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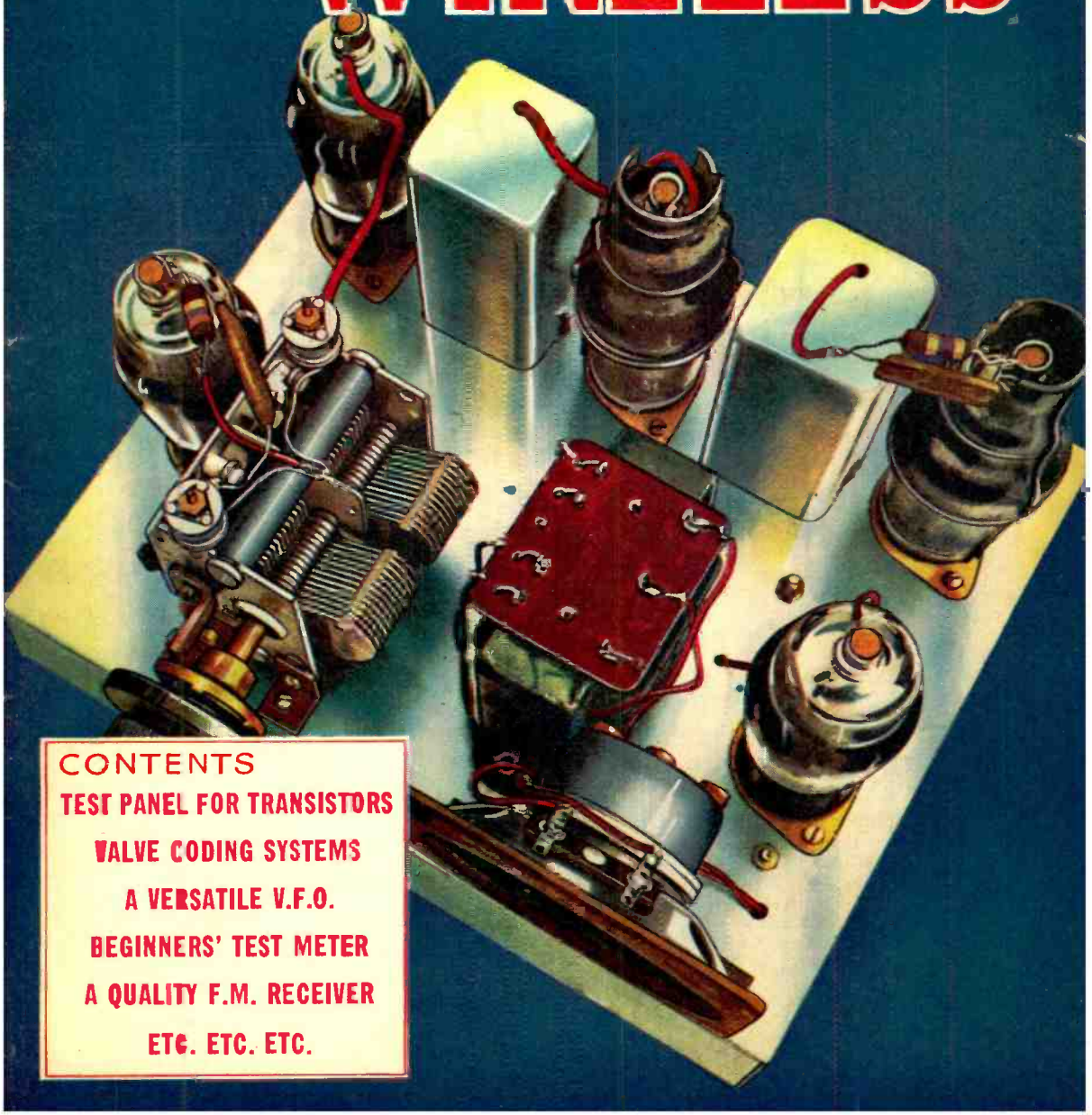

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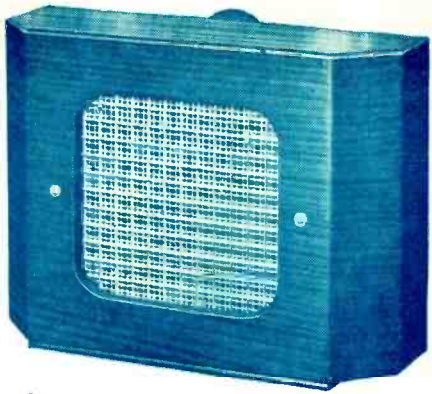

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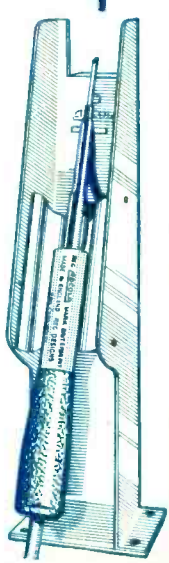

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(£1 extra if we are required to wire up the Transcriptor Switch Banks.)

