cs - 196 M/cs

Suitable for London, Sutton Coldfield and Northern Transmission

£2 - 5 - 0 post free.

This Unit comprising drilled chassis, 7in. x 4in. x 2½in., two miniature valves and met. rect., wound coils, res., cond., etc., is a slightly modified version, incorporating variable oscillator tuning, of *Wireless World* circuit, May 1954. It has proved itself highly successful—over 4,022 sets have already been sold to buyers all over England. We invite you to visit us and see it in operation for yourselves. Suitable for most types of T/V sets. T.R.F. or Superhet. Blueprint and circuit details will be sent on application by return of post, 1/6, post free. Supply voltages required 200-250 v., 20 mA. H.T. 6.3 v. 1 a. L.T. **Power pack components to fit chassis as illustrated, 30/- extra. Complete set wired, tested and aligned ready for use 20/- extra. Band I, Band 3 Ae switching can now be added, switch kit, 6/6. Full range of Band 3 aerials in stock. Adaptors from 7/6 per set, Dipoles-indoor 6/6, outdoor with cable 13/9. Band 1-Band 3 Cross-over filter unit from 10/6.**

B.B.C. BREAK-THROUGH FILTER—tunable filter unit for B.B.C. pattern rejection, 8/6.

Volume Controls

Midget Ediswan type. Long spindles. Guaranteed 1 year. All values. 10,000 ohms for 2 Meg.-ohms.

No Sw.	S.P.Sw.	D.P.Sw.
3/-	4/-	4,9

COAX PLUGS ... 1 2
SOCKETS 1/-
COUPLER 1/3
OUTLET BOXES ... 4/6

80 ohm CABLE COAX

STANDARD ¼in. diam. Polythene insulated. GRADE "A" ONLY

8d. yd.

SPECIAL — Semi-air spaced polythene. 80 ohm **Coax** ¼in. diam. Stranded core. Losses cut 50%

9d. yd.

TWIN FEEDER, 80 ohms, **6d.** yd. ; 300 ohms, **8d.** yd.
TWIN SCREEN FEEDER, 80 ohms, **1/-** yd.

50 OHM COAX CABLE 8d. per yd. ¼in. dia.

TRIMMERS, Ceramic, 4 pf.—70 pf., **9d.** 100 pf., 150 pf., **1/3** ; 250 pf., **1/6** ; 600 pf., **1/9. PHILIPS** Beehive Type—2 to 8 pf. or 3 to 30 pf., **1,3** each.

RESISTORS.—Pref. values 10 ohms 10 megohms.

CARBON
20% Type. ¼ w., **3d.** ; ½ w., **5d.** ; 1 w., **6d.** ; 2 w., **9d.**
10% Type. ½ w., **9d.** ;
5% Type. ½ w., **1/-**
1% Hi-Stab. ½ w., **2/-.**

WIRE WOUND

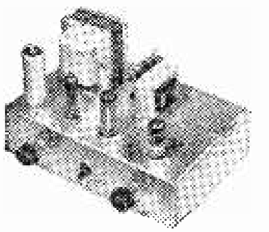
5 w. / 10 w. / 15 w.	25 ohm—10,000 ohms	1/3 / 1'6 / 2/-
5 w. / 10 w.	15,000—33,000 ohms	1/9 / 2/3

WIRE-WOUND POTS. Pre-Set Min. T.V. Type. Knurled Slotted Knob. All values 25 ohms to 30 K., **3/-** ea. 50 K., **4/-.** Ditto Carbon Track 50 K. to 2 Meg., **3/-.**

3w. LAB COLVERN, Etc. Standard Size Pots. 2¼in. Spindle. High Grade. All Values. 100 ohms to 50 K., **5/6** ; 100 K., **6/6.** **W/W EXT. SPEAKER CONTROL** 10 Ω. **3/-.**

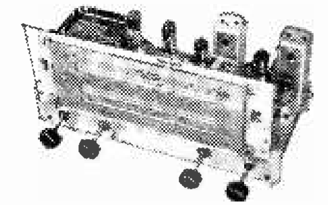
CONDENSERS.—Mica or S. Mica. All pref. values. **3 pf.** to 680 pf., **6d. ea.** Ceramic types, 2.2 pf.-5,000 pf. as available, **9d.** each. **Tubulars**, 450 v., Hunts and T.C.C. .0005, .001, .005, .01, .02, and .1 350 v. **9d.**, .05 .1 500 v. Hunts Moldseal, **1/-.** .25 Hunts, **1/6.** .5 Hunts, **1/9.** .1 1,500 v. T.C.C. (Simplex). **3/6.** .001, 6 kV., T.C.C., **5/6.** .001 12.5 kV. T.C.C., **9,6.**

SILVER MICA CONDENSERS.—
10% 5 pf. to 500 pf., **1/-.** 600 pf. to 3,000 pf., **1/3.**
1% 1.5 pf. to 500 pf., **1/9.** 515 pf. to 5,000 pf., **2/-.**



3 VALVE AMPLIFIER

With variable Tone and Volume controls. 3 Midget B.V.A. valves. 4 watts output. Neg. feedback. Chassis isolated from Mains. A.C. 200 250 v. A quality amplifier at an economical price. **PRICE £3.19.6.** Carr. 2/6. Wired and tested. **15/-** extra. Blueprint, circuit and instr., **1/6** (free with kit).



ALL WAVE RADIOGRAM CHASSIS
THREE WAVEBANDS FIVE VALVES

S.W. 16 m.—50 m.
M.W. 200 m.—550 m.
L.W. 800 m. -2,000 m.

LATEST MIDGET B.V.A. SERIES.

Brand New and Guaranteed. A.C. 200/250 v. Four positions. Wavechange Switch. Short-Medium Long-Gram. Pick-up connections. High Q iron-dust cored coils. Latest circuit technique, delayed A.V.C. and Negative feed back. Output approx. 4 watts. Chassis size 13½ x 5½ x 2¼in. Glass Dial—10in. x 4½in. horizontal or vertical type available, lit by 2 Pilot Lamps. Four Knobs supplied. Walnut or Ivory to choice, aligned and calibrated ready for use. Chassis isolated from mains. **PRICE £9. 15. 0**
Carriage and Insurance, **4/6.**
8in. or 10in. speakers to match available.

7 Valve De Luxe, push-pull version, 7 watt output, £12.10.0.

QUALITY FLUORESCENT FITTINGS

Ideal for home or workshop. 4 ft., 200-250 v., complete with tube, ballast unit, etc., ready for use. Famous manufacturer's surplus offered at approx. half price. Starter switch type, **42/-.** Quick start type, **47/6.** Carr. and ins., 7 6 extra.

NEW BOXED — VALVES — ALL GUARANTEED

1R5	7 6	6Q7	8/6	ECL80	12/6	EY51	12 6
1S5	7/6	6SN7	9/-	EF39	7/6	EZ40	10 -
1T4	7 6	6V6	7 6	EF41	10/6	MU14	8,6
1S4	7 6	6X4	8 6	EF50		PCC84	12 6
3S4	8	6X5	8/-	Sylv.	10/-	PCF80	12 6
3V4	8,	EA50	2,	EBF80	12,6	PCF82	12 6
3D6	3 6	EABC80	12 8	EF50		PL81	12 6
5Z4	8 6	EBC41	10 6	Equip.	5/6	PL82	10 -
6AM6	8 6	ECH35	12 6	EF80	10/6	PL83	12 6
6AT6	8 6	EB91	7/6	EF86	13/6	PY80	11 -
6CH6	10 6	EBC33	8 6	EF91	8,6	PY81	12 6
6H6M	3 6	ECC83	12 6	EL41	11 6	PY82	10 -
6K7	6,6	ECH42	10 6	EL84	12/6	SP61	6 6
6K8	9,	ECH81	12 6	EM80	12,6	U22	8,6

SPECIAL PRICE PER SET.
1R5, 1T4, 1S5, and 3S4 or 3V4 ... 27 6
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5 ... 35/-

SPEAKER FRET.—Expanded Bronze anodised metal 8in. x 8in., **2/3** ; 12in. x 8in., **3/-** ; 12in. x 12in., **4/3** ; 12in. x 16in., **6/-** ; 24in. x 12in., **8/6**, etc.

ELECTROLYTICS ALL TYPES NEW STOCK

Tubular Wire Ends		Can Types, Clips, 3d. ea.	
25/25 v., 50/12 v.	1/9	8+8/450 v. T.C.C.	4/6
50/50 v., 4/500 v.	2/-	8+16/450 v. Hunts	5/-
100/25 v.	2/-	16+16+8/350 v.	5/6
8/50 v., Dub.	2/6	16+16/450 v. B.E.C.	5/6
8+8/500 v. Dub.	4/6	16+16/450 v. T.C.C.	6/-
8+16/450 v. Hunts	5/-	16+24/350 v. B.E.C.	5/-
16/450 v. B.E.C.	3/6	32/350 v. B.E.C.	4/-
16/500 v. Dub.	4/-	32+32/450 v. B.E.C.	6/6
16+16/450 v. T.C.C.	5/6	60/350 v. B.E.C.	6 6
32/350 v. B.E.C.	4/-	60+100/350 v.	11/6
32/500 v. Dub.	5/-	60+250/275 v.	12/6
32+32/350 v. B.E.C.	5/6	100+200/275 v. B.E.C.	12/6

I.F. TRANSFORMERS — 465 k/cs

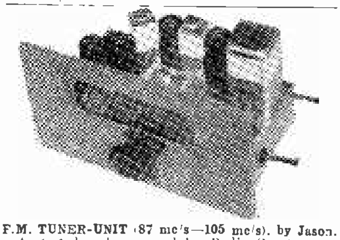
Brand new ex-manufacturer's midget I.F.T., size 2½" x ¾" x ¾", dust core tuning, Litz wound coils, High Q. Bargain offer, **7/6** pair.

MAINS TRANSFORMERS.—Made in our own Workshops to Top Grade spec. Fully interleaved and impregnated. **RADIO AND AMPLIFIER TYPE.**—250 v., 60 ma. F.W. sec., 5 v. or 6.3 v. 1 a. rect. 6.3 v. 2.5 a. set Htrs., **21/-**, etc. **C.R.T. HTR., ISOLATION TYPE.**—Low leakage with or without 25% sec. boost voltage. Ratio 1 : 1 or 1.25. 2 v., 4 v., 6 v. or 13 v., **10/6** ea. Ditto with mains primaries 200/250 v., **12/6.** Special, to order. **SPECIAL TYPES.**—To designers spec., Viewmaster, **35/-** ; Mullard Amp., **35/-** ; Osram 912, **35/-.** **HEATER TRANSF.**—Prim. 200/250 v. 6.3 v. 1½ a. or 4 v. 2 a., or 12 v. .75, **7/6** ; 6.3 v. 3 a. or 5 v. 3 a., **10/6.**

L.F. CHOKES.—10 H. 65 ma., **5/-** ; 15 H. 100 ma., **10/6** ; 10 H., 120 ma., **10/6** ; 20 H. 150 ma., **15/6** ; Simplex, **10/6** ; Soundmaster, **10/6.** **OUTPUT TRANSF.**—Standard pentode, **4/6** ; ditto tapped prim., **4/9** ; small pentode, **3/9** ; Midget battery pentode (1S4, etc.), **4/6.**

SOLON SOLDERING IRONS (200-220 v. or 230-250v.) 25 watt, instrument type, **21/-** ; 65 watt, Pencil Bit Type, **26/8** ; 65 watt, Oval Bit Type, **25/-.** Comprehensive stock of spares available.

RECORDING TAPE. 1,200 ft. REELS.—Scotch boy, **30/-** ; good quality paper tape on Cyldon graded reels, **12/6.**



F.M. TUNER-UNIT (87 mc/s—105 mc/s). by Jason.—As tested and approved by Radio Constructor. Complete Kit of parts to build this modern highly successful unit, drilled chassis and J.B. dial, coils and cans, 4 B.V.A. miniature valves and all components, etc., for only **£6.10.0.** post free. **SUPERIOR TYPE GLASS DIAL**—Calibrated in Mc/s and edge lit by 2 pilot lamps, **12/6** extra.
Illustrated handbook with full details, 2/-, post free.

TRS RADIO COMPONENT SPECIALISTS (Est. 1946)

70 BRIGSTOCK ROAD, THORNTON HEATH, SURREY (THO 2188)

50 yards Thornton Heath Station. Buses 130A, 133, 159, 166 & 190

Listed above are only a few items from our very large stock. **Send 3d. stamp today for Complete Bargain list**

Hours : 9 a.m.—6 p.m. 1 p.m. Wed. OPEN ALL DAY SAT.

Terms C.W.O. or C.O.D. Kindly make cheques, P.O.s, etc., payable to TRS. Post/Packing up to ½ lb. 7d., 1lb. 1/1, 3lb. 1/6, 5lb. 2/-, 10lb. 2/9.

stages and the adjustment of the preset R.F. and oscillator trimmers. It is important for the I.F. tuning to be as sharp as possible because, when the receiver is tuned to the Long-Wave Light Programme, the oscillator frequency is only 200 kc/s away from the intermediate frequency. If the I.F. transformers are not aligned exactly the oscillator signal will get into the I.F. stages and bias off the AVC circuits.

Before using the signal generator at radio frequency the oscillator trimmers were roughly set by picking up the signal on an R1155 receiver using the tuning indicator. The signal generator was then used for more exact alignment and adjustment of the aerial and H.F. trimmers. On connecting an aerial consisting of 3ft. of flex all trimmers were given a final adjustment. The H.F. and oscillator trimmers were then sealed. The sealing of the aerial trimmers was left until after installation in the car when slight readjustment was found to be necessary due to the capacitance of the screened lead which was employed.

The 200 kc/s Light Programme and the local Home Service were received at full strength with the 3ft. aerial with no background hiss.

Front Panel

W3	—	
C29	R27	
C23	R25	
C17	—	
C16	R24	
R20	R21	
W1	R22	R32
W2	R23	
C15	R15	R33
C14	R14	
C28	—	
R31	—	
C13	R13	
C12	R12	
C11	R11	
C10	R10	
C9	R9	
C6	R6	
C7	R7	
C5	R5	
C4	R4	
C3	R3	
R34	—	

Hinged Edge

Rear Panel

Fig. 3.—Position of capacitors and resistors.

Installation and Mobile Power Supply

The illustration on page 251 shows the completed receiver. It can be removed by undoing two wing nuts, a spring clip, and a 3-pin flex connection. A screened aerial lead was run from the aerial terminal to a vertical whip 39in. long.

Fig. 5 shows the circuit of the power supply. It will be seen that a rotary transformer is used for the high-tension supply followed by the usual smoothing circuit. The R.F. choke and 0.01 μF capacitor form a filter to eliminate interference caused by sparking at the commutator. The smoothing and filter components were mounted in a cast aluminium case of the type which is frequently sold as surplus "mains interference suppressors." It is interesting to note that the original tubular 0.1 μF capacitors in these units are rated at only 350 v. D.C. and are in any case almost certainly leaky. They should be replaced before using on the mains.

The rotary transformer and smoothing unit mounted under the bonnet can be seen on p.253. A single pole on-off switch was mounted on the dashboard to control the 12-volt supply to the valve filaments and the generator.

The car was already fitted (as all cars should be !) with an interference suppressor in the distributor high-tension lead.

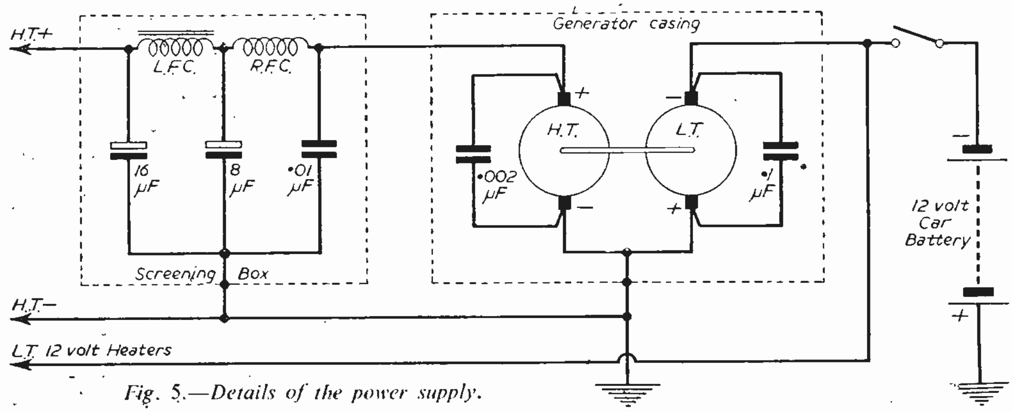


Fig. 5.—Details of the power supply.

TONE CONTROLS

CIRCUIT DETAILS OF SOME OF THE MOST POPULAR FORMS OF TONE VARIATION

By F. G. Rayer

MANY tone control circuits exist and most lend themselves very readily to installation in an existing receiver or amplifier. As a rule, almost no alteration will have to be made to wiring or components, the tone control circuit being introduced between stages to replace the simple coupling circuit usually found. In other cases the tone control can be added without breaking any existing connections whatever.

Such controls can serve several purposes. A top-cut control will reduce surface scratch when playing records, and eliminate or reduce the high-frequency whistle experienced in many areas and arising from interference between desired and undesired stations. In other cases, bass-cut circuits will materially help in removing turntable rumble and other sounds of a low-pitched nature. It is also feasible to boost treble or bass, and this is required, to obtain most brilliant reproduction from records. Variable tone controls enable reproduction to be adjusted to suit the listener, and to compensate for the varying degrees of emphasis and compression imposed upon their recordings by various manufacturers. With a comprehensive control circuit, almost any desired kind of result is obtainable, but an extra valve is frequently necessary to compensate for losses. Such a valve can usually be introduced in home-built equipment. If space is limited it may be possible to replace a single valve by means of a double-triode for this purpose.

Top-cut Controls

The most general form of top-cut control is shown at "A" in Fig. 1, and reduces treble response as the variable resistor or potentiometer is turned towards zero resistance. The values are not critical, though those indicated are most generally satisfactory. As a pentode output stage tends to emphasise higher frequencies, a mid-position setting of the control is normal, with bass predominating when the value is reduced, and treble appearing with more strength when the value nears maximum. The control may also be wired in an A.F. stage—usually between valve anode and H.T. negative line.

Where large power is dissipated it is desirable to have the control in an A.F. stage, or in the grid circuit of the output stage, as shown at "B." Here, push-pull is employed, and a rather high resistance value is necessary, about .25 megohm being satisfactory. The condenser is smaller, to avoid excess bass, but may be increased up to .005μF.

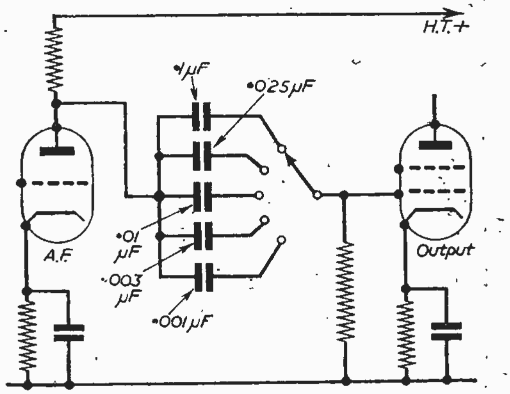


Fig. 2.—Bass cut by coupling capacity selection.

Such top-cut controls can give a somewhat similar result to bass-boost circuits, if treble is reduced, then overall volume is increased by turning up the volume control. They are very largely employed, help to give more "natural" reproduction, and reduced heterodyne whistles, needle scratch, and other high-pitched interference.

Bass-cut Circuit

The simplest form of this appears in Fig. 2, and uses a switch to select various coupling values between stages. This is found in some radiograms and receivers of high quality, and lends itself readily to modification by changing the condenser values. As the value is reduced, bass response falls. It is quite usual to find condensers much smaller than the minimum of .001μF indicated, but excessive control is always best avoided, since it is of not much practical use.

Reducing bass response will avoid turntable rumble and hum induced in the pick-up, which may be difficult to cure. This circuit, like that in Fig. 1, is fairly gradual in effect, not providing a steep cut beyond any definite frequency.

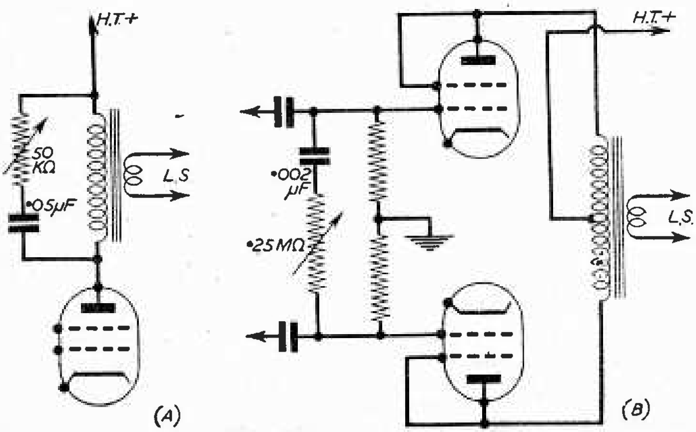
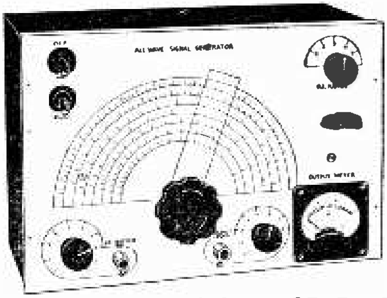


Fig. 1.—Two simple top-cut controls.



COMPLETELY BUILT SIGNAL GENERATOR

Coverage 120 Kc/s-320 Kc/s, 300Kc/s-900 Kc/s, 900 Kc/s-2.75 Mc/s, 2.75 Mc/s-8.5 Mc/s, 8 Mc/s-28 Mc/s, 16 Mc/s-56 Mc/s, 24 Mc/s-84 Mc/s. Metal case 10in. x 6¼in. x 4½in. Size of scale, 6½in. x 3¼in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent., modulated or unmodulated R.F., output continuously variable 100 milli-volts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Black crackle finished case and white panel. Accuracy plus or minus 2%. **£4 19/6** or **34/-** deposit and 3 monthly payments **25/-**. P. & P. 4/6 extra.

Heater Transformer. Pri. 230-250 v. 6 v. 1½ amp., **6/-**.

Three-speed automatic changer, B.S.R. Monarch, current model. Will take 7in., 10in. or 12in. records mixed. Turn-over crystal head, cream finish. VERY LIMITED QUANTITY. A.C. mains 200/250. **£7 15/0.** P. & P. 3/-.

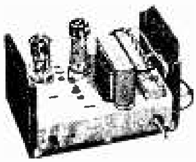
COMMERCIAL TELEVISION CONVERTER

SUITABLE ANY TV

NO ALTERATIONS TO SET

£3.19.6

Plus P./P. 2/6.



Illustrated with cover removed.

Complete with built-in power supply, 230-250 v. A.C. mains. Crackle finish case 5½" long, 3½" wide, 4½" high. Incorporating gain control and band switch.

Extension Speaker cabinet in polished walnut, complete with 8in. P.M. P. & P. 3/-. **24/6.**

8in. P.M. Speakers, removed from chassis, fully guaranteed. All by famous manufacturers. P. & P. 1/6. **12/6.**

Volume Controls. Long spindle less switch, 50 K., 500 K., 1 meg., **2/6** each. P. & P. 3d. each.

GARRARD RC/110

3-SPEED AUTOMATIC CHANGER

10 records, turnover crystal head, brand new. A.C. mains 100/250 v. **£8.19.6**

LIST PRICE **£14/10/0.** P. & P. 5/-.

Volume Controls. Long spindle and switch, ¼, ½, 1, and 2 meg., 4/- each. 10 K. and 50 K., **3/6** each. ½ and 1 meg., long spindle, double pole switch, miniature, 5/-.

Standard Wave-change Switches, 4-pole 3-way, 1/9; 5-pole 3-way, 1/9. Miniature 3-pole 4-way, 4-pole 3-way, 2/6. 2-pole 11-way twin wafer, 5/-. 1-pole 12-way single wafer, 4/-.

16" TUBE

BY FAMOUS MANUFACTURER

BRAND NEW. GUARANTEED 3 MONTHS.

E.H.T. 14 kV. heater, 6.3 v. 0.6 amp.

£9.19.6 Post, Packing & Insurance 22/6. Hire purchase terms available.

20 watt A.C. or D.C. 200/250 v. fluorescent kit, comprising trough in white-stoved enamel, two tubeholders, starter, holder and barreter. No tube. P. & P., 1/6. **12/6.**

1,200ft. High impedance recording tape on aluminium spool **12/6** post paid.

Polishing attachment for electric drills. Quarter-inch spindle, chromium-plated, 5in. brush, 3 polishing cloths and one sheep-skin mop, mounted on a 3in. rubber cup. P. & P., 1/6. **12/6.** Spare sheep-skin mops, 2/6 each.

R. & T.V. COMPONENTS (ACTON) LTD.

23, HIGH STREET, ACTON, LONDON, W.3

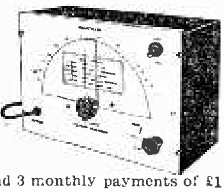
3-speed TRANSCRIPTION MOTOR

BY FAMOUS MANUFACTURER

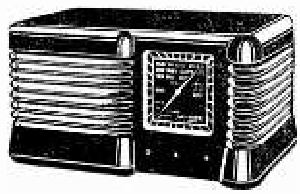
Complete Kit of parts comprising accurately balanced precision made heavy turntable with rubber mat, large constant speed condenser, starting motor, base plate. Can be assembled in half-an-hour. A.C. Mains 200/250 v. Fully guaranteed. **£6.19.6**

Parts sold separately. Post paid.

PATTERN GENERATOR



40-70 Mc/s direct calibration, checks frame and line time-base, frequency and linearity, vision channel alignment, sound channel and sound rejection circuits and vision channel band width. Silver-plated coils, black crackle-finished case 10" x 6¾" x 4½" and white front panel. A.C. mains 200/250 volts. This instrument will align any TV receiver, accuracy ±1%. Cash price £3/19/6 or 29/- deposit and 3 monthly payments of £1 P. & P. 4/6 extra.



Complete A.C. Mains 3 valve plus metal rectifier T.R.F. kit. In the above cabinet, **£3/15/0**, plus 3/6 P. & P.

PLASTIC CABINET as illustrated, 11½ x 6¾ x 5½in. in walnut or cream. ALSO IN POLISHED WALNUT, complete, with T.R.F. chassis, 2 waveband scale, station names, new waveband, back-plate drum, pointer, spring, drive spindle, 3 knobs and back. **22/6.** P. & P. 3/6.

As above with Superhet Chassis, **23/6.** P. & P., 3/6.

As above complete with new 5in. speaker to fit and O.P. trans., **40/-**. P. & P. 3/6. With Superhet Chassis. P. & P. 3/6. **41/-**.

Used Metal Rectifier, 230 v. 50 mA., **3/6**; gang with trimmers, **6/6**; M. & L. T.R.F. coils, **5/-**; 3 Govt. valves, 3 v/h and circuit, **4/6**; heater trans., **6/-**; volume control with switch, **3/6**; wave-change switch, **2/-**; 32 x 32 mfd., **4/-**; bias condenser, **1/-**; resistor kit, **2/-**; condenser kit, **4/-**.

P.M. SPEAKERS. 6½in., closed field, **18/6.** 8in. closed field, **20/6.** 10in. closed field, **25/-**, 12in., **25/-**, 3½in., **16/6.** P. & P. on each, 2/-.

Valveholders. Paxolin octal, **4d.** Moulded octal, **7d.** EF50, **7d.** Moulded B7G, **7d.** Loctal amphenol, **7d.** Loctal pax., **7d.** Mazda Amph., **7d.** Mazda pax., **4d.** B8A, B9A amphenol, **7d.** B7G with screening can, **1/6.** Duodecal paxolin, **9d.**

Twin-gang .0005 Tuning Condensers, 5/-. With trimmers, **6/6.**

32 mfd., 350 wkg.	**2/-**	16+16 mfd., 350 wkg. ...	**3/3**
16 x 24 350 wkg.	**4/-**	60+100 mfd., 280 v. wkg. ...	**7/-**
4 mfd., 200 wkg.	**1/3**	50 mfd., 180 wkg.	**1/9**
40 mfd., 450 wkg.	**3/6**	65 mfd., 220 wkg.	**1/6**
16 x 8 mfd., 500 wkg. ...	**4/6**	8 mfd., 150 wkg.	**1/6**
16 x 16 mfd., 500 wkg. ...	**5/9**	50 mfd., 12 wkg.	**11d.**
16 x 16 mfd., 450 wkg. ...	**3/9**	50 mfd., 50 wkg.	**1/9**
32 x 32 mfd., 350 wkg. ...	**4d.**	Miniature wire ends moulded 100 pf., 500 pf., and .001 ea.	**7d.**
25 mfd., 25 wkg. ...	**11d.**	280-0-280 80 mA., 4 v. 4 a., 4 v. 2 a.	**14/6**
250 mfd., 12 v. wkg. ...	**1/-**	250 v. 350 mA., 6.3 v. 4 a. twice, 2 v. 2 a.	**19/6**
16 mfd., 500 wkg., wire ends...	**3/3**	Auto-trans., input 200/250 HT 500 v. 250 mA. 6 v. 4 a. twice 2 v. 2 a. ...	**19/6**
8 mfd., 500 v. wkg., wire ends...	**2/6**		
8 mfd., 350 v. wkg., tag ends...	**1/6**		
100 mfd., 350 wkg. ...	**4/-**		

Potato & Vegetable Peeler, by famous manufacturer, capacity 4½lbs., complete with water pump. All aluminium construction, white stove-enamelled finish. Originally intended for adaption on an electrical food-mixer, can easily be converted for hand operation. **39/6.** P. & P. 3/-.

Where post and packing charge is not stated, please add 1/6 up to 10/-, 2/- up to £1 and 2/6 up to £2. All enquiries S.A.E. Lists 5d. each.

HENRY'S (RADIO LTD.)

CATHODE RAY TUBES
(Brand New)

VCR97 (slight cut-off)	15/-
VCR97 guaranteed full T/V Picture ...	40/-
VCR517C, guaranteed full T/V Picture ...	35/-
VCR139A, guaranteed T/V Picture ...	35/-
VCR138A (with Screen)	35/-
3BP1, guaranteed full T/V Picture ...	30/-

Carr. & packing on all tubes, 2/-.

"38" WALKIE-TALKIE SETS
Special offer of above set, complete with 5 valves, 4 ARP12 and ATP4, with circuit. Range 7.4 to 9 mc/s. These sets are not guaranteed but are serviceable. 25/-
Junction box 2/6 extra.

VR91A The Selected EF50. Brand New Red Sylvania original cartons, 10/- each, 90/- for ten.

MINIATURE I.F. STRIP TYPE "373" 9-72 MEG.
Brand new miniature I.F. Strip size 10¼in. x 2½in. x 3in. high. Valve line-up: 2 EF92; 3 EF91 and EB91. With Circuit. Price (less valves) 7/6. P.P. 1/6.

SEND 3d. for 28-PAGE ILLUSTRATED CATALOGUE

We have over 50,000 American and B.V.A. valves in Stock.

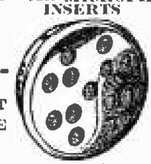
ALL VALVES NEW AND GUARANTEED

1D6GT	10/-	6AG7	10/-	6SG7M	6/6	12SH7GT	7/6	954	5/-	KT2	5/-
1G3	6/6	6B8	7/6	6X5GT	8/6	12SC7	10/-	956/7	6/-	PEN25	6/6
1R5	7/6	6C4	7/6	6SH7	6/6	12J5GT	7/6	1299A	4/6	PEN46	7/6
1S4	7/6	6C5M	5/-	6SA7	8/6	12SJ7	8/6	ATP4	4/-	QP25	6/6
1S5	7/6	6J5GT	5/-	6SQ7	8/6	12SK7	8/6	CV66	5/-	QP21	8/-
1T4	7/6	6J5M	5/-	6SN7GT	9/-	12SR7	7/6	CK510AX	5/-	QP230	8/-
1A7GT	10/-	6AM6	9/-	6SL7GT	9/-	14A7	8/6	D1	5/-	SP61	4/-
1A5GT	10/-	6AG5	7/6	6SJ7	8/6	25A6G	10/-	D41	5/-	SP41	4/-
1H5GT	10/-	6BA6	8/6	6SK7	7/6	25Z5	8/6	D42	5/-	TP22	8/-
1N5GT	10/-	6F6G	7/6	7C5	8/6	25Z6GT	8/6	D63	5/-	TH233	10/-
1C5GT	10/-	6BE6	10/-	7A7	8/6	35Z4GT	8/6	EA50	2/-	U17	5/-
1Q5GT	10/-	6V6G	7/6	7C7	8/6	35Z5GT	8/6	EB34	3/6	U19	10/-
1L4	7/6	6V6GT	7/6	7H7	8/6	35L6GT	8/6	EBC33	6/6	U22	8/6
1LN5	7/6	6V6M	10/-	7B7	8/6	50L6GT	8/6	EF36	6/6	U52	8/6
1LD5	7/6	6J6	9/-	7S7	10/-	50B5	10/-	EF39	6/6	VP23	6/6
2X2	5/-	6AK5	9/-	8D2	4/-	50C5	10/-	ECH35	12/6	VP41	7/6
3A1	9/-	6U5G	7/6	9D2	4/-	42	8/6	SP13C	4/-	VU133	4/-
3Q4	9/-	6J7G	6/6	4D1	4/-	46	10/-	VP13C	4/-	VU120A	4/-
3V4	7/6	6J7M	8/6	12A6	7/6	75	8/6	FC13C	10/-	VT501	7/6
3S4	7/6	6K7G	6/6	12C8GT	7/6	80	8/6	EF91	9/-	VR105/30	8/6
3Q5GT	10/-	6K7GT	6/6	12H6	7/6	807E	7/6	EB91	9/-	VR150/30	8/6
5U4G	8/6	6K7M	7/6	12K7GT	8/6	807USA	10/-	EF50 (Ex-Units)	5/-	STV 280/40	15/-
5Y3GT	8/6	6K6GT	8/6	12AH7GT	8/6	803	35/-	EF50 (Red Syl)	10/-	S130	7/6
5Z3	8/6	6G6G	6/6	12K8GT	8/6	805	35/-	EF51	6/-	VS70 (7475)	7/6
5Z4G	8/6	6H6GT	4/-	12Q7GT	8/6	813	105/-	EL32	7/6	XH (2v)	4/-
6A7G	8/6	6H6M	5/-	12SA7GT	8/6	866A	12/6	GU50	12/6	XP (1.4v)	4/-
6A6	10/-	6K8GT	9/-	12SQ7GT	8/6	872A	21/-	KTW61	7/6	Y63	8/6
6C6	6/6	6L6G	10/-	12SG7	8/6	9001/2/3	6/-	KTW62	7/6	TZ40	35/-
6D6	6/6	1622 (6L6)	11/-			9004	6/-	KTW63	7/6	R3	8/6
6AC7	6/6	6L7M	8/6			9003	5/-	KT33C	10/-	OZ4	7/-
		6N7GT	7/6					KT61	10/-	OZ4A	7/-
		6Q7GT	8/6					KT66	12/6		
		6R7M	8/6								
		6R7G	8/6								
		6SC7M	10/-								
		6SS7M	7/6								

SPECIAL REDUCTION FOR SETS OF VALVES

1A7GT, 1N5GT, 1H5GT, 1A5GT (or 1Q5GT or 3Q5GT) ...	40/- Set
10 EF50 (Ex-Brand New Units), 5/- each	45/- ..
10 EF50 (Red Sylvania ex-new units), 6/- each	55/- ..
6K8G, 6K7G, 6Q7G, 5Z4G, 6V6G...	37/6 ..
1R5, 1S5, 1T4, 1S4 or (3S4 or 3V4)	27/6 ..

CRYSTAL MICROPHONE INSERTS



5/- POST FREE 5/- POST FREE

Ideal for tape recording and amplifiers. No matching transformer required.

OBSOLETE TYPES
(Available from Stock)

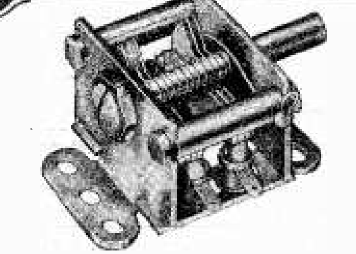
EBC41	10/-	PL81	12/6	EF85	10/6
EY51	12/-	PL82	10/-	EF89	10/-
EF41	11/-	PY81	10/-	ECF82	15/-
EL41	11/-	EM80	10/-	PABC80	15/-
EZ40	10/-	6X4	8/-	6AU6	9/6
EM34	10/-	PY82	10/-	117Z3	8/6
UL41	11/-	PCC84	12/6	12AX7	10/-
UY41	11/-	PCF82	12/6	DK96	10/-
UF41	11/-	12AU7	9/-	DL96	10/-
UCH42	12/6	12AT6	8/-	DAF96	10/-
UBC41	10/-	12AT7	9/-	DF96	10/-
DK40	10/-	12AU6	9/-	ECC84	15/-
EF80	10/6	12BA6	9/-	6AQ5	10/-
EABC80	10/-	12BE6	10/-	PCL82	12/6
ECC85	10/-	12AH8	12/6	ECH42	12/6
EF80	10/-	35W4	8/6		
ECL80	12/6	PCF80	15/-		
		EBF80	11/6		

LATEST TYPES NOW IN STOCK

LP2	3/6	TDD2A	8/6	U10	8/6
210LF	3/6	FW4/500	10/-	DDL4	5/-
P2	4/-	FC13S/C	10/-	42SPT	6/-
215SG	4/-	FC13C	10/-	PENDD 4020	12/6
VP2	8/6	MS/PEN	7/6	354V	5/-
SP2	8/6			ML4	7/6
VP2B	8/6			MU14	8/6
TP22	8/-				

5, HARROW ROAD, PADDINGTON, LONDON, W.2 TEL.: PADDINGTON 1008-9, 0401

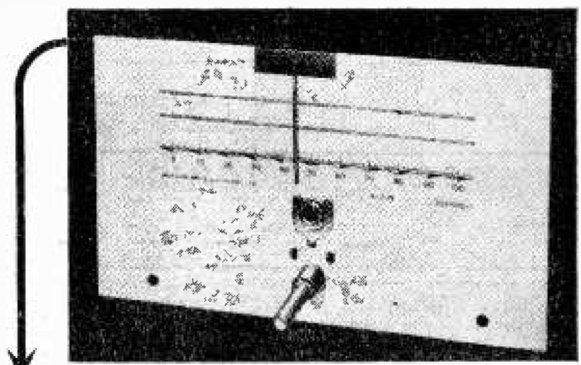
JACKSON



TYPE U.101/S.S.

Cat. No. 5095

Chassis Mounting Gang Condenser with Split-Stators. Ceramic Insulation. Cadmium Plated Chassis. Silver Plated Brass Rotor and Stator. Rotor earthed to Frame. Capacities available each half:- 3-10 pf., 3.8-27 pf., 4-35 pf. or 4.43 pf. Price 10/9 each.



S.L.16 DRIVE

RETAIL PRICE **11/6**

A general purpose slide rule Drive for F.M./V.H.F. Units, short-wave converters, etc. Printed in three colours on aluminium, with a 0-100 scale and provision is made for individual calibrations. Travel of pointer 4⅞in. Scale Plate 7in. x 4¼in. Scale aperture 5½in. x 1½in.

S.L.15 DRIVE

RETAIL PRICE **25/6**

A complete kit of parts for the construction of the Jackson S.L.15 Drive, scale calibrated for the F.M./V.H.F. Band.

Write for further details:

JACKSON BROS. (London) LTD. KINGSWAY · WADDON · SURREY

Telephone: CROydon 2754-5. Telegrams: Walfico, Souphone, London.

Such steep-cutting controls have a certain field of utility, but can give very unnatural and peculiar results, sometimes objectionable, as if the listener or equipment had grown " deaf " to certain notes. There is, as a rule, a greater sense of something *being missing*, with a steep L.F. or H.F. cut circuit, than with more gradual attenuation.

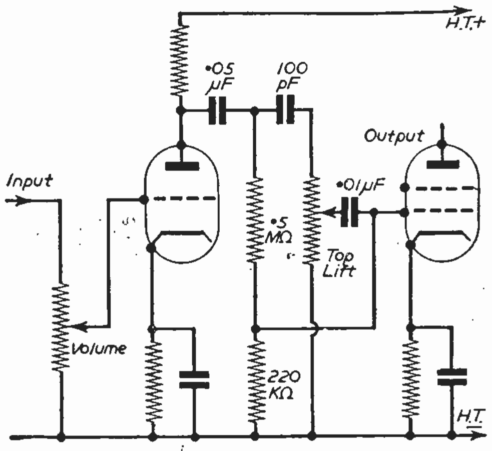


Fig. 3.—Circuit for top lift.

Treble-lifting

Before dealing with comprehensive circuits it is best to consider each aspect of tone control separately. Treble may be suppressed or cut ; or it may be increased, boosted or lifted. Similarly, bass may be cut or boosted. In each case it is possible to employ switches, giving a number of characteristic positions, or to employ potentiometers in a continuously-variable control.

A form of top-lift control is shown in Fig. 3, and will usually be employed in conjunction with other tone controls. A portion of the A.F. signal at normal frequency reaches the output valve grid through the fixed potentiometer network (.5 megohm and 220 K.). Due to the second small coupling condenser only top frequencies are apparent across the variable control, which may be of .5 to 2 megohms. Accordingly, the top-note response can be increased by moving the slider upwards. At the other limit of its travel the control tends to suppress top, by shunting the .01μF condenser across the grid circuit. For this reason the control knob may be marked " Bass " in one direction, and " Treble " in the other. A true bass-lift is not provided, however, but only a similar effect, due to top-cutting, as mentioned. As with all other tone-controls the values may be modified to obtain an increased or reduced amount of control over various frequencies.

Bass-lift

A circuit for this appears in Fig. 4, and is infinitely variable. An A.F. signal of normal characteristic reaches the grid through the one .25 megohm resistor, being tapped off by the .5 megohm and 100 K. network. Frequencies appearing across the .25 megohm potentiometer are primarily of a low-pitched nature, due to the .05μF shunting capacity, and any desired amount of this bass signal can be

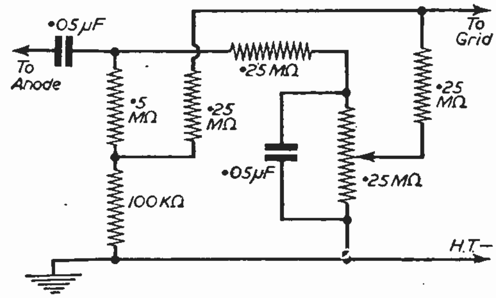


Fig. 4.—A continuously variable bass boost circuit.

supplied to the grid, by operating the control. Bass notes thus grow louder as the slider is moved upwards.

A control giving both top and bass response modification, as required, can be obtained by removing the .5 megohm and 100 K. resistors, substituting a potentiometer of about .5 megohm, with small coupling capacity, the grid feed going to slider instead of the junction of the fixed resistors. Fig. 5 shows this, with two variable controls.

N.F.B. Control

Comprehensive circuits frequently employ selective negative feedback. For example, top will be attenuated by arranging the feedback of high frequencies. A simple circuit of this kind, quite often employed, is shown at " A " in Fig. 6. It is introduced between A.F. and output anode, and enables more and more

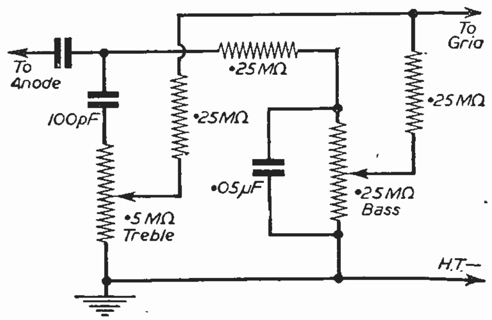


Fig. 5.—Separate controls for treble and bass.

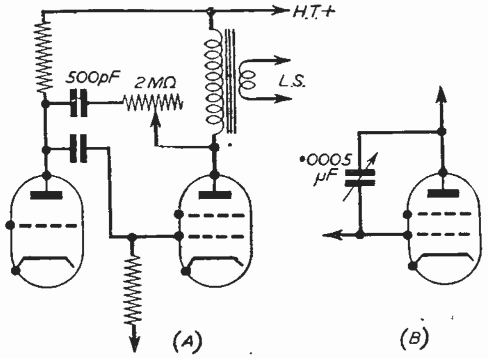


Fig. 6.—Using negative feedback to reduce top.

H.F. to be fed back, as the 2 megohm potentiometer is adjusted. In addition to reducing top, this tends to flatten, or improve, response. Sometimes the potentiometer may be omitted, various capacities being selected by a rotary switch. A similar effect to this can be achieved by wiring a solid-dielectric condenser from anode to control grid, as at "B." This is particularly suitable for battery sets or small output valves.

Similarly, by arranging for the feedback of more bass, bass may be reduced. This will become apparent in a later circuit.

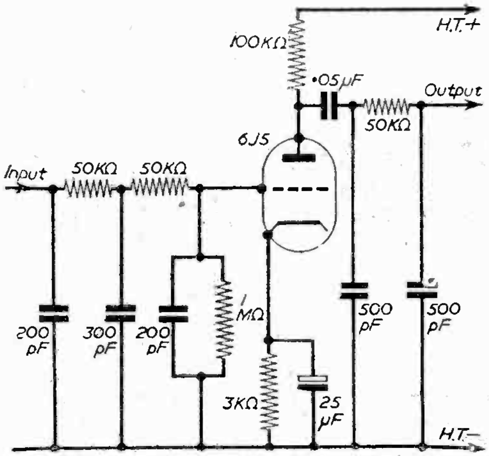


Fig. 7.—Steep cutting H.F. filter.

Steep-cut Filters

When a small capacity is wired from valve grid or anode to chassis, top is attenuated slightly. If the capacity is increased, top is further attenuated, but so are rather lower frequencies. To secure cutting of top frequencies only, a number of small capacities are employed from grid to chassis, or anode to chassis (or both), with resistors between. This produces attenuation of high audio frequencies, but little effect on lower frequencies.

Such a circuit is shown in Fig. 7 and values here are those most generally suitable for average conditions. The network may be added to an existing stage, but if an extra stage is required to compensate for volume losses elsewhere, suitable values for a 6J5 (or one-half of the 6SN7, which is equivalent) are indicated.

The results obtained may be modified, if desired, by changing the values of the condensers. Or a rotary switch can be used to bring in a range of values between 1,000 and 100 pF, thereby providing a form of variable control. The actual amount of cutting necessary depends upon the equipment, and is also to some extent a matter of personal choice, depending upon accustomed standards and the user's ear. It is, however, a relatively simple matter to change the values, though the capacities shown will often be satisfactory.