(b) The New TRUVOX Mk. IV DECK..... **£45.0.0**
H.P. Deposit £9.0.0. and 12 months £3.6.0.

(Carriage and Insurance on all above is 12/6 extra.)

For Constructors with their own Cabinet WE OFFER:

(a) COMPLETE KIT to build the HF/TR3 Amplifier, together with the COLLARO "STUDIO" DECK... **£28.0.0**

(b) As above but with HF/TR3 supplied ASSEMBLED and TESTED **£31.10.0**
H.P. Deposit £6.6.0. and 12 months £2.6.0.

(c) COMPLETE KIT to build the HF/TR3, together with the Mk. IV COLLARO "TRANSCRIPTOR" TAPE DECK **£30.15.0**
(£1 extra if we are required to wire up Deck Switch Banks.)

(d) As above but HF/TR3 supplied ASSEMBLED and TESTED **£34.10.0**
(£1 extra if we are to wire up Deck Switch Banks.)

(e) COMPLETE KIT to build the HF/TR3, together with the NEW TRUVOX Mk. VI TAPE DECK..... **£36.0.0**

(f) As above but HF/TR3 supplied ASSEMBLED and TESTED **£39.10.0**
H.P. Deposit £7.18.0.and 12 months £2.17.11.

(g) COMPLETE KIT to build the HF/TR3 AMPLIFIER with the BRENELL Mk. V TAPE DECK..... **£41.10.0**

(h) As above but HF/TR3 supplied ASSEMBLED and TESTED **£45.0.0**
H.P. Deposit £9.0.0. and 12 months £3.6.0.

Carriage and Insurance on each above is 10/- extra.

Attractive PORTABLE CASE is available to accommodate the TRUVOX or COLLARO TAPE DECKS and we offer it, together with ROLA/CELESTION 10in. x 6in. LOUDSPEAKER—ACOS CRYSTAL MICROPHONE—and 1,200 ft. SPOOL E.M.I. TAPE—ALL FOR £9.0.0. Carriage and Insurance 5/- extra.

WE HAVE THE NEW 2 SPEED TWIN TRACK TRUVOX Mk VI TAPE DECK IN STOCK £26.5.0
DEPOSIT: £5.5.0 and 12 MONTHS: £1.18.6

THE MODEL HF/TR3 TAPE AMPLIFIER

INCORPORATING

3-SPEED TREBLE EQUALISATION by means of the latest FERROXCUBE POT CORE INDUCTOR.

PRICE for COMPLETE KIT OF PARTS **£12.15.0**

PRICE FULLY ASSEMBLED & TESTED **£16.10.0**

HIRE PURCHASE. Deposit £3.6.6 and 12 monthly payments of £1.4.2. A very high-quality Amplifier based on the very successful TYPE "A" design completed in the MULLARD LABORATORIES. ONLY NEW HIGH-GRADE COMPONENTS are incorporated including MULLARD VALVES and a GILSON OUTPUT TRANSFORMER . . . other features are—Magic Eye Recording hand indicator—Effective Tone Control—Monitoring and Extension Speaker Sockets—Has own Power Supply and can be used as independent Amplifier for direct reproduction of Gram Records or from Radio Tuner. Overall size 11in. x 6in. x 6in. Can be supplied for use with Truvox—Collaro—Lane—Brenell or Motok Decks. Please specify which. Send S.A.E. for leaflet or 2/6 for complete Assembly Manual.

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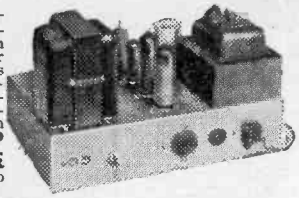
MULLARD DESIGNS

Still by far the finest value

Designed by MULLARD—presented by STERNS strictly to specification.

COMPLETE KIT OF PARTS—

MULLARD "5-10" MAIN AMPLIFIER



For use with the MULLARD 2-stage pre-amplifier (described below) with which an undistorted power output of up to 10 watts is obtained. This combination is thoroughly recommended to "Hi-Fi" enthusiasts who contemplate a versatile and very high quality home installation. We supply **SPECIFIED COMPONENTS AND NEW MULLARD VALVES**, including **PARMEKO MAINS TRANSFORMER** (which has extra Power available to drive Radio Tuner) and the choice of the latest Ultra-Linear **PARMEKO** or the **PARTRIDGE** Output Transformer.

PRICE COMPLETE KIT (**PARMEKO** Output Trans) **£10.0.0** Alternatively we supply **ASSEMBLED** and **TESTED**, £11.10.0.

ABOVE INCORPORATING PARTRIDGE OUTPUT TRANSFORMER, £1.6.0 EXTRA.

MULLARD'S PRE-AMPLIFIER TONE CONTROL UNIT

Employing two EF86 valves, and designed to operate with the MULLARD 3-3 and 5-10 **MAIN AMPLIFIERS**, but also perfectly suitable for other makes.

PRICE, COMPLETE KIT OF PARTS. **£6.6.0** Alternatively we supply ASSEMBLED AND TESTED **£8.0.0** (Carriage & Insurance. 5/- extra.)