A similar result can be achieved by using a filter choke, which is included *in series* with some part of the A.F. circuit, where power is small. For example, in series with the grid coupling condenser. One type of choke for this purpose is known as a 9 Mc/s whistle filter, and has an inductance suitable for the elimination of such whistles. In other cases a tapped choke can be used, best tappings being found by trial. As the actual wiring in of such chokes presents no difficulty and because they are not always easy to obtain they are not dealt with in detail here. It is essential any stray coupling with them be avoided, or hum or instability may arise. They must be remote from the field of mains transformer or smoothing choke.

Comprehensive Feedback

A circuit permitting the amount of negative feedback to be varied, and its strength modified at each end of the audio spectrum, is given in Fig. 8. It can be applied with equal ease to valves other than those shown.

As the 100 K. resistance is increased in value, top frequencies are predominant in the feedback through the parallel .05μF condenser. As with other circuits the condenser value can be modified to secure increased or reduced range of control, but it will always be relatively large, because of the low impedance of the circuit, as compared with anode or grid by-pass circuits.

The overall feedback can be adjusted by modification of the setting of the 5 K. control. When feedback of H.F. is at maximum, relative to other frequencies, top is reduced in strength.

The 30 K. control enables H.F. to be bypassed so that it does not reach the 6J7, and this enables bass to be boosted, since the feedback can be given a predominantly H.F. or L.F. character by moving the slider down or up, respectively, in the diagram.

When tone controls are inserted in an existing receiver or amplifier, they must not be included in any part of the circuit over which negative feedback

(*Continued on page* 282)

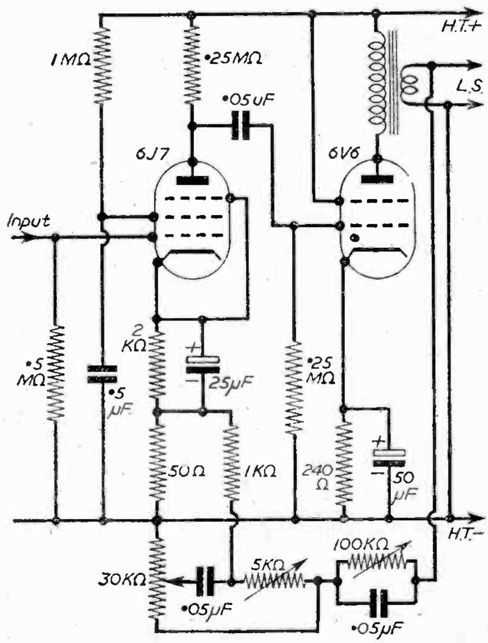
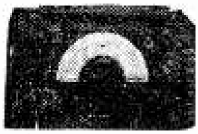


Fig. 8.—Tone control by selective feedback.

HUGE MINISTRY PURCHASE

R.1155—yours for £2 down

Frequency 75 kc/s to 18 mc/s—10 valves—metal case—robust receiver —cost over £60 to make—will give years of service, very little used. Price £10 or 5 payments of £2.

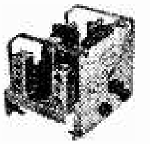


Carr. & transit case 15/- ex.

ENGINEERS 1" MICROMETER

Brand new and perfect—invaluable to engineers, apprentices, model makers, students, etc. **Only 10/- post free.**

5-VALVE SUPERHET YOURS FOR ONLY £1 DOWN

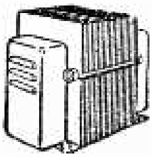


Chassis size approx. 9½ x 7½ x 8½. First-class components. A.C. mains operation. Three waves (medium and two shorts). Complete with five valves, ready to work. New and unused. Cash price £5 19/6, or 6 payments of £1 (carr. and ins. 7/6).

TRANSFORMER SNIP

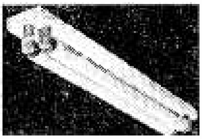
11/6

Post 2/-



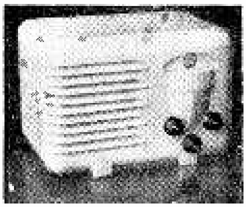
Fully shrouded—standard 200-250 v. primary 280-0-280 at 80 m/a. 6.3 v. at 3 amp., 5 v. at 2 amp.

THE TWIN 20



This is a complete fluorescent lighting fitting. It has built-in ballast and starters—stove enamelled white and ready to work. It is an ideal unit for the kitchen, over the work-bench, and in similar locations. It uses two 20-watt lamps. Price, complete less tubes, 29/6, or with two tubes, 39/6. Post and insurance 5/-. Extra 20-watt tubes, 7/6 each.

MAINS-MINI



Uses high-efficiency coils—covers long and medium wavebands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, £4 10/0, plus 3/6 post. Constructional data free with the parts, or available separately 1/6.

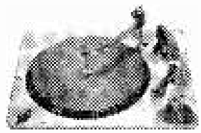
The "CRISPIAN" Portable Radio

A 4-valve truly portable battery set with very many good features as follows: Ferrite rod aerials, low consumption valves, superhet circuit with A.V.C., ready-built and aligned chassis if required, beautiful two-tone cabinet covered with I.C.I. Rexine and Tygan. Guaranteed results on long and medium waves anywhere.

All parts, including speaker and cabinet, are available separately or if all ordered together the price is £7.15 complete, ready-built chassis 30/- extra. Instruction booklet free with parts or available separately price 1/6.

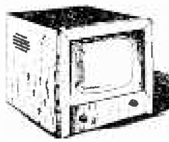
GRAMOPHONE AUTO-CHANGERS

The latest models by very famous manufacturers. 3-speed with crystal turnover pick-up, brand new and perfect, in original cartons. Prices from £7 19 6, carriage, ins., etc., 7/6.



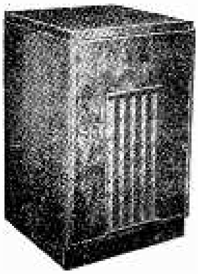
— THIS MONTH'S SNIP —

14" T.V. CABINET



14in. T.V. cabinet of the latest styling made for one of our most famous firms—beautifully veneered and polished—limited quantity—19/6 each. Carriage and packing 3/6 extra.

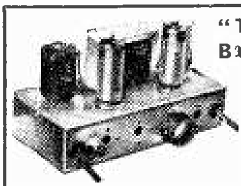
THE STATESMAN



THIS IS ON OFFER AT APPROX. HALF COST TO MAKE.

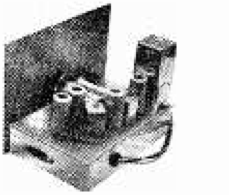
An impressive costly looking cabinet originally designed for T.V. but simple modification makes the cabinet suitable for radio-gram amplifier, tape recorder, or reflex speaker—size 23in. wide, 22in. deep and 37½in. high. Limited quantity at £8 15/- each, carriage 12/6.

"The ESTRONIC" Band III Converter



To-day's best value in Band III converters suitable for your T.V. or money refunded. Complete ready to operate. 59/6 non mains or 85/- mains, post and insurance 3/6.

THE CLEVELAND F.M. TUNER



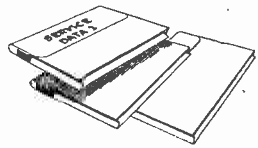
This tuner is based upon the very successful circuit published by Data Publications. We have made up models at all branches and will gladly demonstrate. Stability is extremely good and making and aligning most simple. Cost of all parts including valves, prepared metal chassis, wound coils and stove enamelled scale, slow-motion drive, pointer, tuning knob, in fact everything needed is £6 12 6. Data is included free with the parts or is available separately, price 2/-

MULLARD AMPLIFIER "510"

A Quality Amplifier designed by Mullard. Power output exceeds 10 watts. Frequency response almost flat from 10 to 20,000 C.P.S. For use with the Acos "Hi G" and other good pick-ups. Made up and ready to work is £12/10/-, plus 10/- carr. and insurance.

MULTI-METER KIT

Parts suitable for making a multimeter to measure volts, milliamps and ohms. Kit containing all the essential items including moving-coil meter, resistors, range selector, calibrated scale, etc., etc., is only 15/-, plus 1/- post and packing.



SERVICE DATA

100 service sheets, covering British receivers which have been sold in big quantities and which every service engineer is ultimately bound to meet. The following makers are included: Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster Brandes, Lissen, McMichael, Marconi, Mullard, Murphy, Philco, Philips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder.

ELECTRONIC PRECISION EQUIPMENT, LTD.

Post orders should be addressed to E.P.E., LTD., Dept. 5, 123, Terminus Road, Eastbourne.

Post enquiries to Eastbourne with stamped envelope, please.

42-46, Windmill Hill, Ruislip, Middx. Phone: RUISLIP 5780. Half day, Wednesday.	**152-3, Fleet Street, E.C.4.** Phone: FLEet 2833 Half day, Saturday.	**29, Stroud Green Rd., Finsbury Park, N.4.** Phone: ARChway 1049 Half day, Thursday.	**249, Kilburn High Road, Kilburn.** MAIda Vale 4921.

FOR ALL RADIO COMPONENTS . . .

PUBLICATIONS

No. 124—Bernard's Radio Manual "AT A GLANCE EQUIVALENTS" ★ More than 8,000 Valves listed ★ All Equivalents shown on one line ★ Army, Air Force, Navy types ★ Complete CV to Commercial Listing ... ... 5 ea.

No. 134 —F. M. TUNER CONSTRUCTION by W. J. May ★ Easy to Build, Point to Point Wiring ★ Super High Fidelity Response ★ 32 Pages ★ All Components for this Circuit available ex stock ... ... 2/6 ea.

No. 121 — A COMPREHENSIVE VALVE GUIDE, Book No. 2 (Characteristics and Base Connections) ... ... 5/- ea.

No. 103 -RADIOFOLDER "A" The Master Colour Code Index for Radio and Television ... 1/6 ea.

Postage 6d. each.

STC RECTIFIERS

RM 1 ...	3/10	RM 3 ...	5/-
RM 2 ...	4/3	RM 4 ...	16/-

SMALL SUB-CHASSIS

With 2 valveholders for 954, 955 type of valves ... ... 5 ea.

PENCIL RECTIFIERS

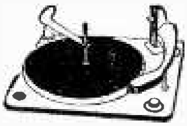
K 3/25 ...	5/8	K 3/50 ...	8/8
K 3/40 ...	7/6	K 3/60 ...	9/8
K 3/45 ...	8/2	K 3/100...	14/8

LOUDSPEAKER CABINETS

This attractive walnut finished cabinet is available for 6½in. or 8in. speaker units. Metal speaker fret, complete with back and rubber feet.

6½in. type :
Measures 8¼in. x 8¼in. x 4½in. at base. Price 16/6 each.

8in. type :
Measures 10¼in. x 10½in. x 5in. at base. Price 20/6 each.



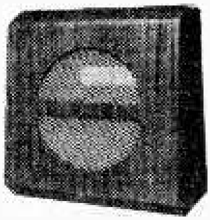
B.S.R. MONARCH AUTOMATIC RECORD CHANGER

These units will autochange on all three speeds, 33⅓, 45, and 78 r.p.m. They play MIXED 7in., 10in. and 12in. records.

They have separate sapphires for L.P. and 78 r.p.m., which are moved into position by a simple switch.

Minimum baseboard size requires 14in. x 12½in., with height above 5¼in., and height below baseboard 2½in. A bulk purchase enables us to offer these BRAND NEW UNITS at this exceptional price. These units are beautifully finished in cream enamel with cream bakelite arm.

COMPLETE WITH FULL INSTRUCTIONS. £7.19.6. Carriage charge 3/-.



COMPONENTS for MULLARD 5-10 AMPLIFIER

RESISTORS. AMPLIFIERS
All resistors and potentiometers R1-R29, 39/- per set.
As above less potentiometers, 24/- per set.
Pre-amplifier unit. R31-R46, 16/6 per set.

AMPLIFIER AND PRE-AMPLIFIER
All resistors and potentiometers, 57/6.
As above less potentiometers, 42/6.

FM TUNER
All resistors R1-R20 and R30, 15/-.

CONDENSERS, Ceramic capacitors, 32/-.

Full stocks of all components available for this popular circuit.

CHASSIS

Aluminium Undrilled with Reinforced Corner. Available in the following sizes.

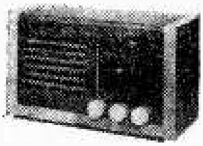
6" x 4" x 2½"	4/6 ea.
8" x 6" x 2½"	6/3 ea.
10" x 7" x 2½"	7/3 ea.
12" x 3" x 2½"	5/9 ea.
12" x 5" x 2½"	6/9 ea.
12" x 8" x 2½"	8/6 ea.
14" x 3" x 2½"	6/- ea.
14" x 9" x 2½"	12/- ea.
16" x 6" x 2½"	8/6 ea.
16" x 10" x 2½"	14/- ea.

All are four-sided ideal for radio receivers, amplifiers, power packs, etc.

Build this Excellent Kit for Yourself !

Alpha 3 valve T.R.F. Kit

£5 . 10 . 0



★ Easy to Build.

★ Valves 6J7, 6K7, 6V6GT plus metal rectifier.

★ Walnut cabinet.

Full instructions, point to point wiring diagram. Circuit diagram, and full shopping lists 1/-. All components may be purchased separately.

Mail Order only. For terms see our advertisement on Page No. 219.
WHEN ORDERING PLEASE QUOTE "DEPT. P.W."

ALPHA RADIO SUPPLY CO
5/6 VINCES CHAMBERS
VICTORIA SQUARE
LEEDS I.

ALL THESE FINE BARGAINS ARE AT
The Walk-around Shop—

ADMIRALTY RESPONSER UNIT. W.4790

This receiver tunes from 160-182 Mc/s. Valve line-up VR.136 R.F., VR.92 Mixer, VR.137 Osc., VR.65's in 5 I.F. stages. Price 12/6. Each full valved. Post & Pkg. 7/6.

MINIATURE I.F. STRIPS

Size 10¾in. x 10¼in. x 3in. frequency 9.72 Mc/s. Line-up : 2 EF.92's and 1 EF.91 I.F., Amps. EB.91 DET/AGC., EF.91 AGC Amp. and EF.91 limiter. Circuit supplied. Price, less valves, 8/- each, post paid.

62A INDICATORS

Ideal for conversion to oscilloscopes. T.V. units, etc., containing VCR.97, 12VR.91 (EF.50), 2 VR.54 (EB.34), 3 VR.92 (EF.50), 4 CV.118 (SP.61). Slow motion dial. 13 Pots and scores of useful components. Size : 8½in. x 11½in. x 18in. Price £3.0.0 each, plus 7/6 Post & Pkg.

TYPE "234" POWER UNITS

Double Smoothed 200-250 v. 505 Input. 240 v. 100 mA. 6.3 at 6 amps. with voltmeter reading input and output voltages. Size : 19in x 10in. x 6½in. Standard Rack Mounting. Price £4.10.0 each, plus 7/6 Post & Pkg.

BENDIX I.F. TRANSFORMERS

1.63 megs. Complete in cans set of 2 New and Boxed. Size 2in. x 1½in. x 3⅞in. Price 5/- each, Post & Pkg. 1/6.

BENDIX POTTED AUDIO OUTPUT TRANSFORMERS

Complete with Integral Smoothing Choke Rating 4½ watt. 9,000 ohms Primary 600 and 4,000 ohms Secondary. Size : 4in. x 1⅞in. x 2in. New and Boxed. Price 4/6 each, Post & Pkg. 1/6.

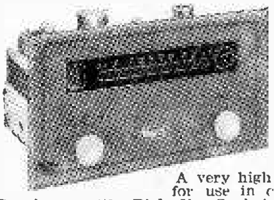
INSULATING TAPE

Perfect condition, ½in. wide, 25 yds. reels. Foiled in tins. Price 1/3 each, Post & Pkg. 8d.

NOTE : ORDERS AND ENQUIRIES TO DEPT. 'P.'

PROOPS BROS. LTD. Telephone LANgham 0141
52 Tottenham Court Road, London, W.1.
Shop Hours : 9-6 p.m. Thursday ; 9-1 p.m. **Open all day Saturdays**

DIRECT FROM THE MANUFACTURER



F.M. (V.H.F.) TUNER CHASSIS COMPLETE AND SELF POWERED ASSEMBLED AND READY FOR USE

A very high quality instrument designed for use in conjunction with Radiograms. Receivers with Pick-Up Sockets. Tape-Recorders and Quality Amplifiers. **£17.10.3** inc. tax

- Switching is incorporated for direct intercommunication.
- Circuit comprises Permeability tuned superheterodyne with R.F. Stage and additive mixer.
- Dial—Full View Perspex Dial size 10½ x 5½.

Incorporating all modern features in Latest Design and Technique and quality components.

COMPLETE CHASSIS

Model H.4. 4 Wavebands, including F.M., 7 Valves with latest miniature Cathode Ray Tuning Indicator. **£27.16.0** inc. tax

Model F.3. 3 Wavebands, 5 Valves, 4 watt output, wide range tone control. **£14.11.11** inc. tax

Model F.3.P.P. 3 Wavebands, 7 Valves, 6 watt output, with "Push Pull" stage. Separate Bass and Treble controls. **£18.15.4** inc. tax

ALL GOODS FULLY GUARANTEED

ALL ABOVE CHASSIS ARE ASSEMBLED AND READY FOR USE AND BUILT TO HIGHEST TECHNICAL STANDARDS.

Write also for details of Tape Recorders and Crystal Receiver Tuners.

We have designed and approved a PRE-AMPLIFIER for the New COLLARO Tape Transcriptor.

Dulci COMPANY LTD.
97, VILLIERS ROAD, LONDON, N.W.2.
Telephone: WILlesden 6678.

Valves for Battery Portables

DETAILS OF AVAILABLE VALVE TYPES AND CIRCUITS

By E. G. Bulley

THE popularity of the portable battery receivers led to the development by valve manufacturers of a range of valves with a button glass base. These valves are of small physical size and have many advantages over their predecessors.

They were originally designed in 1939 and proved useful during the war years for portable equipment. The foremost of the advantages is that these valves can be operated from a 1.4 volt battery, the H.T. being the order of 45 and 90 volts.

One will therefore appreciate that the batteries required to furnish these voltages are relatively small both in physical size and weight.

Valves available in this range are those of frequency changers, R.F. pentodes, diode pentodes and output pentodes, making them very suitable for a superhet receiver.

The Frequency Changer

The frequency changers are heptodes, in which the mixer and oscillator functions are performed within the one envelope. Grid 1 acts as the oscillator grid, whereas Grid 2 is internally connected to Grid 4, and acts as a shield for Grid 3 and performs the function of the oscillator anode. The suppressor grid is G5 and valves of this design are such that the space charge around the cathode is not affected by electrons from the Grid 3. A typical circuit utilising a valve of this type is shown in Fig. 1.

The R.F. Amplifier and A.G.C.

The R.F. amplifiers in this range of valve are pentodes, which can also be used as I.F. amplifiers. They have internal shielding, and the grid is wound so that it has a wide pitch in the centre and a finer pitch at both ends. This type of construction provides a variation in the amplification factor with a change in bias. This can be clarified by bearing in mind that as the grid becomes more negative, larger input signals are handled and the emission from the ends of the filament are cut off by the fine pitch of the grid. Conversely, when smaller or weaker signals

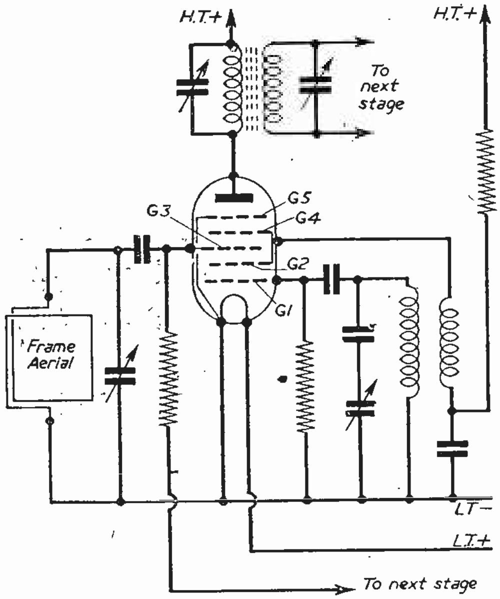


Fig. 1.—Basic circuit of frequency changer for battery miniature valves.

are applied to the grid with a less negative bias the characteristics of the valve are similar to those having a grid of uniform pitch. A basic circuit using one of these valves is shown in Fig. 2, and is that of an I.F. amplifier.

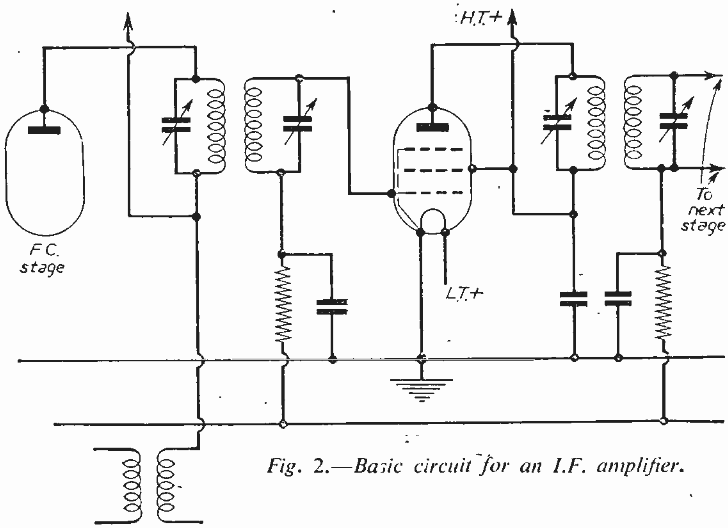


Fig. 2.—Basic circuit for an I.F. amplifier.

Detector and A.F. Amplifier Stage

The diode pentode in this miniature range has the diode and audio-frequency pentode in one envelope, both systems although independent of each other utilise the common filament. These valves provide a high gain and like all valves in this range are small and compact. The diode portion is used for detection, and has the advantage over other methods that it does not produce so much distortion. A typical circuit using one of these valves is shown in

Fig. 3. Here a part of the A.F. voltage developed across the diode resistor is fed on to the control grid of the pentode section and thereby amplified and passed on to the control grid of the output valve.

For the coupling between this stage and that of the output, it is advisable to use R.C. coupling arrangement and not that of the transformer method.

Power Output Valve

The power output valves have an extremely good power sensitivity factor, and have proved very efficient. Some types have their filaments centre tapped, the voltage of the complete filament in this case being 2.8 volts. Nevertheless, valves are available with the 1.4 volt filament. The purpose of the 2.8 volt range is that the valves can be used in the 1.4 volt range or, alternatively, they can be used

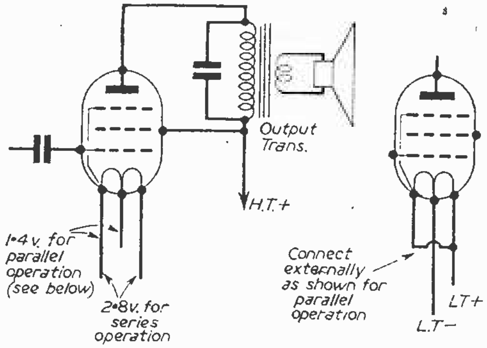


Fig. 5.—Basic circuit for output, using 2.8 volt filament valves.

VALVES FOR PORTABLE RECEIVERS

	American	*Mullard*	*Mazda*	*Osram*	*Fil. volts*	*Fil. current amps.*	*Max. VA volts*	*Max. screen voltage*
Diode Pentode A.F. amplifier	1S5	DAF91	1FD9	ZD17	1.4	0.05	90	90
R.F. and I.F. amplifier	1T4	DF91	1F3	W17	1.4	0.05	90	67.5
Frequency Changer	1R5	DK91	1C1	X17	1.4	0.05	90	67.5
Output Pentodes	3S4	DL92	1P10	N17	2.8* 1.4	0.05 0.10	90 90	67.5 67.5
Output Pentodes	3Q4	—	—	N18	2.8 1.4*	0.05 0.10	90 90	90.0 90.0
Output Pentodes	3V4	DL94	1P11	N19	2.8 1.4*	0.05 0.10	90 90	90 90

* Centre tapped filament.

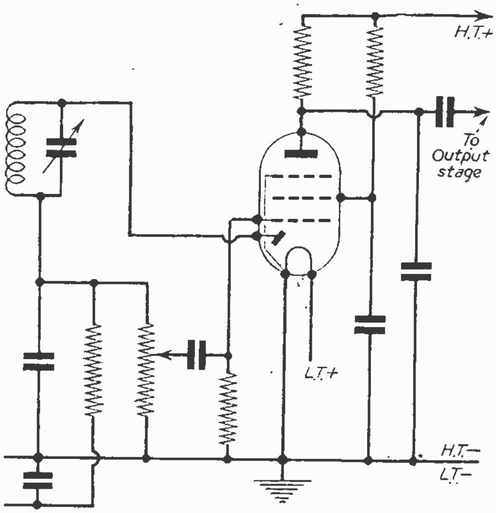


Fig. 3.—Basic circuit of diode detector and audio amplifier.

where the filaments are series connected. All filaments in this case must have a current rating of .05 amps.

Typical circuits using both these valves are shown in Figs. 4 and 5, and are self explanatory.

Furthermore, to assist the reader, a table is given above where the ratings of the valves are shown together with the manufacturers' equivalents.

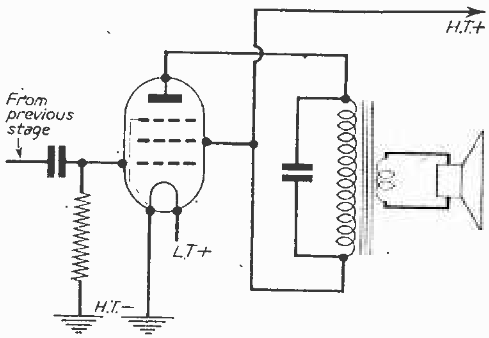
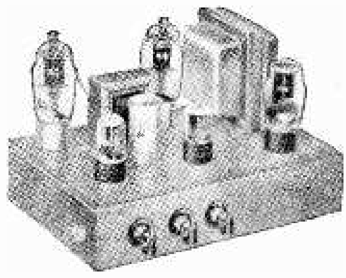


Fig. 4.—Basic output stage.

R.S.C. A8 ULTRA LINEAR 12 WATT AMPLIFIER

NEW 1956 Model High-Fidelity Push-Pull Amplifier with "Built-in" Tone Control, Pre-amp stages. High sensitivity. Includes 5 valves (807 outputs), High Quality sectionally wound output transformer, specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut." Frequency response ± 3 db. 30-30,000 c/cs. Six negative feedback loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs. For **STANDARD or LONG - PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS,** etc. **OUTPUT SOCKET** with plug provides 300 v. 20 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT. H.P. TERMS ON ASSEMBLED UNITS. DEPOSIT 31/- and nine monthly payments of 21/-.** Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/cs. Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value at £7/15/-, or factory built 45/- extra. Carriage 10/-.

£7-15-0



If required louvred metal cover with 2 carrying handles can be supplied for 17/6. Additional input socket with associate Vol. Control so that two different inputs such as Gram and "Mike" or Tape and Radio can be mixed, can be provided for 13/- extra.

HIGH - FIDELITY MICROPHONES and **SPEAKERS** in stock. Keen cash prices or H.P. terms if supplied with amplifier.

R.S.C. 30 WATT ULTRA LINEAR HIGH-FIDELITY AMPLIFIER A6

A highly sensitive Push-Pull, high output unit with self-contained Pre-amp., Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response ± 3 db. 30-30,000 c/cs. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used, and separate Bass and Treble controls. Minimum input required for full output is only 30 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS, or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN, GUITAR, STRING BASS,** etc. For standard or long playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for a **RADIO FEEDER UNIT.** Amplifier operates on 200-250 v. 50 c/cs. A.C. Mains and has outputs for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for 17/6. An extra input with associated vol. control so that two separate inputs such as Gram. and Mike can be mixed, can be provided for 13/- extra. The amplifier can be supplied, factory built with 12 months' guarantee for 50/- extra. **H.P. TERMS** for assembled two input model: **DEPOSIT 28/6** and 12 monthly payments of **21/-**.

ONLY 9 GNS. Carr. 10/-

H.M.V. LONG-PLAYING RECORD TURNTABLE WITH CRYSTAL PICK-UP (Sapphire Stylus). Speed 33⅓ r.p.m. For A.C. mains 200-250 v. Brand New, cartoned. Perfect. Only £3/19/6. Plus carr. 5/-. (Normal price £8 approx.)

FOUR STAGE RADIO FEEDER UNIT. Design of a High-Fidelity Tuner Unit T.R.F. L. & M. Wave. Full decoupling. Only 250-400 v. 10-15 mA. H.T. required from main amplifier. Three valves and low distortion Germanium diode detector. Flat-topped response characteristic. Loaded H.F. coils. Two variable-Mu controlled H.F. stages. 3-Gang condenser tuning. Detailed wiring diagrams, parts lists and illustration, 2/6. Total building cost, £3/15/-.

DEFIANT RECORD PLAYING UNITS Turntable for standard 10in. and 12in. 78 r.p.m. records (fitted auto-stop) and high impedance magnetic pick-up, mounted in attractive polished walnut finish drawer-type cabinet. Exceptional value at £5/19/6, plus 7/6 carr.

B.S.R. MONARCH 3-SPEED MIXER AUTOCHANGER. For standard 200-250 v. 50 c/s mains. Autochanges on all 3 speeds. Plays Ten mixed 7in., 10in. and 12in. records. Separate sapphire styli for L.P. and 78 r.p.m. High-fidelity type crystal pick-up. Minimum baseboard size needed 14in. x 12in. x 5½in. high. Brand new, cartoned, at £7 15/0, carr. 3/6.

WALNUT VENEERED CABINETS by well-known set maker. Designed for above record changers with provision for amplifier and speaker. Limited number. Brand new, cartoned. £3/19/6, carr. 7/6.

3-4 WATT QUALITY AMPLIFIER. Designed especially for use with above changers and cabinets. Fitted separate Bass and Treble Controls, and Vol. Control with switch. Latest miniature type valves used. For A.C. mains 200-250 v. Only £3/19/6, plus 3/6 carr. Ready for use.

P.M. SPEAKER, 7 x 4 in., for use with above. 18/9.

VOLUME CONTROLS with long (¼in. diam.) spindles, all valves less switch, 2/9; with S.P. switch, 3/9; with D.P. switch, 4/6.

PICK-UPS. Collaro high-fidelity low impedance magnetic type, with matching transformer. Only 32/6. Brand New.

R.S.C. 4-5 WATT A5 HIGH-GAIN AMPLIFIER

A highly sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high-fidelity pick-up heads, in addition to all other types of pick-ups and practically all mikes. Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 db. down. 15 db. of negative feedback is used. H.T. of 300 v. 25 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape Deck preamplifier. For A.C. mains input of 200-230-250 v. 50 c/cs. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with green crackle finish, and point-to-point wiring diagrams and instructions. Exceptional value at only £4/15/-, or assembled ready for use 25/- extra, plus 3/6 carr.

GARRARD RC110 3-SPEED AUTO-CHANGERS. For 200-250 v. A.C. Mains. Current Model. Brand new, cartoned. Fitted high fidelity crystal Pick-up with dual pointed sapphire stylus. Limited number at only £8/17/6, carr. 5/6.

ALL DRY BATTERY RECEIVER MAINS UNIT KIT. A complete set of parts for construction of a Unit (housed in metal case) to replace Batteries where A.C. Mains supply is available. Input 200-250 v. 50 c/cs. For receivers requiring 90 v. 10/20 mA. and 1.4 v. 125-250 mA. fully smoothed. Price, complete with circuit, only 39/9. Or ready for use 46/6. Size of unit, 5¼ x 4 x 2¼in.

BATTERY SET CONVERTER KIT All parts for converting any type of Battery receiver to All Mains. A.C. 200-250 v. 50 c/cs. Size of case, 8-5-2½ins. approx. Kit will supply fully smoothed H.T. or 120 v. 90 v. or 60 v. at up to 40 mA. and fully smoothed L.T. or 2 v. at 0.4 to 1 a. Price, complete with circuit, wiring diagrams and instructions, only 49/9. Or ready to use, 9/9 extra.

P.M. SPEAKERS. All 2-3 ohms. 4in. Rola, 19/9. 6½in. Plessey, 16/9. 8in. Plessey, 16/9. 8in. Rola, 19/9. 10in. R.A., 26/9. 12in. Plessey, 29/11. 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, high-fidelity type. Highly recommended for use with any of our amplifiers. £4/6/9.

M.E. SPEAKERS 2-3 ohms. 8in. R.A. Field, 600 ohms, 11/9. 10in. R.A. Field, 1,000 ohms, 23/9.

COAXIAL CABLE 75 ohms, ¼in. 8d. yard. Twin Screened Feeder, 11d. yard.

SELENIUM RECTIFIERS

F.W. Bridge Type		L.T. Types H.W.	
6/12 v. 1 a.	5/9	6-12 v. ¼a. H.W.	2/9
6/12 v. 2 a.	8/9	**H.T. Types H.W.**	
6/12 v. 3 a.	12/9	150 v. 40 mA.	3/9
6/12 v. 4 a.	16/9	250 v. 50 mA.	5/9
6/12 v. 6 a.	19/9	250 v. 80 mA.	7/9
6/12 v. 10 a.	25/9	250 v. 150 mA.	9/9

R.S.C. 3-4 WATT A7 HIGH-GAIN AMPLIFIER

For 230/250 v., 50 c/cs. A.C. Mains. Appearance and Specification with exception of output wattage, as A5. Complete Kit, with diagrams, £3/15/-. Assembled £1 extra. Carr. 3/6.

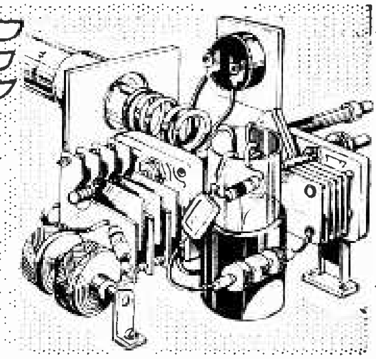
BATTERY CHARGER KITS For mains 200-250 v. 50 c/cs.
To charge 6 v. acc. at 2 a., 25/6.
To charge 6 or 12 v. acc. at 2 a., 31/6.
To charge 6 or 12 v. acc. at 4 a., 49/9.
Above consist of transformer, full wave rectifier, fuses, fuseholders and steel-case. Any type assembled and tested, 6/9 extra.

THE SKYFOUR T.R.F. RECEIVER A design of a 3-valve 230-250 v. A.C. Mains receiver with selenium rectifier. It consists of a variable-Mu high-gain H.F. stage followed by a low distortion anode bend detector. Power pentode output is used. Valve line up being 6K7, SP61, 6F6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-point wiring diagrams, instructions, and parts list, 1/9. This receiver can be built for a maximum of £4/19/6 including attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6¼ x 5½in.

Terms: C.W.O. or C.O.D. NO C.O.D. under £1. Post 1/9 extra under £1; 2/9 extra under £5. Open 9 to 5.30; Sats. until 1 p.m. Catalogue 6d., Trade List 5d. S.A.E. with all enquiries.

RADIO SUPPLY CO. (LEEDS) LTD. 32, THE CALLS, LEEDS, 2

SHORT-WAVE SECTION



INTERESTING NOTES FOR THE SHORT-WAVE ENTHUSIAST

By A. W. Mann

THE general trend among radio amateurs and short-wave experimenters nowadays appears to centre on the modification and adaptation of ex-service components falling into what may be aptly termed the gadget class, rather than complete ex-service receivers. Omitting of course the ubiquitous R1155.

There is no doubt an increasing interest in electronic devices, and the remote control of transmitters and other apparatus to be found in amateur transmitting stations, and to a lesser degree in short-wave listening posts throughout the world.

Magnetic relay control now enables a series of changeovers to be carried out by the operation of a single switch in place of multi-switchboard operation.

A Warning

The availability of ex-service equipment has widened the scope of the radio experimenter by allowing him to adapt precision mechanisms to his requirements, which, from the financial point of view, was previously impossible.

Perusal of surplus radio catalogues and advertisements shows that a considerable variety of apparatus is still available, but one experiences a jolt when comparing similar material dating back two years or more.

We find that popular and at one time commonplace lines are not listed. Inquiries prove them to be no longer available, nor likely to be in the future.

While it will be some years before all ex-service surplus radio materials are unobtainable, it is obvious that experimenters should take time by the forelock and follow a long-term policy. Get the latest catalogues and lists, scan current advertisements, and stock up while there is the chance to do so.

Useful Apparatus

The author has always been on the alert for small items and mechanisms, high-speed and geared motors, relays and selector mechanisms and other devices which could be modified or adapted to meet personal requirements. In addition, scrap radio offered for breakdown purposes has provided many useful components. Readers who are experimentally inclined would be well advised to give the subject of declining surplus stocks careful consideration.

It is, I think, true to say that however efficient the receiver in use, efficient aerials are essential. Where more than one aerial is to be used the advantages of magnetic relay facilities should be appreciated especially in the case of poor locations relative to the reception of signals radiated from blind spot areas, and for quick changeover during comparative tests.

A Double Superhet

Readers will have noticed no doubt that a PRACTICAL WIRELESS advert. inserted by a well-known firm lists among other lines an ex-service receiver about which they know probably very little, due to the fact that but few have been available on the surplus market. This is the DST100.

The author has seen and carefully examined one of them, but had not the opportunity of hearing it in operation. This receiver is a double superhet covering, in seven switched bands, everything from 30 Mc/s to 50 kc/s continuously; 13 valves, plus rectifier, are incorporated. This receiver is a rugged job fitted with a naval type coil turret of outsize proportions, and is intended for use on 200-250 volts A.C. mains.

Plug-in type I.F. transformers are fitted and are as follows: 1st, 2 Mc/s with 110 kc/s link winding; 2nd, exactly the same; 3rd, 2 Mc/s; 4th, 110 kc/s; 5th, 110 kc/s with regeneration winding; 6th, 110 kc/s; also 7th.

Valve Line-up

1st R.F. CV21, 1st F.C. ECH35, Local Osc. 6J5G, 1st I.F. EF39, 2 I.F. and AVC 6B8; 2nd F.C. and Osc. ECH35; 3rd I.F. EF39, Det. 6J5G, noise lim. 6H6G, 1st audio 6Q7G, output 6V6G, BFO 6R7G, noise limiter 6J5G. This receiver incorporates in its design sectional chassis construction, the R.F., I.F. and A.F. stages being withdrawable separate units. With calibrated two-speed tuning dial and all essential panel controls, this is a soundly-designed receiver. A theoretical circuit diagram is printed on the underside of the top cover plate.

Electron Coupling

The electron coupled detector is favoured by many users of mains type receivers. When this system is used with battery type valves, however, filament chokes are necessary. As these are usually home-made, the following data should prove useful. Try 35 turns 26 s.w.g. space wound on ½in. diameter paxolin former. Space thickness of wire.

Bandspread Facilities

Apart from the deservingly well-known 640 and one or two other commercially produced receivers, electrical bandspread is mostly confined to home-constructed short-wave receivers.

Some very soundly designed and accurate mechanical systems are now incorporated in commercial models.

American designers in some instances favour tuning condensers of the ganged type with integral band-spread sections.

As is well known, one British manufacturer is producing two communication models with a calibrated full vision tuning dial of considerable scale length. These are a vast improvement on those featured in pre-war American receivers. These receivers provide mechanical bandspread at its best, but are, of course, in the top price class.

Suggestions

When the radio component industry reverted to peacetime production, one well-known firm listed for export ganged tuning condensers with an integral bandspread section. These, however, have yet to appear on the home market.

The application of click stop mechanism to ganged band setters is, I believe, an idea worthy of consideration in the interest of accurate calibration.

Like many others, the author regrets the passing of several firms who catered for home-constructor requirements. New ones have come into being, but there is room for more, especially in the short-wave field.

Jamming

The question of jamming has been raised in high places relative to the short-wave broadcast bands. One wonders if over the years this pertinacious practice has, or is ever likely to, achieve the desired results taking into account that Nationals abroad centre their interest on keeping in touch with home affairs, and that the broadcast DX enthusiast steers clear of jammed sections of the tuning dial. The serious listener who uses the short-wave bands as a source of entertainment recognises propaganda as such, no matter the country from which it emanates, and tunes through it. In the writer's opinion the British, Canadian and Australian authorities have the secret of holding the interest of the short-wave broadcast listener the world over.

Audio Filters

Some years ago I described a dual headphones and audio filter unit. The filter used was the FL8A. At the time the article appeared this type of filter was available in large quantities. During the past few years they have been in short supply. I note that whilst higher priced they are again available, but imagine that stocks will be limited.

This type of filter is an asset to the C.W. listener, and can be used effectively on the 'phone bands when QRM conditions are bad. This applies especially to the 20 metres American 'phone section.

Loudspeakers

Photographs published in various radio journals and showing the layout of amateur listening posts and transmitting stations sometimes include amongst the other apparatus one or more moving-coil speakers of the 8in. or similar types, mounted on a small baffle. One might as well use one of the old balanced armature types, for unless the M.C. speaker is used on a fairly large baffle, or, better still, built into a suitable cabinet, this type of reproducer is not being correctly used. For communication purposes a small baffle and a suitable cabinet is quite effective. The improvement in reproduction justifies the extra cost. Where quality reproduction is desired a baffle and cabinet combination of greater dimensions is desirable.

V.H.F.

In view of unsatisfactory reception of medium-wave transmissions in various parts of the country, and the introduction of V.H.F. transmissions, what was previously regarded as an up-to-date all-wave receiver may well be discarded as obsolete in areas where satisfactory reception of BBC transmissions makes V.H.F. a necessity.

Where the existing receiver is a rather expensive one capable of providing so called "Hi-Fi" reproduction, there is no doubt that many owners will invest in a suitable V.H.F. adaptor.

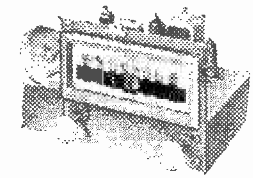
Owners of good class popular models dating back a few years, however, will in many instances no doubt decide to sell their present set and buy one of the new models in which the V.H.F. bands are included.

Part Exchange

In areas where there is a big demand for such receivers, it will depend very much on the resale prospects as to dealers considering taking non-V.H.F. models in part exchange. Now there are quite a number of four or more band receivers which provide first-class performance on the short-wave bands, including some which incorporate bandspread arrangements. In areas where amateur radio is known to have a good following it would appear that there will exist a resale market for such receivers and a means whereby enthusiasts may buy at bargain prices. While receivers incorporating the trawler bands are favoured and used considerably by coastal listeners who have some connection or other with the fishing industry it is, I think, safe to assume that, so far as the average listener is concerned, the short-wave ranges are but seldom, if ever, used. Under the circumstances the owners will not hesitate to dispose of receivers some years old in favour of a V.H.F. type, and the advantages offered so far as interference free BBC reception is concerned.

From the foregoing, and taking into consideration the fact that ex-service receivers which sold mostly because of their short-wave performance are getting scarce, dealers would be well advised, where a possible market exists, as in London and other big cities, to cater for the short-wave enthusiast, featuring the short-wave facilities available in receivers which from the broadcast angle have been replaced as obsolete but from the short-wave point of view are a sound proposition.

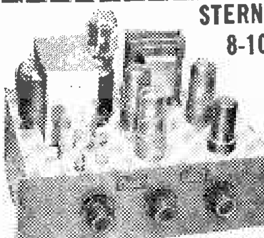
STERN'S "F.M." TUNING UNIT



A 5-valve Tuner incorporating the latest Mullard Permeability Tuning Heart and a "Magic Eye" Tuning Indicator.

THE COMBINED AM-FM TUNER is precisely similar in appearance to the above and incorporates 7 valves. It provides complete coverage of the F.M. Transmissions and the MEDIUM WAVEBAND thereby giving a good selection of foreign stations.

STERN'S "HIGH QUALITY" 8-10 WATT AMPLIFIER

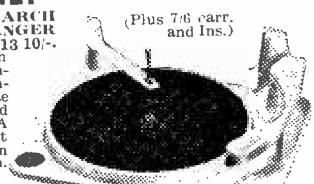


Designed for High Quality reproduction up to an output level of 10 watts, having 6V6's in Push-Pull and incorporating negative feedback. It is suitable for use with all types of Pick-up and most types of microphone and the output transformer provides for use of 3- and 15-ohm speakers.

AN EXCEPTIONAL OFFER FOR CASH ONLY £7.19.6.

(Plus 7/6 carr. and Ins.)

The B.S.R. MONARCH 3-SPEED AUTOCHANGER NORMAL PRICE £13 10/-.



- Complete with High Fidelity Crystal "Turnover" Head which incorporates separate stylus for L.P. and 78 r.p.m. records.
- A "MIXER" Unit that will autochange on 7in., 10in. and 12in. records.
- Brand New in Maker's Cartons, complete with mounting instructions.

THE B.S.R. MODEL T.U.8 3-SPEED PLAYER

Supplied complete including the new lightweight "Turnover" type Crystal Pick-up.

PRICE **£4.12.6.** (Plus 3/6 carr. & ins.)

or we supply it without the Pick-up but including Turntable.

PRICE **£2.18.0.** (Plus 3/6 carr. & ins.).

DESIGNS FOR THE HOME CONSTRUCTOR

THE COMPLETE SPECIFICATIONS OF THE FOLLOWING UNITS ARE AVAILABLE FOR 1/6 EACH.

THESE MANUALS ALSO INCLUDE THEORETICAL and PRACTICAL WIRING DIAGRAMS, AND A COMPLETE COMPONENT PRICE LIST.

The "wire-to-wire" Practical Diagrams are very simple to follow and are drawn for the "inexperienced" Constructor.

- **STERN'S F.M. TUNING UNIT** . . . This is illustrated and briefly described here and can be completely built for **£10.0.0.** It is now available.
- **STERN'S COMBINED AM FM TUNING UNIT** . . . Precisely similar in appearance to the F.M. Tuner and can be completely built for **£13.0.0.** Will be available early May.
- **THE DENCO F.M. TUNING UNIT** . . . The complete set of SPECIFIED COMPONENTS to build this can be supplied for **£7.2.9.** this includes the Denco Dial and Drive Assembly.

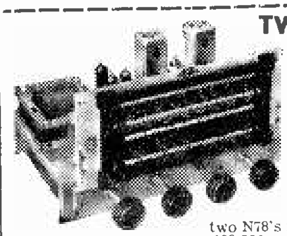
NOTE TO CONSTRUCTORS . . . Where desired our technical staff will, at a reasonable charge, tune and align either of the above units.