Our kit is strictly to **MULLARD'S SPECIFICATION** and incorporates :

- Equalisation for the latest R.I.A.A. characteristics.
- Input for Crystal Pick-ups, and variable reluctance magnetic types.
- Input. (a) Direct from High Imp. Tape Head. (b) From a Tape Amplifier or Pre-amplifier.
- Sensitive Microphone Channel.
- Wide range **BASS** and **TREBLE** Controls.

SPECIAL PRICE REDUCTIONS

(a) The **COMPLETE KIT OF PARTS** to build the "5-10" **MAIN AMPLIFIER** and the **2-STAGE PRE-AMPLIFIER-CONTROL UNIT** **£15.15.0**

(b) The "5-10" and the **2-STAGE PRE - AMPLIFIER** both **ASSEMBLED** and **TESTED** **£18.18.0**

H.P. : DEPOSIT £3.16.0 and 12 Monthly Payments of £1.7.8. When ordering include an extra 7/6 to cover Carriage and Insurance.

PRICES FOR THE "5-10" ARE SUBJECT TO £1.6.0 EXTRA IF THE PARTRIDGE TRANSFORMER IS REQUIRED.

Similar price reductions apply when the Dual Channel Pre-Amplifier is purchased together with a Main Amplifier.

EXAMPLE : The Dual Channel and Dual Channel Pre-Amplifier for **£25.0.0**

Or as KIT OF PARTS for **£21.10.0**

COMPLETE MULLARD 5-10

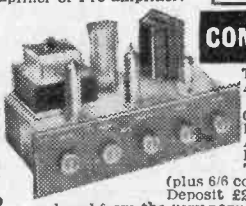
The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Input channels for high output pick-ups and all modern Radio Tuning Units only Specified Components and new **MULLARD VALVES** are supplied, including **PARMEKO MAINS TRANSFORMER** and choice of the latest **PARMEKO** or **PARTRIDGE** ULTRA-Linear Output Transformers. Adequate power available to drive Radio Tuner. **£11.10.0**

Alternatively we supply ASSEMBLED and TESTED **£13.10.0**

HIRE PURCHASE (Assembled Amp. only) DEPOSIT : £2.14.0. 12 MONTHS : 19/10.

ABOVE incorporating PARTRIDGE OUTPUT TRANS., £1.6.0 extra.

COMPLETE MULLARD 3-3



THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION

COMPLETE KIT OF PARTS **£7.10.0**

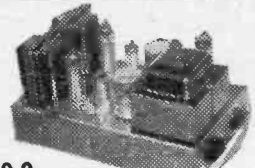
Alternatively supplied ASSEMBLED and FULLY TESTED **£8.19.6**

(plus 6/6 coverage and insurance) H.P. Terms : Deposit £2.0.0 and 8 Months at £1.0.0. Developed from the very popular 3-valve 3-watt design. Complete to MULLARD'S SPECIFICATION including Mullard valves and a **PARMEKO OUTPUT TRANSFORMER.**

Only new **HIGH GRADE** Specified Components and **MULLARD VALVES** are supplied.

MULLARD—STERN STEREO DESIGNS

DUAL "3-3" MAIN AMPLIFIER

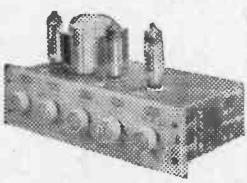


Comprises two "3-3" **MAIN AMPLIFIERS** (described above) on one chassis and is designed to operate with our **DUAL CHANNEL PRE-AMPLIFIER** for both **STEREOPHONIC** or **MONAURAL** operation.

PRICE: COMPLETE KIT OF PARTS **£10.0.0**

Alternatively ASSEMBLED AND TESTED **£11.15.0** H.P. Terms: Deposit £2-7-0 & 12 months at 17/4. Its output power is 6 watts (3 watts per channel) and together with our **PRE-AMPLIFIER** provides a very acceptable **STEREO** installation.

COMPLETE STEREO AMPLIFIER



A thoroughly recommended design that very effectively meets the many requests for a low-priced but good quality **DUAL CHANNEL STEREOPHONIC AMPLIFIER.**

PRICE: COMPLETE KIT OF PARTS..... **£8.10.0**

ALTERNATIVELY ASSEMBLED AND TESTED **£10.10.0**

Two **MULLARD ECL82** Triode Pentode Valves are incorporated in the design ; they form a "CLASS A" single-ended output stage in each channel. The input sensitivity is 300 m/volts, therefore when used with most **STEREO** Crystal Pick-Ups, or Radio Tuning Units, an output of 2 watts per channel is achieved, or similarly when switched to **MONAURAL** Pick-Up position a combined output of 4 watts is produced.

DUAL CHANNEL PRE-AMPLIFIER

This model incorporates two 2-valve Pre-Amplifiers (described above) combined into a Single Unit, enabling it to be used for both **STEREOPHONIC** or **MONAURAL** operation. It is designed primarily to operate with our range of **MULLARD MAIN AMPLIFIERS** but will also operate equally well with any make of Amplifiers requiring an input of 250 m/volts.