- **STERN'S "fidelity" PREAMPLIFIER-TONE CONTROL UNIT** . . . A design for the "Hi-Fi" enthusiast ! ! ! Briefly, it has inputs for MICROPHONES, HIGH and LOW GAIN PICK-UPS, and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL. (b) STEEP CUT FILTER. (c) Continuously variable BASS and TREBLE CONTROLS and a VARIABLE OUTPUT CONTROL which enables its use with any make or type of Amplifier . . . THE COMPLETE KIT OF PARTS is available now for **£6.6.0.**
- **STERN'S "fidelity" 10-WATT AMPLIFIER** . . . This design comprises the MAIN AMPLIFIER of the famous MULLARD 5-10 design and our own "fidelity" PREAMPLIFIER-TONE CONTROL UNIT which we describe briefly above. We incorporate the latest GILSEN ULTRALINEAR OUTPUT TRANSFORMER and the combination of these two units undoubtedly provides reproduction of extremely high quality, in fact, the complete Amplifier is comparable to the very expensive commercially made High Fidelity models. We offer the COMPLETE KIT OF PARTS FOR **£15.15.0.** Will be available at the end of May.
- **STERN'S HIGH QUALITY 8-10 WATT AMPLIFIER** . . . This is illustrated and briefly described here. It is one of the most successful Amplifiers (in the lower price range) yet offered to the Home Constructor. WE can supply the complete Kit ex-stock.
- **STERN'S "JUNIOR" PREAMPLIFIER-TONE CONTROL UNIT** . . . Provides full control of BASS and TREBLE in conjunction with main VOLUME CONTROL and can be used with any Amplifier. The unit contains its own POWER SUPPLY . . . THE COMPLETE KIT OF PARTS is available at **£3.16.9.**
- **STERN'S "PERSONAL SET" BATTERY ELIMINATORS** . . . Complete Kits OF PARTS to build Midget "All-dry" Battery Eliminators (a) Providing approx. 69 Volts at 10 m.a and 1.4 Volts at 250 m.a. Price **42/6.** (b) Providing approx. 90 Volts at 10 m/a and 1.4 Volts at 250 m/a. Price **47/6.**

ALL COMPONENTS TO BUILD THESE AMPLIFIERS, TUNERS, ETC., ARE AVAILABLE FOR SALE SEPARATELY. CONSTRUCTORS CAN, THEREFORE, GRADUALLY BUILD ANY UNIT.

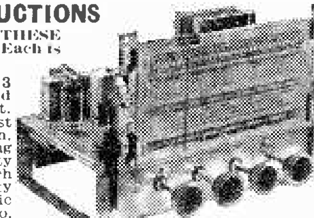
TWO REALLY GENUINE PRICE REDUCTIONS

A BULK PURCHASE ENABLES US TO OFFER THESE RECEIVER CHASSIS AT SUCH LOW PRICES. Each is BRAND NEW and FULLY GUARANTEED.



The **MODEL AW3-7** A 7-valve 3 waveband Superhet Chassis having a push-pull stage for approximately 6 watts output. Made by a well-known manufacturer and incorporate the latest Osram Valve Line-up of X79-W77-DH77-H77-U78 and two N78's in Push-Pull. They cover 3 wave-bands 18-50 metres, 190-550 and 800-2,000 metres, and are for operation on A.C. mains 200-250 volts. A Gram position is on the Wavechange Switch.

PRICE **£12.19.6.** (Plus 7/6 carr.& ins.) H.P. Terms: Deposit £6/9/6 and 8 monthly payments of 18/9.



The **MODEL B.3** 5-valve 3-waveband A.C. mains Superhet. Designed to the most modern specification, great attention having been given to the quality of reproduction which gives excellent clarity of speech and music on both gram. and radio, making them the ideal replacement chassis for that "old radiogram," etc.: Valve Line-up. 6BE6-6BA6-6AT6-6BW6-6X4; coverage: sht. 16-50, med. 187-550, lg. 900-2,000 metres.

PRICE. **£11.11.0.** (Plus 7/6 carr. & ins.) H.P. Terms: Deposit £5 16/- and 7 monthly payments of 19/3.

STERN'S "COMPACT 5" AMPLIFIERS

(a) The "**COMPACT 5-2**" A Two-stage high sensitivity Amplifier having SEPARATE BASS and TREBLE CONTROLS and designed to give up to approx. 5 watts with very pleasing quality. PRICE £5 15/- (plus 5/- carr. and in.).

(b) The "**COMPACT 5-3**" A Three-stage version of the "5-2" model, but in this case having an additional stage and incorporating Negative Feedback. PRICE £6 16/- (plus 5/- carr. and insurance).

Expressly developed for very high quality reproduction of Gram. Records and particularly suitable for high quality reproduction of the FM transmissions. Two models are available: A separate **POWER SUPPLY UNIT** to operate with these amplifiers is available for £2 10/- (plus 2/- carr. & ins.). Has additional supply available for Radio Tuner, etc.

The Amplifiers are compact and very attractively designed, having a Bronze Gold finish with a fully engraved front panel by which the entire Amplifier is conveniently mounted into a Cabinet, thus occupying no more space than a conventional Tone Control Unit.

STERN RADIO LTD. 109 & 115 FLEET STREET, LONDON, E.C.4. (Telephone: FLEet 5812/3/4)

Servicing Radio Receivers

G.E.C. BC5246 Series

By Gordon J. King, A.M.I.P.R.E.

THIS is a five-valve (including H.T. rectifier) compact three waveband A.C. mains only receiver. It is housed in an attractive brown bakelite cabinet ; two frame aerials are mounted on the card cabinet back and are connected to the chassis by means of a plug and socket. The waveband ranges are 1,000 to 2,000 metres, 185 to 572 metres, and 13.5 to 50 metres. The series is fairly recent and was released to the market during the latter part of 1953.

It should be mentioned that a similar receiver for A.C./D.C. operation (Model BT6245) was also released at about the same time. This model, however, differs slightly in circuit make-up and in valve line-up from the A.C. only version.

Circuit Description

From the receiver's circuit diagram at Fig. 1 it may be seen that on long and medium wavebands the two frame aerials L3 and L4 collect the signal and pass it on to the signal grid of the frequency changer valve V1. On short-wave an external aerial is, of course, required, and in this case the signal is coupled to the short-wave aerial coil L2 by means of the primary winding L1. When an aerial is so used additional pick-up is achieved also on the long and medium wavebands by reason of the common impedance existing across the 3,950 pF capacitor connected at the earthy end of L4.

Switches S1A and S1B perform the function of selecting the required aerial coil, which is tuned by C1 section of the tuning gang. The 10 K resistor connected across the aerial and earth terminals serves the purpose of discharging static built up on the aerial.

Coils L5/6, L7 and L8 are for short-, medium- and long-wave oscillator functions respectively. On short-wave L6 works as a feedback winding, while feedback on long and medium-waves occurs as the result of a common impedance existing across the 425 pF fixed padder capacitor in the earthy end of the oscillator circuit. Switches S1C and S1D select the required oscillator coil, and are ganged to S1A and S1B in the form of a Yaxley type three-position switch wafer. The oscillator is tuned by C2 section of the tuning gang.

An intermediate frequency of 470 kc/s is developed across the first I.F. transformer (I.F.T.1) and is fed to the signal grid of the I.F. amplifier valve V2. The amplified signals thus appearing across the second I.F. transformer (I.F.T.2) are passed on to the signal diode in V3 for demodulation.

The volume control R1 acts as the detector load and the associated 300 pF capacitor serves to filter the unwanted I.F. which may be present at this point. The A.F. signal so derived is conveyed to the grid of the triode section of V3 through the 0.02 μF coupling capacitor. This triode is used as an A.F. amplifier and raises the A.F. voltage to a level suitable for driving the output valve V4. The signal as will be seen is taken from the anode circuit through an 0.005 μF coupling capacitor and a potential divider network to the signal grid of V4.

Varying degrees of tone correction are given by the 0.005 μF capacitor in the grid circuit of V4, by the 0.01 μF capacitor in the anode circuit, and by the omission of a by-pass capacitor across the 150 ohm cathode resistor, which also provides negative feedback.

A.V.C.

Some of the I.F. signal appearing at the anode of the I.F. amplifier valve V2 is taken to the second, or A.V.C. diode in V3 through the 22 pF coupling capacitor. This signal is thus rectified independently and gives rise to a potential, negative with respect to chassis, across the 470 K load resistor which is used as A.V.C. bias for the first and second valves.

The potential is filtered from the R.F. point of view by means of the 1 megohm resistor and the

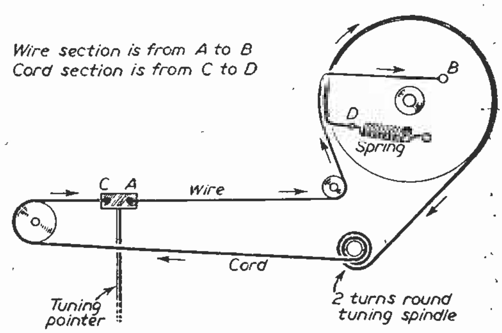


Fig. 4.—Details of the Cord Drive for the Tuning Dial.

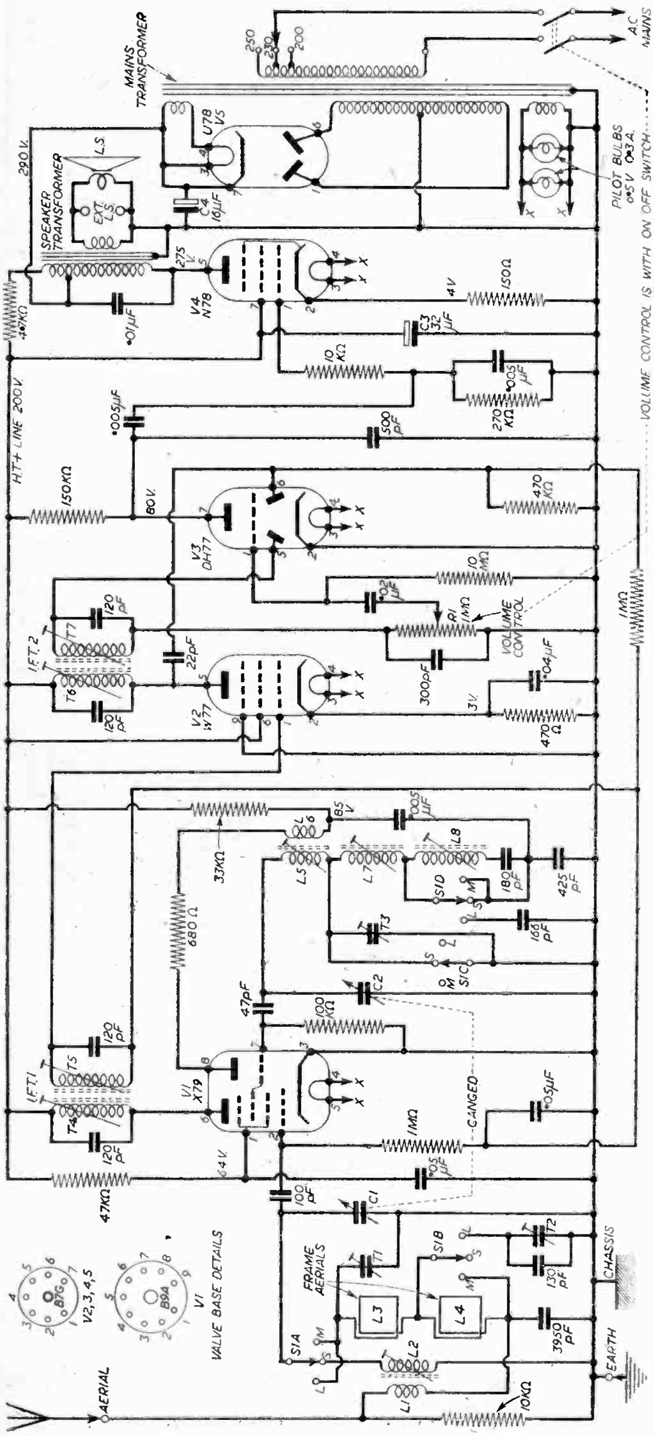


Fig. 1.—Theoretical circuit of the G.E.C. BC5246.

associated 0.05 μF capacitor. V1 is biased solely by this control potential, but V2 is in receipt of a degree of standing bias as the result of the voltage drop across the 470 ohm cathode resistor.

The Power Supply

H.T. current is supplied by the full-wave indirectly-heated rectifier valve V5, and smoothing is achieved partly by the 16 and 32 μF electrolytic capacitors C4 and C3, and partly by the hum neutralising effect created by passing the H.T. current through a section of the primary winding on the speaker transformer.

L.T. for the rectifier is given by an isolated winding on the mains transformer, while a separate winding caters for the remaining valve heaters and the two pilot bulbs.

General Notes

The drive cord arrangement on this receiver is rather unusual in the fact that it is made up of approximately 2ft. of ordinary drive cord, such as nylon thread, and about 1ft. of steel flexible wire. The wire section is used between one side of the tuning pointer carriage and the tuning drum, and the cord section is used between the tuning drum—being connected direct to the tension spring—and the other side of the tuning pointer carriage; the cord section also passes round the tuning spindle and the left-hand pulley. The arrangement is illustrated at Fig. 4 when the tuning gang is at minimum capacitance.

The tuning pointer should be accurately positioned by turning the gang to maximum capacitance and sliding the carriage along the scale plate until its right-hand edge, as viewing from the front, coincides with 90 marked on the substitute scale.

Alignment

The I.F. stages are first aligned by applying a modulated 470 kc/s signal from a service oscillator or signal generator, via an 0.1 μF capacitor in each lead, to pin 2 of V1 and chassis. The local oscillator should be muted by shorting C2 section of the tuning gang and the receiver tuned to the low-frequency end of the M.W. band. It is desirable to use an output meter as resonance indicator; this, if desired, may be connected to the extension loudspeaker sockets.

Throughout the whole of the alignment process the generator signal should be kept as low as possible, consistent with usable

(Continued on page 277)

indication on the output meter, in order to avoid alignment errors as the result of the action of the A.V.C. system.

Trimmers T7 (Fig. 3), T6 (Fig. 2), T5 (Fig. 3) and T4 (Fig. 2) should be adjusted in that order for maximum indication on the output meter. The process should be repeated until no improvement is possible.

R.F. and Oscillator Alignment

The signal generator output leads should be disconnected from V1 and transferred to the aerial and earth sockets, via an all-wave dummy aerial. Remove the short-circuit from across C2, and check that the right-hand edge of the tuning pointer carriage coincides with 90 on the substitute scale.

Tune the receiver to the 85 mark on the substitute scale, switch to S.W., feed in a 6 Mc/s modulated signal and adjust the cores in L5/6 and L1/2 (Fig. 3) for maximum output ; repeat these adjustments until no further improvement is possible.

Tune the receiver to the 71.5 mark on the substitute scale, switch to M.W., feed in a 600 kc/s modulated signal and adjust the core in L7 (Fig. 3) for maximum output.

Tune the receiver to the 6 mark on the substitute scale, feed in a 1,500 kc/s modulated signal and adjust T3 and T1 (Fig. 2) for maximum output. Repeat these adjustments.

Tune the receiver to the 26 mark on the substitute scale, switch to L.W., feed in a 230 kc/s modulated signal and adjust the core of L8 (Fig. 3) and the trimmer T2 (Fig. 2) for maximum output. Repeat these adjustments until no further improvement can be obtained.

Servicing Notes

In a few earlier models of this series the 0.04 μF V2 cathode capacitor and the 0.005 μF tone compensating capacitor in the grid circuit of V4 were omitted ; the screen feed for V2 was also taken to the screen-grid of V1 and both were energised from the H.T. line through a common resistor.

Excessive noise on these receivers, which seems to point to noisy valves, is often caused by poor connections between the valve pins and the valveholder sockets. The effect can be located by wriggling the valves in their holders while the receiver is working. It can be cleared by carefully cleaning the valve pins with fine emery cloth.

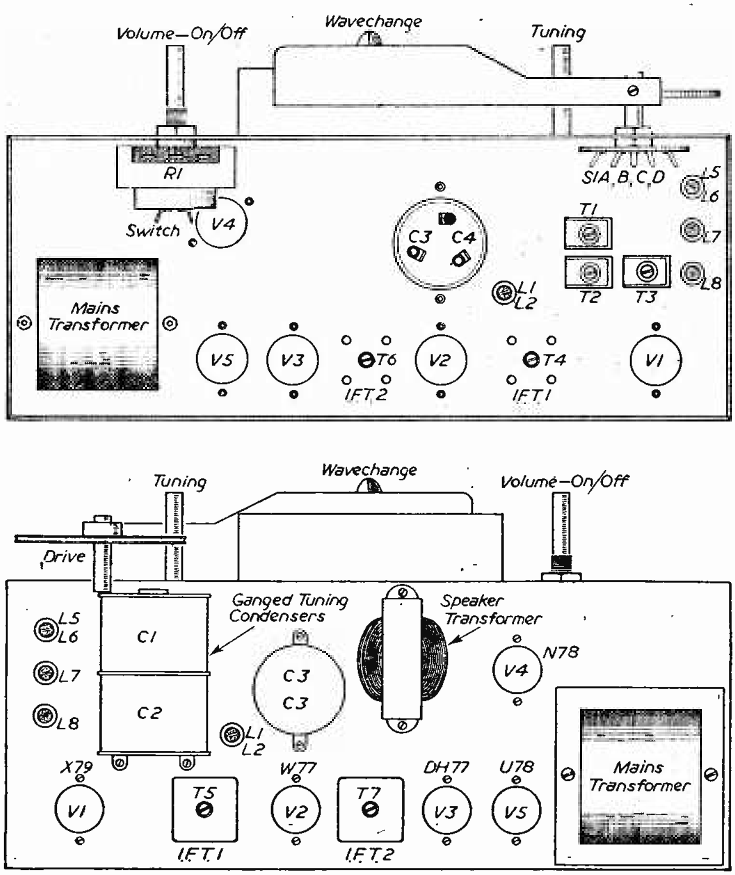
Intermittent fall-off in sensitivity is sometimes caused by an alteration in value of one of the 120 pF fixed I.F. tuning capacitors. These are situated beneath the I.F. transformer screening cans and often escape attention. A permanent fault in one of them often gives rise to the symptom of low sensitivity which has no apparent cause. Trouble of this kind, however can be located quite quickly by running through the I.F. alignment procedure ; it will be revealed by flat tuning of the associated I.F. transformer winding—it may, in fact, be found that the coil tends to start peaking when the core is coming well out of the former.

Excessive distortion should lead one to check the cathode voltage of V4. If this is above the stipulated 4 volts, the 0.005 μF coupling capacitor should be suspected for high resistance. Replacement should be made with a component of high quality in order to avoid further trouble of this kind.

If the voltage at the cathode of V4 is near normal, the 150 K resistor in the anode circuit of V3 should be checked for value. This sometimes rises to two or three times its normal value.

A short or resistance developing across the 22 pF A.V.C. coupling capacitor has been known to cut off the receiver completely. Again, this part should be replaced with a good quality mica capacitor.

Another cause of total lack of signals is the oscillator grid 47 pF coupling capacitor going either open-circuit or high in value.



Figs. 2 and 3.—Above and below chassis layout with main components identified.

Programme Pointers

Our Critic Maurice Reeve, Reviews Some Recent Programmes

THAT we sometimes have to be "Cruel to be kind," is a very old adage. But seldom can it have been more applicable than when applied to one or two recent revivals of Itma. How Mr. Handley and his colleagues show up the modern standard of Music Hall talent. For only one or two regular features to-day, and an odd item or so from here and there, can hold a candle to those maestros of yesteryear. But we will not detail either their superior virtues, collectively and individually, or present their shortcomings. We must all be frightfully glad to have them back with us. As we undoubtedly are when we are so fortunate as to strike an early Chaplin Keystone or Essanay film at the cinema.

Nostalgia

A large cast of present habitués, and others "standing in" for those of bygone days, gave a pleasant and nostalgic programme of reminiscences based on the ninety years' history of the famous Café Royal, of Regent Street. Nothing very shocking or scandalous came out of it, and the programme gave what was, I should imagine, a much too Trilby-ish picture of this celebrated continental oasis in the London Sahara. Oscar Wilde came out as a grand signeur but otherwise a quite harmless gentleman. Frank Harris, in company with G. B. S. of all people !, as a gargantuan eater. George Moore as a gregarious literateur, etc. etc. The programme was arranged by Guy Begby and edited by Sasha Moorsom. The narrator being Roger Livesey.

Honourable Intentions

How do we propose? What do we say, or write, when we want to beguile or cajole the Fair One into granting us our lifelong happiness? What would we think, to-day, of ourselves in those yesterdays, if we were forced to listen to playbacks of our avowals and promises, and hopes? These, with other interesting and kindred topics, formed the subject of an entertaining half-hour, "Honourable Intentions," compiled and produced by Nesta Pain, and given by Michael Hordern.

Sporting Views

The hour-long "Sports Report," under the bright, breezy and buoyant Eamonn Andrews, has settled down into a very entertaining and informative programme. Correspondents, commentators, reporters, interviewers and others are alert and always at their posts. League tables are up to date to the last minute. Winners of £75,000 are brought half an hour nearer El Dorado, whilst most others are thrown back on their own resources by the same amount of time. Rubbishy "competitions" have now been scrapped. In short, it has become an efficient and business-like centre where hopes and fears mix on equal terms. Whilst the less inhibited, over a quiet pipe, enjoy the news of who has won.

Gilbert and Sullivan

The Gilbert and Sullivan biographical series concluded on a satisfactory note. But a letter in a London newspaper, from an octogenarian niece of Gilbert's, wondered whether the stern authoritarian of the radio programmes bore any relationship to the kindly and genial Uncle of her memory. I have no such knowledge to go on, of course, but I did wonder how near verisimilitude the character had been drawn. Gilbert was made to talk to a great leading actor like George Grossmith as though he, Grossmith, were the prettiest of underlings. "Yes, Mr. Gilbert," "No, Mr. Gilbert," was almost all we heard the famous player say. Doubtless we shall never know the exact truth.

Stars in Their Choices

I listened to "Life with Father," with Ralph Truman in one of the series of "Stars in Their Choices," for 40 minutes, but it so bored me that I changed over to Elgar's Second Symphony at the Royal Philharmonic Society's concert. I didn't expect any laughs there and wasn't disappointed. But the play, I believe, holds the all-time Broadway record for length of run. As Americans are most unlikely to have lavished such favours on such a piece of dud wit, I can only conclude that Father and the family must have lost all their wit and appeal on the way over. It seemed to me an inexpressibly uninteresting play.

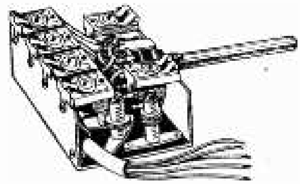
"Escape Me Never," by Margaret Kennedy, with Mai Zetterling choosing it this time in the course of her passage through stardom, is yet another piece which just makes one sit down and wonder. A favourite ever since first produced 20-odd years ago, it is nothing but a miasma of confused thinking and romantic nonsense run riot. Possibly a good "starring" vehicle on the stage—for Elizabeth Bergner found it so, at any rate—but listening, without anything to look at, made one feel like being in Hampton Court maze screaming for assistance to get out. Miss Zetterling sounded very gay, foolish and fanciful, but some of our "stars" certainly have some weird "choices," as I remarked once before.

How to Live on £7 10s.

"Saturday Night at the Crown," by Walter Greenwood, was an instructive lesson in how to live, married, on £7 10s. per week, including 18s. for television and sundry others for drinks and smokes, etc. I forget whether anyone paid any rent or bought any clothes. However, it was a North Country witticism well played and produced.

REPANCO HIGH GAIN SUPERHET COIL PACK

TYPE LMS



Size $2\frac{5}{8} \times 2\frac{3}{8} \times 1\frac{1}{2}$in.
Long Wave 900-2,000 m.
Medium Wave 190-550 m.
Short Wave 16-60 m.
Aligned before Despatch.

36/- Inc. Tax
Complete with 5-valve Superhet Wiring Diagrams

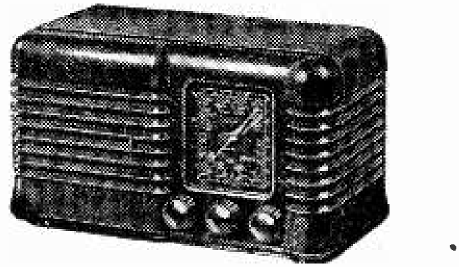
Send S.A.E. for Catalogue of Complete Range of Coils.

REPANCO HIGH-GAIN LOW-NOISE BAND III CONVERTER

Self-contained Power Supply. Easy to Build. Envelope of comprehensive wiring plans and instructions, 1/9 (post free).

RADIO EXPERIMENTAL PRODUCTS LTD.
33 MUCH PARK STREET, COVENTRY
Phone : 62572

PROFESSIONAL 3 VALVE MAINS SET



109/6
Plus 2/8 for Postage & Packing

A straight T.R.F. A.C. Mains set—in Brown or Ivory cabinet—requires no radio knowledge to assemble. Easy-to-read diagrams take you step by step. Only tools needed are pliers, screwdriver and soldering iron. ALL parts in stock NOW. Order AT ONCE—these are the sets to SHOW to FRIENDS.

. . . OR A REALLY SELECTIVE 5 VALVE SUPERHET

Complete parts available for this fine SUPERHET Receiver. Similar cabinet to that illustrated in brown or ivory, but with terrific power and volume on both Long and Medium Waves. Specially designed for "fringe" areas! Only 138/6, plus 2/8 postage and packing.

EASY INSTRUCTIONS AND "KNOW-HOW" DIAGRAMS, 1/-, POST FREE. SEND TO-DAY!

NORMAN H. FIELD
MAIL ORDERS : 20, Snow Hill, Birmingham, 4
CALLERS 68, Hurst Street, Birmingham, 5

Best Buy at Britain's

FURZEHILL CRYSTAL CALIBRATORS.—Contained in polished laminated plastic case, size 12in. x 7in. x 8in. deep. Six valves. A 1 Mc/s crystal controlled oscillator controls two multi-vibrators, enabling the instrument to give switched 10, 100, or 1,000 Kc/s "pips." Built-in modulator. Can be used for checking transmitters or receiver calibration. Operates from 2 v. L.T. and 120 v. H.T. Complete with circuit, instructions, valves and crystal. Brand new condition, a real SNIP at ONLY 49/6, plus 3/- postage.
I.F. STRIP TYPE 373.—2 EF92 and 1 EF91 9.72 Mc/s. I.F. amplifiers, EB91 Det/A.G.C., EF91 A.G.C. Amp., EF91 Limiter. Size $10\frac{3}{4}$in. x $2\frac{1}{4}$in. x 3in. high. Price, less valves, 7/6. Circuit supplied.
RECEIVERS TYPE R1155.—In excellent condition, thoroughly checked and air-tested. These first-class communications receivers are available from £5.19.6, according to condition. Send S.A.E. for particulars or 1/3 for comprehensive booklet.
A.C. MAINS POWER PACK & OUTPUT STAGE.—These enable the R1155 to be used on the mains WITHOUT ANY MODIFICATION. Three types available. £4.10.0 £5.5.0 and de-luxe model with 8in. speaker, £6.10.0. Carriage 5/-. All Power Packs guaranteed six months.
DUAL VOLTAGE BLOWERS.—12 and 24 v. Ideal for hair dryers, car heaters, etc., 25/- plus 2/6 postage.
SOUND-POWERED HANDSETS.—Similar to telephone. Balanced armature microphone and earpiece. No batteries required, 10/6 each. Breast mike and pr. headphones, 12/6 set, post 1/3 either.

METER BARGAINS. New and Boxed.

1 milliamp. D.C.	M/C. 2in. Flush. Square. Fe/NFe	... 22/6
10 Miliamp D.C.	M/C. $2\frac{1}{4}$in. Fl. Circ. Blank scale	... 10/6
100 milliamp. D.C.	M/C. $2\frac{1}{2}$in. Flush, Circular ...	... 10/6
150 milliamp. D.C.	M/C. 2in. Flush, Square ...	... 7/6
1 Amp. R.F. Thermo-Couple	$2\frac{1}{2}$in. Projecting, Circular	... 6/9
4 Amp. R.F. Thermo-Couple	2in. Flush, Square	... 6/9
20 Amp. D.C.	M/C. 2in. Projecting, Circular ...	... 7/6
30-0-30 Amp. D.C.	M/I. 2in. Proj. Circ. Metal Car type	... 5/-
15 volts A.C.	M/I. $2\frac{1}{2}$in. Flush, Circular ...	... 8/6
300 volts D.C.	M/C. 2in. Flush. Square	... 10/6

MINIATURE MODEL MOTORS.—2in. long x $1\frac{1}{4}$in. diam., 3/16in. diam. spindle, weight 5 ozs. Will work from 6-volt dry battery and are reversible. Ball bearings. Price 8/6.
METER RECTIFIERS.—1 mA. Salford Instruments, 8/6. 2 mA. S.T.C., as used in E.M.I. Output Meter, 5/6. All full wave bridge and brand new.
METAL RECTIFIERS.—250 volts, 100 mA, 6/9 each. 230 volts, 60 mA, 5/- each.

CHARLES BRITAIN (RADIO) LTD.
11, Upper Saint Martin's Lane, London, W.C.2.
TEMple Bar 0545
Shop hours 9-6 p.m. (9-1 p.m. Thursday) Open All Day Saturday

Train for a wonderful future in—

ELECTRONICS

Train to meet the need for pioneers in this expanding field.

Every day the demand for the expert in electronics grows. Radio, television, radar and the whole field of industrial automation are rapidly expanding, and the trained specialist assures for himself a well-paid career in this quickly developing profession. Here is your opportunity to enter for

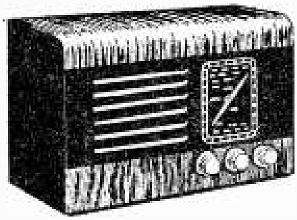
1-year course

Full-time day course in the Principles and Practice of Radio and Television. Mainly designed for the training of Radio and Television Servicing Engineers. Next course, commencing May 22nd, is already fully booked. Enrolments for following course, commencing September 11th, now being accepted.

E.M.I. INSTITUTES
Dept. 32, 10, Pembridge Square, London, W.2.
Telephone : BAYswater 5131/2

The College associated with a world-wide electronics industry, including "His Master's Voice," Marconiphone, Columbia, etc.

BUILD THIS FOR £5. 7. 6.!



Total building cost including choice of beautiful walnut veneered cabinet or ivory or brown bakelite. **This is the lowest possible price consistent with high quality. No radio knowledge whatever needed . . . can be built by anyone in 2-3 hours,** using our very simple, easy-to-follow diagrams. This terrific new circuit covers all medium and long waves with optional negative feedback, has razor-edge selectivity, and exceptionally good tone. Price also includes ready drilled and punched chassis, set of simple easy-to-follow plans—in fact, everything! All parts sparkling brand-new—no junk! **Every single part tested before despatching.** Uses standard octal-base valves: 6K7G high-frequency pentode feeding into 6J5G anode-bend detector triode, coupled to 6V6G powerful output beam-power tetrode, fed by robust rectifier. For A.C. Mains, 200-250 Volts (low running costs—approximately 18 Watts!). Size 12in. x 6in. x 5in. **Build this long range powerful midget NOW. All parts and set of plans. £5-7-6.** (Post and packing 3/6.) C.O.D. 1/6 extra. Priced Parts Lists, 2/-. **Orders despatched instantly.**

CONCORD ELECTRONICS (Dept. PK6), 39, Queens Road, Brighton, 1.

ALFRED PADGETT

40, MEADOW LANE, LEEDS 11

Tel.: Cleckheaton 93

New TX 1154 Model H. In maker's cases. Four-wave Band. The best of all 1154 sets. All alll chassis, **37 6.** Carriage 12 6 (complete with all valves).

New TX 1154 Model N. In maker's cases. Three-wave Model. Complete with all valves, **25 -.** Carriage 12 6.

Bring your T.V. set up to date with the ZC13312 R.D.F. No. 1 set. These sets are Brand New in makers' metal case. R.F. osc. and mixer stages. Suitable for I.T.A. 4 I.F. stages and they are tunable. Valve line up: 13 in all—5 VR65, 1 CV63, 1 VR137, 2 VR66, 1 VR54, 3 VR92, less power pack, but otherwise complete. This is offered at the very low price of **15/-** only, with 13 valves. Less valves, **8 6.** Carriage and packing, **7/6.**

Condenser Bargain. 8 x 8 x 8 450 volts working and surge proof, neat and compact, **2 6,** post 9d. **£1.5.0** per doz. lots, post free.

Special purchase of Crystal Diodes. 10d. each. Post 2½d. These are the Real McCoy, with long wire ends, and will put real pep into any crystal set.

Small 24-Volt A.C./D.C. Motor. 1,800 revs. p.m. Good torque on 12 volts. Brand New, **3/6** (scrap price), post 1 9.

Small Ball Races for model maker, etc., **6d.** each, post 3d. Doz. lots **5 -,** post free.

Small Metal Rectifiers. 12 months' guaranteed. 250 volts at 100 mills. **6 6,** post 1 3.

Brand New 3BP1, complete with base and screening case. Just the job for a scope or bedside T.V., **15/-,** insurance and packing 4 -.

Radio Valves with a 90 days' guarantee, post 9d. per valve. Doz. lots post free less 5 per cent.

8D2, **1/-**; VR56, **4/-**; 6K79, **4/-**; 6H6G, **1/3**; 6H6M, **1 9**; 6G6, **3 6**; 6SN7, **6/6**; 6X5, **5 -**; 2X2, **1/6**; VU111, **1 6**; 954, **1 3**; CV6, **1 -**; VR137, **1/3**; VR65, **1 6**; VR66, **1 -**; VR54, **9d.**; CV63, **1/-**; VR92, **9d.**

Handy Box of Mixed B.A. Nuts and Bolts. ½lb. weight, **1/-,** post 9d.

G.W. SMITH & CO (RADIO) LIMITED

3-34 LISLE STREET, LONDON, W.C.2

TELEPHONE: GERRARD 8204/9155

FANTASTIC OFFER
BENDIX COMMAND RECEIVERS

Four types available. All complete with valves and in perfect condition. Valve line-up, 12SK7, 12K8, 12SK7, 12SK7, 12SR7, 12A6.

BC-454. Coverage 3-6 Mc/s ...	25/-
BC-455. Coverage 6-9 Mc/s ...	27/6
BC-453. "Q-Fiver." Coverage 190-550 Kc/s....	59/6
TOP BAND MODEL. Coverage 1.5-3 Mc/s	65/-

BUY NOW WHILE THEY LAST.

DEAF-AIDS. Few only left. Complete with 3 miniature valves, volume and tone control, crystal mike, etc., less only outside bakelite case, **19/6.** Earpieces to match, **3/6**; leads, **1/-**; batteries, **2/9.** Spare valves, CK505, **2/6**; spare pots, 1 meg., **1/-.**

AMERICAN HEADSETS. Best quality moving coil type with earmuffs and connector leads, 20 ohms, brand new, **17/6** pr.

MODULATION TRANSFORMERS. Brand new "Collins" type, push-pull 807 to 807, 20 watts, **12/6.**

CHOKE BARGAINS. G.B. type, 20 H. 175 m/a, **10/6.** Parmeko swinging choke, 3.6-4.2 Henry 250 m/a. **10/6.** Collins potted type, 8 H. 100 m/a, **8/6.**

METER BARGAINS

50 microamp. 2½in. F.M.M.C. ...	59/6
100 microamp. 2½in. F.M.M.C. ...	39/6
500 microamp. 2in. F.M.M.C. ...	16/6
50 m/amp. 2in. F.M.M.C.	7/6
200 m/amp. 2½in. F.M.M.C.	9/6
1 amp. R.F. 2½in. F.M.T.C.	6/9
1 amp. R.F. 2½in. Pj.T.C.	5/-
4 amp. R.F. 2in. F.M.T.C.	5/-
300 volt D.C. 2in. F.M.M.C.	10/6
300 volt A.C. 2½in. F.M.M.I.... ...	25/-
500/0/500 microamp. 2½in. F.M. ...	25/-

JACK PLUG LEADS. 6ft. screened lead with 2 standard jack plugs, **3/-.**

12 v. ROTARIES. Input 12 v. D.C. Output 180 v. 65 m/a fully smoothed, **19/6.**

ROTARY CONVERTORS. Input 24 v. D.C. Output 230 volt A.C. 50 cycles, 100 watts, **92/6.**

BATTERY CHARGING EQUIPMENT. Transformers, 200/250 v. input. (1) 9 or 15 v. 1 amp, **9/9**; (2) 3.5, 9 or 15 v. 2 amp, **14/3**; (3) 3.5, 9 or 15 v. 4 amp, **16/6.** Rectifiers. Full wave and bridged. 12 v. 1 amp, **7/6**; 12 v. 2 amp, **11/3**; 12 v. 4 amp, **14/3.**

BARGAIN COMPONENTS. Crystal diodes, **10d.** Complete crystal set kit, **9/11.** 8-bank 12-way Yaxley switch, **7/6.** VU111 4 v. e.h.t. rect., **1/9.** 2,000 mfd. 50 v., **4/6.** TCC 100 mfd. 25 v., **9d.** 4 mfd. 500 v., paper, **1/3.** Mains/6.3 v. 1.5 a. Tr., **5/9.** Midget 465 kc/s IFT, **8/6** pr. Twin 3 amp mains flex, 12 yds., **2/6.** Toggle on-off, **9d.** 3 bank 5 a. switchbox, **1/9.** Fuses, 1¼in, all sizes, **3d.** Fuseholder, **5d.**; double, **10d.** Ferrite rod, **6/-**; with M/W. coil, **8/9**; with M/W & L/W coil, **12/9.**

A.R.88 SPARES. Brand new tuning drives, **10/6.** Brand new ceramic switch assemblies, **17/6.**

GRAM MOTOR BARGAIN. Garrard 200/250v. A.C. gram motors complete with turntable, adjustable speed 0-45 r.p.m. Ideal for 33 or 45 r.p.m. L.P. records, only **22/6** each.

HOURS OF BUSINESS: 9 a.m.—6 p.m., Thursday, 1 p.m. Open all day Saturday.

Please print name and address clearly and include postage or carriage on all items.

COPPER WIRE

ENAMELLED, TINNED, LITZ, COTTON AND SILK COVERED. RESISTANCE WIRES, 1oz., 2 oz. & 4 oz. REELS. All gauges available.

B.A. SCREWS, NUTS, WASHERS, soldering tags, eyelets and rivets. EBONITE AND BAKELITE PANELS, TUFNOL ROD, PAXOLIN TYPE COIL FORMERS AND TUBES. ALL DIAMETERS. Latest Radio Publications. SEND STAMP FOR LISTS

SPECIAL OFFER

G.E.C. & B.T.H.
GERMANIUM CRYSTAL DIODES

1/- each. Postage 2½d.

Diagrams and three Crystal Set Circuits Free with each diode.

A large purchase of these fully GUARANTEED diodes from the manufacturers enables us to make this attractive offer.

CRYSTAL SET

INCORPORATING THE SILICON **CRYSTAL VALVE**

Adjustable Iron Cored Coil.

RECEPTION GUARANTEED

Polished wood cabinet, 15/-, post 1/3

A REAL CRYSTAL SET, NOT A TOY

POST RADIO SUPPLIES
33 Bourne Gardens, London, E.4

NEW!

1956 EDITION of Our Supa-Handbook, "The Home Constructor" JUST OUT! incorporating

★**23 CIRCUITS.**—Superhets, T.R.F. Sets, Amplifiers, Feeder Units, Test Equipment, etc.
★**SUPERHETS.**—Full constructional details, supa-simplified layout and point-to-point wiring diagrams for building a variety of superhets.
★**COIL PACK.**—Full constructional details for building a superhet coil pack.
★**CAR RADIO.**—Full constructional details.
★**BATTERY CHARGER,** details for building a **CHEAP** charger.
★**B.F.O. UNIT.**—For converting your receiver to "Communications."
★**I.F. STAGE.**—Adding an I.F. Stage to increase your set's gain and selectivity.
★**MAGIC EYE.**—Details for incorporating a Tuning Indicator for accurate tuning.
★**RADIO GEN.**—Pages of information. Resistance Colour Code, Formulae, and "know-how."
★**CATALOGUE.**—Profusely illustrated price list of components. All for 2 6 (plus 3d. post). Send for your copy *to-day!*

SUPACOILS (Dept. P6.)
21, Markhouse Road, London, E.17
Telephone: KEY 6896

The Editor does not necessarily agree with opinions expressed by his correspondents

A Three-valve A.C./D.C. Superhet

SIR,—I was interested to study the design of the reflex superhet in your February issue, but, in fairness to any beginner who may attempt to make this receiver, the error in the H.T. supply line should be pointed out.

The negative side of the ½-wave rectifier should be connected direct to the junction of the dropper resistance, the .1μF condenser and the mains input.—J. R. CROWTHER (Whitton).

Radio Jack

SIR,—I have received a query about the "Radio Jack" in PRACTICAL WIRELESS for February and one point concerns the load resistor. Apparently, I show it as 680 K. in the circuit diagram (Fig. 1) and 68 K. in the sketch (Fig. 4).

The correct value is 680 K. I hope this has not caused anyone difficulty in obtaining results.—J. B. HUGHES (Liverpool).

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying commercial or surplus equipment. We cannot supply alternative details for receivers described in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of cover.

Electronic Painting

SIR,—On page 102 of your February, 1956, issue you give news of the electronic painting method now being used in Hungary's Red Star Tractor Factory. The tone of the article suggests that you regard this as a novel departure. In fact, we, at Dagenham, have been using this electrostatic principle for some time on our Fordson Major. We have developed the technique to the ultimate hoped for at Red Star, since we paint the whole tractor and not just its components.—J. MOORE, Ford Motor Company, Ltd.

Electric Drills

SIR—I think the Editorial in the March issue of PRACTICAL WIRELESS on the subject of electric drills does not state all of the facts.

Whether an electric drill is styled "handyman" or whether it is a heavy duty industrial job makes no difference, the principles are the same, each is just as capable of killing if incorrectly used.

Agreed that they are safe to use *if properly connected or maintained*, but unfortunately all too often they are not. In many cases I have found drills, apparently earthed, which for one reason or another were found not to be. The position is much worse in the case of home use, too often they are used from a lamp holder, two-pin plugs and even three-pin plugs without a continuous earth on the house system. I know, I see them too often. The reason is usually ignorance, not carelessness.

I have such a drill with a three-pin plug and my house system has a good continuous earth, but I confess I am never really happy using the drill other than on a wooden floor.

At work, we have recently converted all our hand tools to 110 volts, supplied from transformers having the 110 volt side centre-tapped to earth to give a maximum possible 55 volts to earth. This cost a lot of money which is fully justified in the light of experience.

It has been my unfortunate lot to have to investigate and report electrical accidents and fatalities and I have some knowledge of the subject.—WILLIAM BUCKLEY (Luton).

Vibrator Supplies

SIR,—I was very interested in the article entitled "Experiences with Vibrator Supplies," published in the January edition.

Here in Uganda I have on many occasions tried to cut out H.F. interference from vibrators. Owing to frequent very weak reception here, a large amount of amplification is necessary, which increases the interference. I have a 6 volt synchronous vibrator which, mainly for lack of space, has to be mounted separate from the radio chassis and L.F. smoothing. The vibrator has ample chokes, so condensers were tried in various positions. A 50μF across the L.T. input gave a big improvement (this corresponds to the 100μF mentioned in the article), and a slight improvement was given by a 0.02μF from H.T.+ to L.T.+. (The earth is negative.) Screened leads from the vibrator to radio appeared to increase interference. A good earth to the radio chassis made a big improvement, but any earth to the vibrator (other than via the H.T. and L.T. leads) caused a large increase of interference.

I have just completed a radiogram for 6 volts or A.C. mains operation which may be of interest. It consists of a Garrard RC80M, three-speed record changer (6 volts D.C. model), vibrator, radio tuner with 6SK7 (R.F.), 6SA7 (F.C.) and 6B8 (I.F., A.V.C. and second Det), amplifier with 6J7, 6SL7 and two 6V6's in push-pull. In addition there is a U52 as mains rectifier and a 6 volt metal rectifier for the record player on mains. The radio tuner switches off/on records. The current consumption is about 6 amps at 6 volts on either radio or records. It works excellently on batteries, but I have not had a chance to try it on mains.

It may be of interest to readers to know that on the market here Philips, of Holland, have a 6 volt vibrator unit for sale, which gives off 220 volts A.C. at 50 c.p.s. to operate the A.C. mains Philips three-speed record changer from batteries. These units are very effective and the price here for the vibrator unit is £8.—PETER NEAL (Uganda).

A Recording Critic

SIR,—I read with interest the answers to Mr. Kershaw, put forward by Messrs. Depto and Chapman, in your March issue.

Mr. Depto is wrong in thinking that a tip radius of .003in. is usual for microgroove styli, .001in. for 78 r.p.m. and that the compromise size is .0025in.

A tip radius of .001in. is essential for microgrooves: .0025in. is the most acceptable for all the various groove sizes of 78 r.p.m. disks and the compromise is about .00125in.

Mr. Chapman considers that jewel-tipped styli wreck discs. This is, of course, sheer nonsense. He states as a reason the fact that jewels cannot be ground to a point. No stylus, whether metal or jewel, is ground to a point. If it were it would quickly break down and would certainly not fit the grooves.

The tip is always ground to a radius, the optimum being decided by the type of groove for which it is intended. The end of the stylus should not rest on the bottom of the groove as would happen were it pointed.

I hope this letter clears the subject in the minds of these two rather confused gentlemen and of anybody who may have been misled by their statements. —J. ROBERTSON (Manchester, 16).

A Multivibrator Timebase

SIR,—Some readers have queried the use of a VCR97 tube as the basis of an oscilloscope design. The procedure commences with the consideration of the sensitivities of the X and Y deflections. One source quotes these as follows:

X plate 600 mm/kV.

Y plate 1,140 mm/kV.

Hence for 5in. deflection the push-pull output from the timebase would have to be about 212 volts peak and that from the Y amplifier about 110 volts peak.

These sensitivities are quoted for first and final anode potentials of 2 kV. and second anode potential of 350 volts.

Push-pull deflection is simplest achieved using long-tailed pair amplifiers. Design information on these was given in the July, 1955, copy of *Practical Television*.—H. GUY (Sunbury).

"Experiences with Vibrator Supplies"

SIR,—It seems to me that E. R. Beney, of Neatishead (March issue), is rather sanguine about the efficiency of his conversion arrangements for the supply of H.T. Since he gives no figures for the H.T. voltage used it is impossible to give any accurate assessment, but it seems probable that his overall efficiency is in the region of 40 per cent. The fact that he charges two secondary cells in the process means that he loses about 30 per cent. input to each, and to these losses must be added those of the rotary converter.