COMPLETE KIT OF PARTS **£12.10.0** ASSEMBLED AND TESTED **£15.0.0**

It will operate equally well for **MONAURAL** only operation with one "5/10" Main Amplifier to which the second Main Amplifier can at any time be added, thus very easily providing for both **STEREO** or **MONAURAL** reproduction. Recommended combinations for **STEREO** operation :

(a) The **DUAL CHANNEL PRE-AMPLIFIER** together with the Dual "3/3" **MAIN AMPLIFIER.**

(b) The **DUAL CHANNEL PRE-AMPLIFIER** together with two "5/10" **MAIN AMPLIFIERS.**

THE ASSEMBLY MANUAL is available for 3/-.

Please enclose S.A.E. if ILLUSTRATED and DESCRIPTIVE LEAFLETS are required . . . alternatively the COMPLETE ASSEMBLY MANUALS are available at 1/6 each.

STERN RADIO LTD.

www.americanradiohistory.com

Stern's "fidelity" TAPE RECORDERS

There are no better value for money Tape Recorders on the market—if you can't call and hear them, send S.A.E. for fully descriptive leaflets.

All prices quoted provide for the COMPLETE RECORDER including CRYSTAL MICROPHONE and 1,200 ft. Spool of Tape.

Each Model incorporates the highly successful HF/TR3 Amplifier (described opposite) thus ensuring truly "Hi-Fi" record and playback facilities.

BEFORE YOU BUY—YOU SHOULD HEAR THESE RECORDERS. THEY ARE COMPARABLE TO THE MUCH HIGHER-PRICED MODELS

MODEL CR3/S. Incorporates the New COLLARO "STUDIO" TWIN TRACK 3-Speed Deck **£41.0.0**
H.P. Terms: Deposit £8.4.0 and 12 months of £3.0.2.

MODEL CR3/T. Incorporates the very popular 3-Speed COLLARO Mk. IV "TRANSCRIPTOR" Deck which has both upper and lower tape tracks..... **£49.10.0**
H.P. Terms: Deposit £9.18.0 and 12 months of £3.12.7.

MODEL TR3/Mk. VI. Incorporates the New TRUVOX Mk. VI TWIN TRACK 2-Speed Tape Deck **£49.10.0**
H.P. Terms: Deposit £9.18.0 and 12 months of £3.12.7.

!! RADIOGRAM CHASSIS !!

ARMSTRONG MODEL AF/208..... **£23.2.0**
7 valve AM/FM Chassis producing Max. 5 watts output.

ARMSTRONG "STEREO TWELVE"..... **£37.16.0**
The most complete AM/FM unit yet produced for Stereo, giving 6 watts high-fidelity push-pull output on each channel, 12 watts for monaural.

ARMSTRONG "JUBILEE"..... **£29.8.0**
An AM/FM chassis with nine valves and with push-pull output stage providing 6 watts.

ARMSTRONG AM/FM "STEREO 44" **£28.7.0**
Provision is made for Stereo and monaural playback from pick-up or tape. Outputs provided for Stereo or Monaural tape recordings.

RADIO TUNING UNITS

DULCI MODEL FMT/2..... **£19.17.6**
A complete self-powered F.M. Tuner incorporating automatic frequency control.

ARMSTRONG "S.T.3" AM/FM UNITS..... **£27.6.0**
A self-powered high-fidelity Tuner covering full VHF, medium, and long wavebands with automatic frequency control on VHF.

DULCI "H4/T" AM/FM UNIT **£23.15.8**
A 4 waveband self-powered high-fidelity tuner covering the VHF/FM transmissions plus the long, medium and short wavebands.

NEW HIRE PURCHASE TERMS are available on all above. Illustrated leaflets available—send S.A.E. (Carr. and Ins. 5/- extra.)

A SPECIAL CASH ONLY OFFER !!

This very attractive **PORTABLE AMPLIFIER CASE** together with a good quality **GRAM AMPLIFIER** and a matched **P.M. SPEAKER.**

ALL for ONLY **£8.7.6** (Plus 7/6 Carr. & Ins.)

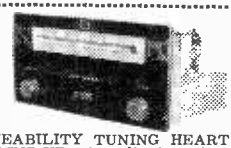
The Amplifier consists of a 2-stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Mushroom Grey Rexine.

WE ALSO SUPPLY SEPARATELY—
(a) The 2-stage (plus Rectifier) **AMPLIFIER** **£4.2.6** (b) The **PORTABLE CARRYING CASE** **£3.17.6**
(c) **P.M. SPEAKER** **18/9** Carriage and Insurance 4/- extra.

— SPECIAL CASH ONLY BARGAIN —

A bulk purchase enables us to offer a very useful
INTERCOM SET OR BABY ALARM *for only* **£5.5.0**
(Plus 5/- carriage & Insurance).
Consists of MASTER UNIT and one EXTENSION, providing 2-way TALK-LISTEN facility. Complete in polished wood cases, size of each only 7½ x 4½ x 6in. high.