I should have thought a metal rectifier connected with or without transformer to his output of 230 volts A.C. would have been preferable for charging his H.T. accumulator.—G. BUIDDON (Chelsea).

TONE CONTROLS

(*Continued from page 262*)

takes place. If they are the N.F.B. will largely compensate for the effect of the tone control, thereby appearing to make it ineffective. It is absolutely essential, for proper working, that this is not overlooked. Usually, the control can be situated in an early stage, where N.F.B. is not present. If feedback takes place over the whole amplifier, as is occasionally so, then the control is best inserted in a single valve pre-amplifier stage or a selective type of feedback substituted, as shown in Fig. 8. If feedback is introduced in an amplifier not previously operated in this way, it must be remembered that a considerable reduction in volume arises with any N.F.B. circuit. This addition is thus unsuitable except for amplifiers with ample gain. With powerful equipment great care is necessary to see that the feedback circuit is not wired in the wrong phase, or violent oscillation may damage the output valves or speaker. This will arise if the speaker secondary is wired in the wrong phase. When a feedback circuit is first tried, the equipment should at once be switched off if oscillation begins and secondary connections should be reversed. If oscillation still continues, this is caused by phase-shift in the output transformer and a better-quality component is desirable.

Combined Circuits

In a comprehensive pre-amplifier or tone-control stage, several of the features dealt with may all be used together. For example, a steep-cutting filter, as in Fig. 7, possibly with two or more switched positions, to select the degree of H.F. attenuation and the frequency at which it becomes effective. Often two variable controls, for treble and bass, will be present, a circuit similar to that in Fig. 5 being used. This gives bass and treble compensation, with steep-cutting when required. If circumstances permit the occasional elimination of the steep-cut filter (as when it is required for some stations, but not for others, or required for records only) then a switch can be added to disconnect the condensers, or by-pass the network.

Frequently a bass-cut control is present, usually taking the form of a rotary switch selecting various coupling values, as in Fig. 2. A simple top-cut control, resembling that in Fig. 1, is almost always present. If a comprehensive circuit is to be made up then four controls are desirable: treble cut, bass cut, treble boost and bass boost combined with an optional steep-cut filter, when circumstances make this essential.

Editorial and Advertisement Offices:
"Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone: Temple Bar 4363.
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

HANNEY of BATH offers :—

MULLARD 3-VALVE 3-WATT AMPLIFIER
Gilson Output trans., 25/6 ; Mains trans., 35/- ; Resistor/pot kit, 25/- ; Condenser, 23/6. Send for full list.

"WIRELESS WORLD" F.M. TUNER (May 1955)
Osmor coilset with IF's and RDT, 58 6. J.B. type U.102 variable, 14/6. ERIE condenser and resistor kits, low-loss valveholders and valves. Full list available.

MULLARD F.M. TUNER UNIT
Denco drilled chassis, 21/- ; coilset with IF's, etc., complete, 46/- ; J.B. U.101 variable, 10/9 ; J.B. SL.15 dial/drive assemtly, 25/6 ; condenser and resistor kits, valves, etc. Full list available.

OSRAM 912 F.M. TUNER UNIT
Denco chassis with dial assembly, 37/6 ; Denco coilset IF's and RDT, 44 9 ; 2 gang variable, 17/6. Condenser and resistor kits, valves, etc. Full list available.

MAXI-Q DENCO F.M. TUNER UNIT
Chassis set, 7/6 ; Coilset, 11/9 ; 10.7 Mc s IF's, 6/- each ; Ratio discrim. trans., 12/6 ; Phase discrim. trans., 9/- ; Technical Bulletin giving circuit, point-to-point wiring, etc., 1 9 P.F.

COILPACKS. DENCO CP 4/L and CP 4/M, 35/- ; CP 3/370 pf. and CP 3/500 pf., 44 9 ; OSMOR "Q" HO, 50/5 ; LM, 40/- ; Batt., 50/- ; TRF, 40/- ; HF stage for HO pack, 20/- ; We stock COILS by Weymouth, Osmor, Wearite, Denco and R.E.P.

OSRAM 912 PLUS AMPLIFIER
Erie resistor kit, 17/4 ; Erie 1 meg. pots, 4 6 each ; TCC condenser kit, 55/- ; PARTRIDGE components with loose lead terminations (includes packing charge). Mains trans., 65 6 ; choke, 34 6 ; output trans., 85/6 ; W.B. components. Choke, 18 9 ; output trans., 32/- ; Denco drilled chassis, 14 6 ; Denco 912 Plus printed panel, 7 6 ; pre-amp or passive chassis, 6/-. Full list available.

MULLARD 510 AMPLIFIER
ERIE resistor kits, 27/- ; TCC condensers, 45/- ; Elstone mains trans., 36/- ; Elstone output trans. (state 6,000 or 8,000 ohms), 45/- ; Partridge components (loose leads). Mains trans., 65/6 ; output trans. type PPO (state 6,000 or 8,000 ohms), 85 6 ; smaller version type P.3667, 55/6 ; Denco drilled chassis, 19/6 ; Denco printed panel, 6 6. Full list available.

DENCO WIDE ANGLE COMPONENTS. Magnaview chassis set, 37 6 ; Supervisor chassis, 51 6 ; Magnaview coilset, 41/2 ; scan coils WA/DCA1, 43/- ; focus coil WA FCA1, 31/- ; width and line lin. controls WA/WC1 and WA LC1, 7 6 each ; frame trans. WA FMA1, 21/- ; line trans. WA/LOT1, 42/- ; frame blocking osc. trans. WA FBT1, 16/-.

Send stamp for lists. Please add postage 2/- to all orders under £3. (Excess refunded).

L. F. HANNEY
77, LOWER BRISTOL ROAD, BATH
Tel. : 3811

WHY WASTE TIME

Give that set its best chance
FIT QUALITY COMPONENTS
Catalogue 1/-.

Parts for the following :	Manual
Osram "912" Plus Amplifier	4/-
Mullard 10-watt Amplifier	3/6
The Coventry	
2-watt Amplifier	1/-
4-watt Amplifier	1/-
6-watt Quality Amplifier	1/-
The Coventry A.M. Tuner Unit	1/-
Denco F.M. Tuner Unit	1/6

Complete Component Price Lists will be supplied with each Manual

COVENTRY RADIO
EST. 1925
189, DUNSTABLE ROAD, LUTON, BEDS.
Phone : Luton 2677

THE T.S.L. F.M. TUNER for home construction using Gorler V.H.F. Unit and I.F.s. Full constructional details in Bernards No. 134 manual at 2/6 each. FULL PRICE-LIST in our complete list 6d. Post Paid.

T.S.L. ELECTROSTATIC LOUDSPEAKERS (Tweeters), LSH75, 12/6 each. LSH518, 17/6 each. LSH100, 21/- each. Complete with instructions and circuits.

WE CARRY FULL STOCKS OF "BERNARD" AND "NORMAN PRICE" Publications. All post paid. See our list for details.

BAND III CONVERTERS.—CHANNEL C3, £10/10/0 each, GILLONE CONVERTER, £10/10/0 each. Post Paid.

AERAXIAL CO-AX CABLE for Band III, 10½d. per yard.
Send 6d. in stamps for our Complete Price-List, everything for the engineer, home constructor, etc.

RADIO HAM SHACK LIMITED,
155, SWAN ARCADE, BRADFORD, 1

CONSTRUCTORS build these at

DOWN-TO-EARTH PRICES

PERSONAL PORTABLE RADIO 30/-

This little set was designed to give you a real personal portable radio that you can enjoy anywhere without disturbing others. Use it on camping trips, in bed, in your office, or just anywhere.
Send 2/- for layout, Wiring diagram and Components Price List.

1v SHORT-WAVE RADIO 30/-

- ★ Covers 10-100 metres.
- ★ World-wide reception.
- ★ Low drain valve.
- ★ Picture diagram and instructions for beginners.
- ★ Assembling time 1 hr.

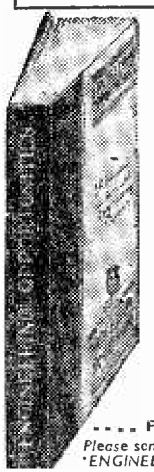
This 1 valve S.W. receiver can be built from our list of components for 30/-, including valve and 1 coil covering 20-40 metres. Provision is made to increase to 2 or 3 valves if required. All components can be purchased separately and are colour-coded so that the beginner can build this set quite easily.
Send 2/- for specification, wiring diagram, layout and price list to :—

R.C.S. PRODUCTS (RADIO) LTD
11 OLIVER ROAD, LONDON, E.17. Mail order only.

FREE TO AMBITIOUS ENGINEERS!

This 144-page Book

Have you sent for your copy ?



'ENGINEERING OPPORTUNITIES' is a highly informative guide to the best-paid Engineering posts. It tells you how you can quickly prepare at home on "NO PASS—NO FEE" terms for a recognised engineering qualification, outlines the widest range of modern Home-Study Courses in all branches of Engineering and explains the benefits of our Employment Dept. If you're earning less than £15 a week you cannot afford to miss reading this unique book. Send for your copy to-day—FREE.

WHICH IS YOUR PET SUBJECT ?
Mechanical Eng.
Electrical Eng.
Civil Engineering
Radio Engineering
Automobile Eng.
Aeronautical Eng.
Production Eng.
Building, Plastics,
Draughtsmanship
Television, etc.

GET SOME LETTERS AFTER YOUR NAME !
A.M.I.Mech.E.
A.M.I.C.E.
A.M.I.P.E.
A.M.I.M.I.
L.I.O.B.
A.F.R.Ae.S.
B.Sc.
A.M.Brit.I.R.E.
CITY & GUILDS
GEN. CERT. OF EDUCATION
etc., etc.

FREE COUPON
Please send me your FREE 144-page "ENGINEERING OPPORTUNITIES"
NAME ....
ADDRESS ....
....
Subject or Exam. that interests me ....

British Institute of Engineering Technology
409B, College House, 29-31, Wright's Lane, Kensington, W.8.

BIET

RECEIVERS & COMPONENTS

MAKING YOUR OWN? Telescopes, Enlargers, Projectors or, in fact, anything using lenses. Then get our booklets "How to use Ex-Gov. Lenses & Prisms," price 2/6 ea. Comprehensive lists of optical, radio and scientific equipment free for s.a.e. H. W. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex.

AMERICAN RADIO Plans and Devices. Now available. Hundreds of new and startling devices you can make. Only designs of this type available in UK. Receivers, walkie talkies, amplifiers, recorders, magic eye alarms, etc., etc. Full lists, data, illustrations Free for stamp. Send to-day.—A.P.S. (PW), Sedgeford, King's Lynn.

LOUDSPEAKERS repaired promptly. MODEL LOUDSPEAKER SERVICE, Bullingdon Rd., Oxford.

MIDDLESBROUGH. Largest stocks on N.-East coast, Radio TV components, FM Kits, Gram Cabinets, Tape Decks, Leak Amplifiers, Valves, etc. Callers only. PALMERS, 106, Newport Road. (Phone: 3096.)

BUILD YOUR OWN T/V and learn about its operation, maintenance and servicing. Qualified engineer-tutor available whilst you are learning and building. Free Brochure from E.M.I. INSTITUTES, Dept. PW58, London, W.4. (Associated with H.M.V.)

B.S.R. Monarch 3-speed Autochange Units, new, in maker's sealed carton, guarantee, complete with instructions, template, suspension springs, **£9/15/-**; carriage paid; immediate delivery. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23.

TELEVISION, 9in. Models, **£6/10/-**; 12in. Models, **£15**; all makes working; carriage paid. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23.

OSMOR would like you to have Free Practical Wiring Diagrams of the latest published circuits with full lists of components required. Send 7½d. (stamps) to OSMOR RADIO PRODUCTS LTD., 418, Brighton Rd., Sth. Croydon, Croydon 5148. (See advert., page 239.)

R.F.UNITS, Types 27 or 26, **25/-**; 25 or 24, **10/-**; brand new with valves; post 2/6. E.W.S. CO., 69, Church Rd., Moseley, Birmingham.

ALL DISTRICTS.—Television Technicians as Technical Agents. Write: TELEPATROL LTD., West St., Epsom, Surrey.

THE HIWAYMAN. A new super Portable Radio for the home constructor; all-dry 4-valve superhet with Ferrite rod aerial; easy wiring diagrams and instructions, **1/6** (post 3d.). RADIO EXPERIMENTAL PRODUCTS LTD., 33, Much Park St., Coventry.

WALNUT Radiogram Cabinets of distinction; stamp details. R. SHAW, 69, Fairlop Rd., E.11.

MIDLAND BAND III CONVERTERS. —Complete kit of parts for "WW" and "Teletron" Converters, including Teletron or Osmor Coils, 2 EF80 valves, drilled chassis and wiring diagram, **45/-**, p. and p. 1/-; as above, with power pack kit, **70/-**, p. and p. 1/6; Teletron and Osmor Coil Sets, **15/-**; Drilled Chassis, **3/9**, p. and p. 9d.; Matched Pairs, 6V6G and GT, **17/-** per pair, p. and p. 6d. R. J. COOPER, 32, South End, Croydon, Surrey. (CRO 9186.)

RATES: 5/6 per line or part thereof, average five words to line, minimum 2 lines. Box No. 1/- extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless," Tower House, Southampton St., Strand, London, W.C.2.

SERVICE SHEETS, T.V. and Radio, over 2,000 models, sale or hire; Valves and Components. S.A.E. with enquiries. W. J. GILBERT, 24, Frithville Gardens, London, W.12.

EX-A.M. High Tension Batteries, all perfect and guaranteed, 120v. small, **4/6**, 90 x 7½ **5/6**, 67½ **4/6**, 60v **2/-**, 22½ **2/-**, etc., etc. Stamp for full list. All incl. p. and p. DIGGINS, 129, Radnor St., M/c. 15.

AMERICAN MAGAZINES. One year's "Audio," **35/-**; "High Fidelity," **50/-**. Specimens **4/-** and **5/-**, respectively. Full list from WILLEN LTD. (Dept. 40), 9, Drapers' Gardens, London, E.C.2.

ELECTROLYTICS, capacity, voltage, size, type of mounting, price, post paid. 250 + 250, 6v, 1in. x 2in. lug, **1/6**; 1,000 + 2,000, 6v, 1 x 3 clip, **3/9**; 250, 12v, ⅝ x 1¼, clip, **1/9**; 500, 12v, ¾ x ¾, W.E., **2/-**; 10, 25v, ½ x 1¼, clip, **1/3**; 25, 25v, ⅝ x 1¾, W/E, **1/6**; 500, 50v, 1 x 3, clip, **3/6**; 50 + 50, 150v, 1⅓ x 2, clip, **2/9**; 100, 275/350v, 1⅜ x 3, clip, **3/3**; 24, 275v, ⅞ x 2, clip, **3/-**; 60 + 250, 275/350v, 1¾ x 4½, clip, **6/3**; 16 + 16 + 8, 350/425, lug, **4/3**; 8, 450v, 1 x 2, clip, **1/9**; 15 + 15, 450v + 20, 25v, 1 x 3, lug, **4/3**; 20 + 10, 450v, 1 x 3, clip, **4/-**; 8, 500v, 1⅜ x 2¾, clip, **2/6**; 32 + 32 + 8, 350/425v, 1⅜ x 3, clip, **5/-**; 32 + 32 + 2, 350/425v, 1⅓ x 2, clip, **4/3**; 5, 150v, ⅝ x 1¼, W.E., **1/3**; 8 + 8, 450v, 1 x 2, clip, **3/9**; 100, 350/425v, 1⅜ x 3, clip, **4/-**; Photoflash Type, 1,000 mf, 200v, wkg., 1¾ x 4½, clip, **12/6**; all Ali Cans, some with sleeves, all voltages, wkg., sure where marked, new stock, guaranteed. Television Chassis, cadmium plated steel, size 13 x 13 x 2¼in., complete with 13 valveholders (9-B9A Pax, 1-B9A Cer., 2-B7G Cer., 1-Int. Oct. Amph.), 20 various tag strips, cut away for metal rec., line trans., etc., **9/11** each, post paid; front and rear tube mounts to fit above chassis, **3/-** pair, post paid. P.M. focus Magnets, wide angle, tetrode tube, fully adjustable, **12/-**, post paid. Scanning Coils, wide angle, with mounting lugs, **19/6**, post paid. Vision I.F.s (2nd, 3rd and 4th), freq. 34 mc/s, slug tuned, size 13/16 x 13/16 x 2¼in. can, set of 3, **5/6**, post paid. Mains Trans 340-220-0, 220-340v, 220mA, 4v 6.5A, 4v 3A, 4v 1.5A, 2v 1.5A, 4v 6.5A, Pri. 0-205-225-245v, **30/-**, postage paid. Mains trans 250-0-250v, 120mA, 6.3v 2.5A, 6.3v 0.6A, Pri. 0-110-125-150-205-225-245v, **17/-**, postage paid. RADIO CLEARANCE LIMITED, 27, Tottenham Court Road, London, W.1. (Telephone: Museum 9188.)

T/V IN PERFECT WORKING ORDER from £14, carriage paid; all makes; many sets suitable use anywhere. Impossible to show complete stocks here. Send s.a.e. for lists of latest bargains. 10in. Marconi **£14**, 9in. Ekco **£15**, 12in. Ekco **£22/10/-**, 12in. Ferguson **£24**. THIS IS A GENUINE OFFER — NOT A "CATCH." 100'S SOLD EVERY WEEK. Callers welcomed. HIGH STREET RADIO, 284-6, High Street, Croydon, Surrey. (Phone: CROydon 9015.)

SERVICE SHEETS for hire, Radio, T.V. Components, Valves, etc., supplied. Send stamp for list. M. FOY, 6, Wykebeck Gardens, Leeds, 9.

SEND TO-DAY for our stock list of T.V. and Radio Bargains, C.R.T.s Valves, Speakers and all Components. We are the cheapest people in the trade. All goods sold by us are guaranteed. VIDEO ELECTRONICS (LONDON) LTD., Dept. P.W., 16/22, Bacon Street, London, E.1.

COIL PACK, 3/9. Bargain parcel incl. 2-gang conds., pair 465, I.F.s (similar drawing) and dial, post 2/-. Speakers **8/9**, 8in. standard, 2-5 ohms, P.M. Ideal extension, post 1/9. V.H.F. 1124 Receiver, **7/6**, 6-channel switch ing, X-W.D. receives T.V. sound, police, amateurs, 30-40 mc/s, I.F. 7 mc/s. Free drawing, less valves post 2/6. V.H.F. 1125 Receiver, **7/9**. Complete with valves and drawings post 2/6 X-W.D. DUKE & CO., 621, Romford Rd., London, E.12. (Grangewood 6677.)

ENGRAVING.—Amateurs and trade surplus can be undertaken by getting in touch with A. G. ENGRAVING, now at 292, Earlsfield Rd., London, S.W.18. (BAT 9897.) (Engravers to well-known makers of Electronic Equipment used by the Aircraft Industry, A.W.R.E., etc.)

GUARANTEED TELEVISION, 12in. models, first-class picture, 5-channel, **£30** each; carriage paid. THE GRAMOPHONE SHOP, 19-21, Brockley Rise, Forest Hill, S.E.23.

SEVERAL EARLY MODELS 9in. Television, complete and mostly working, **£5/5/-** each; carriage paid. TOMLINS, 127, Brockley Rise, Forest Hill, S.E.23. (FOR 5497.)

VIEWMASTER CONVERTER SWITCH, fine tuner, coil mounting plates and tag panel complete, 27/-. DENCO (CLACTON) LIMITED, 357, Old Road, Clacton-on-Sea, Essex.

FM—KIT SETS, Type P4, combines med. wave and power supply with push-pull output, price **£19**. Type PA for FM only, **£5**. Completed receivers: A **£7/10/-**, P4 **£23**. Kits are aligned for you. Guaranteed valves and components. Demonstrations at Marlborough Yard, Archway, N.19.

HOLIDAYS

JERSEY HOLIDAY.—Ham Shack; photo darkroom; s.a.c. for brochure. GC3KPO, "The Lincoln," 3, Saviours Rd.

VALVES

ALL TYPES of new radio valves wanted, small or large quantities; cash payment. R. H. S. LTD. (W), 155, Swan Arcade, Bradford, 1.

WANTED, Valves, EY51, ECL80, KT61, 6U4GT, PL81, 35Z4, etc., etc., prompt cash. WM. CARVIS LTD., 103, North Street, Leeds, 7.

ALL TYPES of Valves required for cash. State quantity and condition. RADIO FACILITIES LTD., 38, Chalcot Road, N.W.1. (PRImrose 9090.)

BOOKS

I.P.R.E. TECHNICAL PUBLICATIONS, 6,500 Alignment Peaks for Superheterodynes, **5/9**, post free. Data for constructing TV Aerial Strength Meter, **7/6**. Sample copy, The Practical Radio Engineer, quarterly publication of the Institute, 2/-; membership and examination data, 1/-; Secretary, I.P.R.E., 20, Fairfield Rd., London, N.8.

FOR SALE

SERVICE SHEETS, Radio/Tele., etc. Ex dealers' stock. Grand opportunity. S.A.E. with enquiries to: F.I.E.L.D., 80, Oldfield Rd., London, N.16.

BACK ISSUES P.W., P.T., 1/-, p.p. List. 21, Manor Way, Nth. Harrow, Middx.

AMATEUR CLEARANCE.—QA12P Amplifier, new condition. Weston type 432 wattmeter, Taylor model 90 multimeter. Box No. 272, c/o PRACTICAL WIRELESS.

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64, inclusive, or a woman aged 18-59, inclusive, unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

ELECTRONIC APPRENTICESHIPS.—The Ministry of Supply invites applications for Electronic Apprenticeships tenable for five years at the Radar Research Establishment, Malvern, Worcestershire. Applicants should normally be 16 and under 17 years of age on 1st September, 1956. They should be in possession of, or be studying to obtain, in 1956, the General Certificate of Education at Ordinary level, with passes in four subjects, including Mathematics and Physics (or other Science subject covering Physics), or be of equivalent educational standard. Technical Schoolboys are eligible to apply provided they have exemption from S.1 stage of the Ordinary National Certificate. Forms of application and further particulars may be obtained from MINISTRY OF SUPPLY, D.T.O. (Industrial), 66/72, Gower Street. London, W.C.1.

RADIO TECHNICIANS required immediately by Air Ministry for service in Ocean Weather Ship based Greenock. Voyages approximately 1 month, then 11-21 days in port. Applicants should have sound knowledge radio/radar to third year City and Guilds Telecommunications Engineering and practical experience in maintenance of ground radio, D/F systems and radar installations. Duties include radar operation. Engagement, subject to trade test, non-pensionable at first. Inclusive pay at age 25 and over is £506, rising by annual increments to £605. Lower rates below 25. Additional pay for excess hours. Food and accommodation free on board ship. Minimum 6 days' leave between voyages. Applications, stating age, qualifications and experience, to the SHORE CAPTAIN, Ocean Weather Ship Base (W.S.5), Great Harbour, Greenock.

TELEVISION AND RADIO Service Engineer required, good salary and prospects. JONES, Cobham, Surrey. (Phone: 176, or 3004 evenings.)

RADIO AND TELEVISION COMPONENTS

All parts in stock for:
Viewmaster, Soundmaster, Teleking, etc.
Easy Terms available.
2½d. stamp (only) for Catalogue.