STERN'S MK. II *"fidelity"* F.M. TUNING UNIT



PRICE £14.5.0 (Plus 5/- Carr. and Ins.)

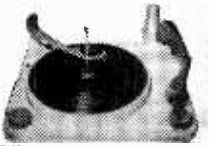
HIRE PURCHASE: Deposit £2.17.0 and 12 Monthly Payments of £1.0.11.
Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP. A really first-class Tuner, very attractively presented and comparable to many offered at much higher prices. Power consumption is only 1.5 amps. at 6.3 volts and 25 m.a. at 250 volts.
HOME CONSTRUCTORS! YOU CAN BUILD THIS TUNING UNIT FOR ONLY £10.10.0 (Plus 5/- Carr. & Ins.) Please send S.A.E. for fully descriptive leaflet or the Assembly Manual is available for 1/6.

109 & 115 FLEET ST., LONDON, E.C.4
Telephone: FLEET STREET 5812/3/4

PLEASE ENCLOSE S.A.E. WITH ALL ENQUIRIES.

!! RECORD PLAYERS !!

THE LATEST MODELS ARE IN STOCK MANY AT REDUCED PRICES !!!
SEND S.A.E. FOR ILLUSTRATED LEAFLET



B.S.R. MONARCH UA8 4-speed mixer Autochanger with Crystal Pick-up **£6.12.6**

The NEW COLLARO MODEL RP594 4-speed Single Record Player, Studio Cartridge **£9.18.9**

The COLLARO "CONQUEST" 4-speed Autochanger, Studio Pick-up **£7.10.0**

The latest COLLARO "CONTINENTAL" 4-speed MIXER Autochanger Studio "O" Pick-up **£8.10.0**

The COLLARO 4-speed Single Record Player, Studio Pick-up..... **£6.6.0**

THE NEW B.S.R. Model UA12 is in Stock. A 4 "SPEED" MIXER AUTOCHANGER **£8.7.6**

UA12 also available incorporating the B.S.R. STEREO Pick-up, plays L.P. and 78 Records **£10.10.0**

B.S.R. MODEL TU9 4-speed Single Record Player, complete with separate Crystal Pick-up **£4.4.0**

GARRARD MODEL TA/Mk. 11 4 Speed Player fitted high output Crystal Pick-Up **£8.10.0**

GARRARD MODEL RC/121/4. Autochanger 4 speeds. High Output. Crystal Pick-Up..... **£10.0.0**

Carriage and Insurance on each above, 5/- extra.

"Hi-Fi" LOUDSPEAKERS

WE HAVE IN STOCK A COMPLETE RANGE BY GOODMANS—WHARFDALE—W.B.
And will be pleased to send you Illustrated and Priced Leaflets. Recommended Types are:

GOODMANS "AXIOM 300". The Best 12in. Seller. 15 ohms V/Coil **£11.5.9**
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WHARFDALE "SUPER 8 FS/A1". 8 in. 3 or 15 ohms..... **£6.19.11**
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WHARFDALE "W12/Fs". 12in. 15 ohms. Voice Coil **£10.5.0**
WHARFDALE "SUPER 12/FS/AL". 12in. 15 ohms. Voice Coil **£17.10.0**

LOUDSPEAKER ENCLOSURES, TWEETER UNITS, CROSSOVER UNITS are also available.

HOME CONSTRUCTOR

A RANGE OF "EASY TO ASSEMBLE" PREFABRICATED CABINETS. Designed by the W.B. "STENTORIAN" COMPANY for "Hi-Fi" Loudspeaker systems or to accommodate high-quality equipment. The acoustically designed Bass Reflex Cabinets containing the very successful "Stentorian" Speakers give really first-class reproduction and are well recommended. Models are also available to accommodate high-quality Amplifiers, Pre-amplifiers, Tuning Units, Record Players, etc. All models are very easily assembled, in fact, only a screwdriver is required. Fully illustrated leaflets are available, including complete specifications of the various STENTORIAN LOUDSPEAKERS.

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THE VALVE SPECIALISTS. 38 CHALCOT ROAD, LONDON, N.W.1. Telephone : PRIMROSE 9090

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ANY ORDER INSURED AGAINST DAMAGE IN TRANSIT FOR ONLY 6d. EXTRA.

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1A7	21/11	6CH6	12/6	7B6	21/3	20F2	26/6	AC2PEN		EAC91	7/6	EL81	12/6	MH4(C)	7/-
1C5	12/6	6D3	19/11	7B7	8/6	20L1	26/6		23/3	EAF42	9/6	EL84	8/6	MHL4	7/6
1D6	10/6	6D6	6/6	7C5	8/-	20P1	26/6	AC2PEN/		EB34	2/6	EL85	13/11	MHLD6	12/6
1H5GT	11/-	6E5	12/6	7C6	8/-	20P3	23/3	DD	26/6	EB41	8/6	EL91	5/-	ML4	12/6
1L4	6/-	6F1	26/6	7D8	23/3	20P5	23/3	AC4PEN		EB91	5/6	EL95	10/6	MU14	9/-
1LD5	5/-	6F6G	7/-	7H7	8/-	25A6G	11/-		26/6	EBC3	23/3	EM34	10/-	MX40	15/-
1LN5	5/-	6F6GTM	8/-	7R7	12/6	25L6GT	10/-	AC5PEN		EBC33	7/-	EM71	23/3	N37	19/11
1N5GT	11/-	6F8	12/6	7S7	10/6	25U4	16/7		23/3	EBC41	8/6	EM80	9/6	N78	19/11
1R5	7/6	6F11	17/3	7V7	8/6	25Y5	10/6	AC6PEN	7/6	EBC81	8/-	EM81	9/6	N108	19/11
1S4	9/-	6F12	5/6	7Y4	8/-	25Y5G	10/-	AC/SG	23/3	EBF80	10/-	EM84	10/6	N308	20/7
1S5	7/6	6F13	11/6	7Z4	18/7	25Z4G	9/6	AC/TP	33/2	EBF83	13/11	EN31	37/-	N339	29/10
1T4	6/-	6F14	26/6	8D2	3/6	25Z5	10/6	AC/VP1	15/-	EBF89	9/6	EY51	9/6	P61	3/6
1U5	10/-	6F15	15/3	8D3	5/6	25Z6G	10/-	AC/VP2	23/3	EBL21	23/3	EY83	16/7	PABC80	
2A7	10/6	6F16	9/6	9BW6	15/3	25Z6GT		ATP4	5/-	EBL31	23/3	EY84	14/-		13/11
2P	26/6	6F17	12/6	9D2	4/-		16/7	AZ1	18/7	EC52	5/6	EY86	10/-	PCC84	8/-
2X2	4/6	6F32	10/6	10C1	12/-	27SU	19/11	AZ31	10/-	EC54	6/-	EZ35	6/-	PCC85	9/6
3A4	7/-	6F33	7/6	10C2	26/6	28D7	7/-	AZ41	13/11	EC70	12/6	EZ40	7/6	PCC88	23/11
3A5	10/6	6G6	6/6	10D2	12/-	30C1	8/-	B36	24/7	EC92	13/3	EZ41	7/6	PCC89	14/-
3B7	12/6	6H6GTG	3/-	10F1	17/6	30F5	7/-	BL63	7/6	ECC32	10/6	EZ80	7/-	PCF80	8/-
3D6	5/-	6H6GTM	3/6	10F9	10/6	30FL1	10/-	C1	12/6	ECC33	8/6	EZ81	7/-	PCF82	11/6
3Q4	7/6	6J5G	5/-	10LD3	8/6	30L1	8/-	C1C	12/6	ECC34	24/7	FC2A	24/7	PCL82	12/6
3Q5GT	9/6	6J5GTG	5/6	10LD11		30P12	8/-	CBL1	26/6	ECC35	8/6	FC4	15/-	PCL83	11/6
3S4	7/6	6J5GTM	6/-		15/11	30P16	8/-	CBL31	23/3	ECC40	23/3	FC13	26/6	PCL84	12/6
3V4	7/6	6J6	5/6	10P13	15/6	30PL1	11/6	CCH35	23/3	ECC81	8/-	FC13C	26/6	PEN4DD	
5R4GY	17/6	6J7G	6/-	10P14	19/3	31	7/6	CK506	6/6	ECC82	7/6	FW4/500			26/6
5U4G	8/6	6J7GT	10/6	11D3	24/7	33A/158M		CL33	19/3	ECC83	8/-		9/-	PEN25	19/11
5V4G	11/-	6K6GT	8/-	12A6	6/6		30/-	CV63	10/6	ECC84	9/6	FW4/800		PEN36C	
5X4G	12/6	6K7G	5/-	12AC6	15/3	35/51	12/6	CV271	10/6	ECC85	8/6		9/-		10/6
5Y3G	8/-	6K7GT	6/-	12AD6	17/3	35A5	21/3	CV428	30/-	ECC91	5/6	GZ30	10/6	PEN40DD	
5Y3GT	7/6	6K8G	8/-	12AE6	13/11	35L6GT	9/6	CY1	18/7	ECF80	11/6	GZ32	12/-		25/-
5Y4	12/6	6K8GTG		12AH7	8/-	35W4	7/6	CY31	16/7	ECF82	10/6	GZ34	14/-	PEN44	26/6
5Z3	12/6		12/6	12AH8	12/6	35Z3	10/6	D1	3/-	ECH3	26/6	H30	5/-	PEN45	19/6
5Z4G	10/6	6K25	19/11	12AT6	7/6	35Z4	6/6	D15	10/6	ECH21	23/3	H63	12/6	PEN45DD	
5Z4GT	12/6	6L1	23/3	12AT7	8/-	35Z5GT	9/-	D63	5/-	ECH35	9/6	HABC80			26/6
6A7	26/6	6L6G	9/6	12AU6	23/3	41MTL	8/-	D77	5/6	ECH42	10/6		13/6	PEN46	7/6
6A8	10/-	6L6M	12/6	12AU7	7/6	42	23/3	DAC32	11/-	ECH81	9/-	HL23	10/6	PEN383	23/3
6AB7	8/-	6L7GT	12/6	12AV6	12/7	43	12/6	DAF91	7/6	ECH83	13/11	HL23DD		PEN453DD	
6AB8	10/6	6L18	13/-	12AX7	8/-	50CS	12/6	DAF96	9/-	ECL80	10/6		17/3		33/2
6AC7	6/6	6L19	23/3	12BA6	8/-	50CD6G		DD41	13/11	ECL82	10/6	HL41	12/6	PEN/DD	
6AG5	6/6	6LD3	8/6	12BE6	10/-		36/6	DF33	11/-	ECL83	19/3	HL41DD		4020	33/2
6AK5	8/-	6LD20	15/11	12BH7	21/3	50L6GT	9/6	DF66	15/-	EF9	23/3		19/3	PL33	19/3
6AL5	5/6	6N7	8/-	12E1	30/-	53KU	19/11	DF70	15/-	EF22	14/-	HL42DD		PL36	14/-
6AM6	5/6	6P1	19/3	12J5GT	4/6	72	4/6	DF91	6/-	EF36	6/-		19/3	PL38	26/6
6AQ5	8/6	6P25	12/6	12J7GT	10/6	75	24/7	DF96	9/-	EF37A	8/-	HN309	24/7	PL81	12/6
6AT6	8/6	6P28	26/6	12K5	17/11	77	8/-	DF97	9/-	EF39	5/6	HVR2	20/-	PL82	8/-
6AU6	10/6	6Q7G	8/-	12K7GT	6/6	78	8/6	DH30	15/6	EF40	15/-	HVR2A	6/-	PL83	9/-
6AV6	12/7	6Q7GT	11/-	12K8GT	14/-	80	9/-	DH63	8/-	EF41	9/6	KF3S	8/6	PL84	12/8
6B7	10/6	6R7G	10/-	12Q7GT	6/6	83	15/-	DH63(Met)		EF42	11/6	KK32	21/11	PL820	18/7
6B8G	4/6	6SA7GT	8/6	12SA7	8/6	83V	12/6		17/6	EF50(A)	7/-	KL35	8/6	PM2B	12/6
6B8GT	5/-	6SC7	10/6	12SC7	8/6	85A2	15/-	DH76	6/6	EF50(E)	5/-	KLL32	24/7	PM12	6/6
6BA6	7/6	6SG7GT	8/-	12SG7	8/6	150B2	15/-	DH77	8/6	EF54	5/-	KT2	5/-	PM12M	6/6
6BE6	7/6	6SH7GT	8/-	12SH7	8/6	185BT	33/2	DH101	28/6	EF73	10/6	KT33C	10/-	PM24M	21/3
6BG6G	23/3	6SJ7GT	8/-	12SJ7	8/6	185BTA	33/2	DH107	13/11	EF80	7/-	KT36	29/10	PX4	10/6
6BH6	9/-	6SK7GT	8/-	12SK7	8/6	304	10/6	DK32	21/11	EF85	7/-	KT41	26/6	PX25	59/8
6BJ6	7/6	6SL7GT	8/-	12SQ7	12/6	305	10/6	DK40	21/3	EF86	12/6	KT44	15/-	PY31	16/7
6BQ7A	15/-	6SN7GT	6/6	12SR7	8/6	402Pen/A		DK91	7/6	EF89	9/-	KT61	12/6	PY32	17/11
6BR7	23/3	6SQ7GT	9/-	12Y4	10/6		23/3	DK92	10/6	EF91	5/6	KT63	7/-	PY80	7/6
6BW6	10/6	6SS7GT	8/-	14B6	19/3	807	7/6	DK96	9/-	EF92	5/6	KT66	15/-	PY81	9/-
6BW7	7/-	6U4GT	12/6	14H7	23/3	956	3/-	DL33	9/6	EF97	13/3	KT88	22/6	PY82	7/-
6BX6	7/-	6U5G	7/6	14S7	27/10	1821	16/7	DL66	15/-	EF98	13/3	KTW61	8/-	PY83	9/6
6C4	7/-	6U7G	8/6	15D1	26/6	5763	12/6	DL68	15/-	EK32	8/6	KTW62	8/-	PZ30	19/11
6C5G	6/6	6V6G	7/-	18	23/3	7193	5/-	DL92	7/6	EL32	5/6	KTW63	8/-	QP21	7/-
6C6	6/6	6V6GTG	8/-	19AQ5	10/6	747S	7/6	DL94	7/6	EL33	12/6	KTZ41	8/-	QP25	15/-