JAMES H. MARTIN & CO.,
FINSTHWAITE, NEWBY BRIDGE ULVERSTON, LANCS.

ANNAKIN'S BARGAINS

Waveform Generator type 40. 1—6V6G, 2—SP61, 1—EF50, 1—EA50, 2—potms. relay, metal tubulars, etc. New. £1 post free. **Modulator** BC456B with 12J5, 1625, VR150 30, valves. Less dynamotor and top relays, 22/6 post free. **RF unit** type 24. 3—VR65. Switched Tuning. Used. 11/9 post free. **12 Mc/s IF**, slug tuned, in screening can. 1/7 post free. Most of previous bargains available. Money back Guarantee. C/W.O. only. Free Lists.—
25, ASHFIELD PLACE, OTLEY, YORKS.

ASSISTANT ENGINEER.—Electronic Engineer required for Calibration Department. Varied and interesting work on electronic test equipment for electric automatic pilot. Able to work from engineers' manuals and drawings. Salary according to age and experience. Write, giving full particulars, to: PERSONNEL MANAGER, Smiths Aircraft Instruments Ltd., Bishops Cleeve, nr. Cheltenham, quoting ref.: 67/EN/PW.

PLYMOUTH AND DEVONPORT TECHNICAL COLLEGE, Tavistock Road, Plymouth. Radio Officer's Course. The next full-time course leading to the P.M.G. Certificates will commence in September, 1956. Application should be made as early as possible to the PRINCIPAL, giving particulars of previous education.

WANTED

REQUIRED, "Amateur Wireless," No. 589, Sept. 23rd, 1933. Write to Box No. 271, c/o PRACTICAL WIRELESS.

VALVES WANTED, all types. State quantity, condition. Prompt cash. HERMES RADIO, Glazebury, Manchester.

EDUCATIONAL

WIRELESS.—Day and Evening Class instruction for P.M.G. Certificate of Proficiency and Amateur Wireless Licence. Morse instruction only if required, also postal courses. Apply B.S.T. LTD., 179, Clapham Rd., London, S.W.9.

MERCHANT NAVY Wireless School, Overseas House, Brooks' Bar, M/cr 16.

FREE! Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the Hobby Enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds, R.T.E.B., and other Professional examinations. Train with the college operated by Britain's largest Electronics organisation. Moderate fees. Write to E.M.I. INSTITUTES, Dept. PW28, London, W.4.

VACANCIES FOR SKILLED CRAFTSMEN IN GOVERNMENT SERVICE AT CHELTENHAM

Experienced in one or more of the following:

1. Instrument Makers with fitting and machine shop experience in light engineering.
2. Maintenance of radio communication receivers.
3. Sub-assembly lay-out, wiring and testing of radio type chassis.
4. Cabling, wiring and adjustment of telephone type equipment.
5. Maintenance of teleprinters or cypher machines and associated telegraph equipment.
6. Fault finding in, and maintenance of, electronic apparatus.

BASIC PAY: £8 11s. 4d. plus up to £2 10s. merit pay, assessed at interview and based on ability and experience.

Opportunities for permanent and pensionable posts.

5-day week—good working conditions—single accommodation available.

Apply to:

Personnel Officer, G.C.H.Q.
(FOREIGN OFFICE),
53, Clarence Street, Cheltenham.

WIRELESS. See the World as a Radio Officer in the Merchant Navy; short training period; low fees; scholarships, etc., available. Boarding and Day students. Stamp for prospectus. WIRELESS COLLEGE, Colwyn Bay.

THERE IS a national shortage of Mercantile Radio Officers. Why not make Communications your career? You can be assured of a sea-going appointment after qualifying at THE SCHOOL OF MARINE RADIO AND RADAR (A.S.T.), Hamble, Southampton. For details apply Commandant, quoting A.12.

RADIO AND ELECTRONICS Correspondence School. Easy postal courses in radio and electronics; our courses are specially prepared for the beginner; moderate fees. Syllabus free. Write THE SECRETARY, Radio and Electronics Correspondence School, 68, Nina Drive, New Moston, Manchester, 10, Lancs.

THERE IS A GREAT FUTURE for qualified Radio, Television and Electronic Engineers. This is your opportunity to train for a well-paid career. E.M.I. Institutes offer a 3-year course in Telecommunications Engineering commencing September 11th. On successful completion employment is assured. Full details from E.M.I. INSTITUTES, Dept. PW38, 10, Pembridge Square, London, W.2.

T/V AND RADIO.—A.M.Brit.I.R.E., City and Guilds. R.T.E.B. Cert., etc., on "no pass—no fee" terms. Over 95% successes. Details of exams. and home training courses in all branches of radio and T/V; write for 144-page handbook free. B.I.E.T. (Dept. 242G), 29, Wright's Lane, London, W.8.

CITY AND GUILDS (Electrical, etc.) on "no pass—no fee" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook—free and post free. B.I.E.T. (Dept. 242A), 29, Wright's Lane, London, W.8.

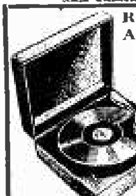
THE INSTITUTE of Practical Radio Engineers' Home Study Courses are suitable coaching text for I.P.R.E. and other qualifying examinations. Fees are moderate. Syllabus of seven modern courses post free from SECRETARY, I.P.R.E., 20, Fairfield Road, London, N.8.

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc., on "no pass—no fee" terms; over 95% successes. For details of exams. and courses in all branches of engineering, building, etc., write for 144-page handbook, free. B.I.E.T. (Dept. 242B), 29, Wright's Lane, London, W.8.

THE WIRELESS SCHOOL. Day, Evening and "Radiocerts" Postal Courses; s.a.e. for prospectus. THE DIRECTOR, 21, Manor Gardens, London, N.7.

ASTRAL RADIO PRODUCTS

'HOME RADIO,' 32 page illustrated booklet. Simple wiring instructions for Crystal Set, 1, 2, 3 Valvers, 2/-, post 3d.
TRF COILS. Specified for **'Bedside Push-button 4,' 'All Dry 3 Band, 3,' 'Push-button 4,'** etc., 6/6 pr., post 6d. Push-button Unit with modification data 7/-.
DUAL WAVE HF Coil. Specified for **'Summer All Dry Portable,' 'Modern 1 Valver,' 'Modern 2 Valver,' 'B 7 G Battery Miniature,'** etc., 4/3, post 3d.
IFT'S Miniature, 1" x 1¼" x 2¼" in cans. Extra high 'Q.' Special offer. 8/6 pr., post 6d.
K COILS. 'AC. B'pass 3.' 3/3 each, post 6d.
FRAME AERIALS. M.W., 5/-, post 4d.
H.F. Choke (Osmor Q.C.1), 4/-, post 4d.
Crystal Set Coils, L. & M.W., 2/6, post 3d.
82, Centurion Road, Brighton



RECORD PLAYERS! AMPLIFIED PLAYERS! GRAM MOTORS! AUTOCHANGERS! CABINETS!

Many to be cleared at less than half price.
3-speed 'Gram Motors by well-known manufacturer. 100 125, 200/250 AC mains. 33⅓, 45, 78 r.p.m. and neutral by selector switch. 7 guinea value! Our price £3.10.0.
3-speed Record Players, fitted Acos turn-over HGP 59 pick-ups, with twin sapphire styli. Rexine case with lid, fitted clasps and handle. Worth 10 gns.! Our price £7.15.6.
Carriage, Packing & Insurance, 5/6.

RONALD WILSON & CO.
12 Bridge Street, Worcester

H.A.C. SHORT WAVE EQUIPMENT

Noted for over 18 years for . . .
S.W. Receivers and Kits of Quality.

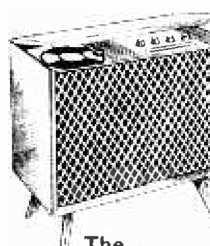
Improved designs with Denco coils:
One-Valve Kit, Model "C" Price, 25/-
Two " " " "E" " 50/-

All kits complete with all components, accessories, and full instructions. Before ordering call and inspect a demonstration receiver, or send stamped, addressed envelope for descriptive catalogue.

"H.A.C." SHORT-WAVE PRODUCTS
(Dept. TH), 11, Old Bond Street, London, W.1.

CABINETS & HI-FI EQUIPMENT

We can supply any Cabinet to your own specification



The Contemporary

is oak veneered with mahogany interior, normally wax finished at **£9.15.0**

Available in any shade to order at slight extra cost.

We can supply and fit into any cabinet all the latest hi-fi amplifiers, tuners, transcription units, record changers, speakers, etc.

Send for free illustrated catalogue of cabinets, chassis, autochangers and speakers, etc. H.P. can be arranged.

LEWIS RADIO COMPANY
120, GREEN LANES,
PALMERS GREEN, LONDON, N.13
BOWes Park 6064

TELETRON COILSETS FOR VIEWMASTER CONVERSION

(P.T., Dec., '55-Jan. '56)

Bands I and III. Coilsets as specified.

—Comprising—

Tuner kit, metal screens and cover, and I.F. coil kit. Coded coil formers for easy reference.

London version for Channels 1, 2 and 9. Midlands version for Channels 3, 4, 5 and 8.

Complete Tuner and I.F. Coilsets, 49/6.

THE TELETRON CO., LTD.,
266, Nightingale Road,
London, N.9
HOW 2527.

ARE YOU SURE ?

Only one in a hundred home-built receivers, amplifiers and so on give of their best. Remember, just one inaccurate component will ruin performance. Is that 1,000-ohm resistor 800 ohms or 1,200 ohms—or something in between? With 20 per cent. tolerance it could be any of these values.
Our Res Cap. Bridge, complete in every detail for only **31 6**, will check every resistor and condenser quickly and accurately. Here are other items from our range of famous test gear kits, at the lowest prices in the world.
Spot Frequency Sig. Gen., **35/-**. Inductance Bridge, **42 6**. Audio-Frequency Bridge, **38/6**. Twin Multi-ometer, **30/-**.
Post and packing 1 6 on all kits.
Send stamp for illustrated lists.

RADIO MAIL, Dept. R
6, Raleigh Street, Nottingham

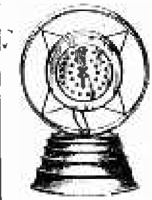
HIGH QUALITY SOUND REPRODUCTION

(New Mullard 5-10, etc.)
3/6 post 4d.

Kit of Hunts Capacitors for same	45/-
Kit of Lab Resistors and Pots. ...	38/-
Ready-punched Chassis	14/6
Mains Transformer MT/5/10 ...	36/-
Output Transformer, Low Loading	45/-

KENDALL & MOUSLEY LTD.
18, Melville Road, Birmingham, 16

Broadcast in Your Own Home



The New Highly Sensitive Microphone incorporating a specially wound transformer designed to match any Radio or Radiogram, mains or battery. Hours of amusement at a party, good fun for all the family. Suitable for baby alarms and many other purposes. Not a toy but a guaranteed working instrument. Full instructions enclosed.
Made to sell at 21/-. OUR PRICE **15/-** POST FREE.
Trade supplied

E. CLAPSHAW
369, Alexandra Rd., Muswell Hill, London, N.10.

SPARKS' DATA SHEETS

Constructional Sheets of Guaranteed and Tested Radio Designs.

Battery Operated.
LO 25. 1-V. M L Waves. Fine Phone Sigs.
LO 23. 1-V. Med Wave Portable.
LO 31. 2-V. M L. Portable Fine Range.
LO 30. 2-V. M L. Most Widely Praised.
LO 35. 4-V. M L. T.R.F. Range and Power.
LO 27. 4-V. All-wave S.Het. Compact.
DX.2. 2-V. Short-waver. Really Good.
Data Sheets, etc., for above, 3/- each. Post Free.

MULLARD 5 10 AMPLIFIER
The Sparks' version, with Separate Control Unit, is noted for its simplicity and efficiency. D Sheet, etc., 3 9.
MANY OTHER DESIGNS AVAILABLE. SEND 2½d. STAMP FOR DETAILED LIST.
All Components & Chassis Available.

L. ORMOND SPARKS (P),
Valley Road, Corfe Castle, Dorset.

RK34—THE VERSATILE VALVE AT THE GIVE-AWAY PRICE!

Double triode, used for both push pull output and full-wave rectifier in P.W. Economical Amplifier (June, '55). Two RK34's **with holders.** Only **5 6**, post 1/-.

BARGAINS IN TOP QUALITY VALVES!
MAKERS' CARTONS: 6K6GT, **5 9**; 6K7G, **4 3**; 6K7, **5 9**; RK34, **2 3**; 6SK7, **4 9**; VU111, **2 9**.
UNUSED, BOXED: 1299, **1 3**; KTZ63, **5/-**; 80, **7 6**; 6Q7GT, **7 6**; EB34, **1 9**.

CLEARANCE UNUSED CARBON RESISTORS (Famous make). 5 *watt* 700 Ω, 3K, 4K, 5-6K, 20K, 30K, 200K, **6d.** (**5/-** doz.); 2 *watt* 36 Ω, 200Ω 500Ω, 5K, 15K, 300K, 500K, **4d.** (**3/-** doz.); 1 *watt*, 20Ω, 12K, 15K, 75K, 150K, 180K, **3d.** (**2/6** doz.); ½ *watt*, 30Ω, 33Ω; and ¼ *watt*, 220K, both **2d.** each (**1/9** doz.).
(Nearly all the above will accept 100% overload.)

MIDGET 500v. CERAMICS (For a **QUALITY** job).—4-7, 7-5, 10, 15, 22, 27, 33, 39, 47, 56, 75, 100, 150, 200, 270, 330, 390, 470, 1,000, 2,000, 3,000, **9d.** each, **8/-** doz. (5,000 pf., 10,000 pf., **1/-** each).

6 MFD. 1,000v. WKG. 2,000v. TEST, 2/9, post 1/-.

LOW LOSS COAX. Latest cellular polythene, suitable Band I or III. **9d.** yd.

COAX FITTINGS. Solderless plug, **1 2**; socket **1/3**; outlet box, **4 6**; Coupler (double socket), **1 6**; Line connector (permanent join), **1 3**.

WIRE WOUND RESISTORS (Silicone coated). 25, 50, 100, 150, 200, 250, 350, 500, 1,000, 1-5K, 2K, 2-5K, 3-5K, 7K, 6-8K, 10K, 5 w., **1-3**; 10 w., **1/6**, 15 w., **1 9**; 15K, 18K, 20K, 25K, 33K, 5 w., **1/9**, 10 w., **2/3**; 47K, 5 w., **2 3**; 10 w., **2 6**.

JONES PLUGS AND SOCKETS. (6 way or 10 way), less covers, **9d.** pair.

SLEEVING. Assortment of 4 colours, from 1 to 2 mm. bore, 36 yds., **2 6** (post 6d.). (2 gross yds., 1 mm. bore, green, **12/6**, post 2/-.)

LATEST "GEN" BOOKS.

PRACTICAL TRANSISTORS & TRANSISTOR CIRCUITS. Build these new exciting circuits now using your own cheaply made transistors, **3/6**, post 4d.

PRACTICAL F.M.—F.M. Fully explained, with lots of circuits for home constructors, **5/-**, post 6d.

RADIO CONTROLLED MODELS FOR AMATEURS. Theory and construction, various systems, **5/-**, post 6d.

VALVE EQUIVALENTS. (Genuinely at-a-glance), **5/-**.
SEND 3d. FOR FULL BARGAIN LIST.
Please allow post and packing on orders under £1.

REED & FORD 2A, BURNLEY RD., AINSDALE, SOUTHPORT.

Practical Wireless BLUEPRINT SERVICE

PRACTICAL WIRELESS

No. of Blueprint

CRYSTAL SETS

1/6d. each

1937 Crystal Receiver ... PW71*
The "Junior" Crystal Set PW94*

2s. each

Dual - Wave "Crystal Diode" PW95*

STRAIGHT SETS

Battery Operated.

One-valve : 2s. each

The "Pyramid" One-valver (HF Pen) ... PW93*
The Modern One-valver PW96*

Two-valve : 2s. each

The Signet Two (D & LF) PW76*

3s. each

Modern Two-valver (two band receiver) ... PW98*

Three-valve : 2s. each

Summit Three (HF Pen, D, Pen) PW37*
The "Rapide" Straight 3 (D, 2 LF (RC & Trans)) PW82*
F. J. Camm's "Sprite" Three (HF, Pen, D, Tet) PW87*

3s. each

The All-dry Three ... PW97*

Four-valve : 2s. each.

Fury Four Super (SG, SG, D, Pen) PW34C*

Mains Operated

Two-valve : 2s. each.

Selectone A.C. Radiogram Two (D, Pow) ... PW19*

Three-valve : 3s. 6d. each.

A.C. Band-Pass 3 ... PW99*

Four-valve : 2s. each.

A.C. Fury Four (SG, SG, D, Pen) PW20*
A.C. Hall-Mark (HF Pen, D, Push Pull) ... PW45*

SUPERHETS

Battery Sets : 2s. each.

F. J. Camm's 2-valve Superhet PW52*

Mains Operated : 3s. 6d. each.

"Coronet" A.C.4 ... PW100*
AC/DC "Coronet" Four PW101*

No. of Blueprint

SHORT-WAVE SETS

Battery Operated.

One-valve : 2s. each.

Simple S.W. One-valver PW88*

Two-valve : 2s. each.

Midget Short-wave Two (D, Pen) PW38A*

Three-valve : 2s. each.

Experimenter's Short-wave Three (SG, D, Pow) PW30A*
The Prefect 3 (D, 2 LF (RC and Trans)) ... PW63*
The Band-spread S.W. Three (HF, Pen, D, (Pen), Pen) PW68*

PORTABLES

1s. 6d.

The "Mini-Four" All-dry (4-valve superhet) *

MISCELLANEOUS

2s. each.

S.W. Converter-Adapter (1 valve) PW48A*
The P.W. 3-speed Autogram ... ...(2 sheets), 7s. 6d.*
The P.W. Electronic Organ (2 sheets), 7s. 6d. *

TELEVISION

The "Argus" (6in. C.R. Tube), 2/6*
The "Super-Visor" (3 sheets), 7/6*
The "Simplex" ... 3/-*
The P.T. Band III Converter 1/-*

All the following blueprints, as well as the PRACTICAL WIRELESS numbers below 94 are pre-war designs, kept in circulation for those amateurs who wish to utilise old components which they may have in their spares box. The majority of the components for these receivers are no longer stocked by retailers.

AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated.

One-valve : 2s.

B.B.C. Special One-valver AW387*

Mains Operated

Two-valve : 2s. each.

Consoelectric Two (D, Pen), A.C. AW403

SPECIAL NOTE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears. Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

No. of Blueprint

SHORT-WAVE SETS

Battery Operated

One-valve : 2s. each.

S.W. One-valver for American AW429*

Two-valve : 2s. each.

Ultra-short Battery Two (SG, det Pen)... .. WM402*

Four-valve : 3s. each.

A.W. Short Wave World-beater (HF Pen, D, RC, Trans) AW436*
Standard Four-valver Short-waver (SG, D, LF, P) WM383*

Mains Operated

Four-valve : 3s.

Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) WM391*

MISCELLANEOUS

Enthusiast's Power Amplifier (10 Watts) (3/-) WM387*
Listener's 5-watt A.C. Amplifier (3/-) ... WM392*
De Luxe Concert A.C. Electrogram (2/-) ... WM403*

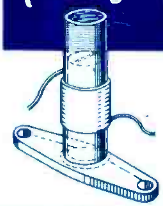
QUERY COUPON

This coupon is available until June 6th, 1956 and must accompany all Queries, sent in accord with the notice on our "Open to Discussion" page.
PRACTICAL WIRELESS, June, 1956.

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), LTD. South Africa: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage, for one year: Inland 18s., Abroad 16s. 6d. (Canada 16s.) Registered at the General Post Office for the Canadian Magazine Post.

Maxi-Q 'VIEW MASTER' T.V.

3 STATION TUNER AND MODIFICATION COMPONENTS



3 STATION T.V. TUNER

These coils have been specially wound for use in the "View Master" T.C.C. Printed Circuit Commercial Television Converter, as described in the January, February and March, 1956, issues of *Practical Television*. The packet contains Coils, Iron Dust Slugs, Screens, Screening Can and Screws. Price 30/-.

MODIFICATION COILS

The "View Master" modification of T.R.F. receivers for the reception of I.T.A. transmissions is given in the December, 1955, issue of *Practical Television*. The packet contains all Coils complete with Iron Dust Slugs. Price 20/-.
Fine Tuning Flange, 4/-. Switch Kit available shortly.
Available from all reputable stockists, or in case of difficulty direct from works. Send 1/- in stamps for General Catalogue covering full range of components.

DENCO (CLACTON) LTD., 357/9, OLD ROAD, CLACTON-ON-SEA, ESSEX

STOP PRESS: "MAXI-Q" **F.M. TUNER UNIT** assembled and valved at **£9/19/6** inc. Power Pack at £3.
"**OSRAM**" **F.M. TUNER** completely assembled and valved at **£30/16/-** inc.

MULLARD AMPLIFIERS' PRICE AND DETAIL REVISION

Due to recent introductions and modifications, we are standardising on one chassis for the "5-10," "5-10A" and "5-10B," which includes the front control holes and an additional valveholder hole, thus the alternative valveholder hole can be used as required and the front control holes either used or not. The internal screen is provided as a long type, but there are additional holes to enable the constructor to shorten the screen and assemble for the "B" version.

"5-10" Front Panel, gold finished with control markings	6/6
Common Chassis, Baseplate and Screen for the "5-10," "5-10A" and "5-10B"	19/6
Type "A" Pre-amplifier Chassis and Front Panel (unprinted in 16 s.w.g. aluminium)	8/6
Type "B" Pre-amplifier Chassis and Front Panel (unprinted in 16 s.w.g. aluminium)	12/6
Complete Metalwork for use with the T.C.C. Printed Circuit	10/-
Mullard F.M. Tuner Chassis, completely punched	12/6
Baseplate for above	4/-

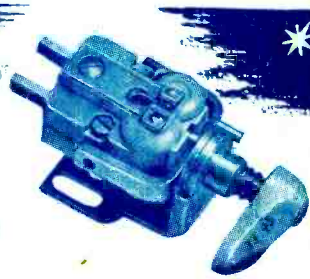
NOTE: Transformer holes in all chassis are not drilled due to the various types obtainable.
The chassis for the Mullard 3 watt and 20 watt Amplifiers are executed under our special home constructor chassis service only. Material is in either 16 s.w.g. Bright Aluminium or Matt Black, 19 s.w.g. steel, at **1d.** per square inch—plus **3d.** per bend—plus **2d** per round hole—plus **2/-** per shaped hole—plus **1/-** postage.

GOLDRING PRODUCTS

Leading in the HI-FI field

CARTRIDGE No500

acclaimed the world over as one of the best



GOLDRING JUBILEE MICRO-BALANCED TRANSCRIPTION ARMS.

- ★ LATEST MODEL, THE SUPER No. 500/M.SD NOW AVAILABLE.
- ★ GOLDRING PRE-AMPLIFIER FOR USE WITH No. 500 CARTRIDGE.
- ★ GOLDRNG SUPER QUALITY Diamond and Sapphire Styli for GOLDRING Cartridges and replacements for other well-known Pick-ups.
- ★ GOLDRING ANTI-STATIC CLEANING PADS. Specially developed for removing dust from L.P. Records.

THE GOLDRING MANUFACTURING CO. (GREAT BRITAIN), LTD.

486 & 488, HIGH ROAD, LEYTONSTONE, LONDON, E.11

Telephone: LEYtonstone 8343-4-5