QS150/15		UCL82	11/6												
	10/6	UCL83	19/3												
R12	9/6	UF41	9/-												
R18	14/-	UF42	12/6												
R19	19/11	UF80	10/6												
SD6	12/-	UF85	10/6												
SP4(7)	15/-	UF86	17/11												
SP41	3/6	UF89	9/-												
SP42	12/6	UL41	9/-												
SP61	3/6	UL44	26/6												
SU25	26/6	UL46	14 6												
SU61	9/6	UL84	8/6												
T41	23/3	UM4	17/3												
TDD4	24/7	URIC	9/-												
TH4B	15/-	UU6	19/11												
TH41	26/6	UU7	16/7												
TH233	33/2	UU8	26/6												
TH2321	20/-	UU9	7/6												
TP22	15/-	UYIN	18/7												
TP25	19/6	UY21	16/6												
TP2620	33/2	UY41	7/6												
TY86F	13/3	UY85	7/-												
U12/14	12/-	VMS4B	23/3												
U16	12/-	VP2(7)	12/6												
U18/20	9/-	VP4(7)	15/-												
U22	8/-	VP2B	14/6												
U24	29/10	VP4B	23/3												
U25	13/6	VP13C	7/-												
U26	10/-	VP23	6/6												
U31	9/6	VP41	6/6												
U33	26/6	VR75/30													
U35	26/6		17/6												
U37	26/6	VR105/30													
U43	9/6		9/-												
U45	9/6	VR150/30													
U50	8/-		9/-												
U52	8/6	VT61A	5/-												
U54	19/11	VT501	5/-												
U76	6/6	W61M	26/6												
U78	6/6	W76	6/6												
U107	16/7	W81M	6/-												
U191	16/7	W107	15/3												
U201	16/7	W729	18/7												
U251	14/-	X24M	24/7												
U281	19/11	X31	26/6												
U282	22/7	X41	15/-												
U301	23/3	X42	15/-												
U329	14/-	X61(C)	12/6												
U339	16/7	X61M	26/6												
U403	16/7	X63	10/-												
U404	8/6	X65	12/6												
U801	29/10	X66	12/6												
U4020	16/7	X76M	14/-												
UABC80	9/-	X78	21/3												
UAF42	9/6	X79	21/3												
UB41	12/-	X101	33/2												
UBC41	8/6	X109	17/3												
UBC81	11/4	XD(1.5)	6/6												
UBF80	9/-	XFG1	18/-												
UBF89	9/6	XFY34	17/6												
UBL21	23/3	XH(1.5)	6/6												
UCC84	14/7	XSG(1.5)													
UCC85	9/-		6/6												
UCF80	16/7	Y63	7/6												
UCH21	23/3	Z63	10/6												
UCH42	9/6	Z66	20/-												
UCH81	9/6	Z77	5/6												

FULL RANGE OF TRANSISTORS AND GERMANIUM DIODES IN STOCK. TECHNICAL DATA AND PRICES FREE ON RECEIPT OF SELF ADDRESSED ENVELOPE.

NEW METAL RECTIFIERS—FULLY GUARANTEED

Technical leaflet on Metal Rectifiers free on receipt of S.A.E.

DRM-1B	15/4	RM-1	7/-	WX3	3/6	14A100	27/-	14RA 1-2-8-2	17/6	16RE 2-1-8-1	8/6
DRM-2B	16/2	RM-2	9/-	WX4	3/6	14A124	28/-	14RA 1-2-8-3	21/-	18RA 1-1-8-1	4/6
DRM-3B	23/3	RM-3	9/6	WX6	3/6	14A163	38/-	14RA 2-1-16-1	21/-	18RA 1-1-16-1	6/6
LW7	21/-	RM-4	16/-	14A86	17/6	14B130	35/-	16RC 1-1-16-1	8/6	18RA 1-2-8-1	11/-
RM-0	7/11	RM-5	19/6	14A97	25/-	14B261	11/6	16RD 2-2-8-1	12/-	18RD 2-2-8-1	15/-

VOLUME CONTROLS

All with long spindle and double-pole switch, 4/6 each. 10K, 25K, 50K, 100K, ¼ meg. ½ meg. 1 meg. 2 meg.

ELECTROLYTIC CONDENSERS

Standard Can				Wire-ended Tubular			
8 x 8 x 8 mfd., 400 v.	3/6	100 x 400 mfd., 275 v.	12/6	32 mfd., 350 v.	2/6	8 x 8 mfd., 450 v.	3/-
32 x 32 mfd., 450 v.	5/9	100 mfd., 275 v.	2/6	8 mfd., 450 v.	1/9	16 x 16 mfd., 450 v.	4/-
64 x 120 mfd., 350 v.	8/3	200 mfd., 275 v.	3/6	16 mfd., 450 v.	2/9	32 x 32 mfd., 350 v.	4/-
60 x 250 mfd., 275 v.	9/6	100 x 200 mfd., 275 v.	9/6	32 mfd., 450 v.	3/9	8 x 16 mfd., 450 v.	3/9

TERMS OF BUSINESS: CASH WITH ORDER OR C.O.D. ONLY. POST/PACKING CHARGES 6d. PER ITEM; C.O.D. 2/6 EXTRA. ORDERS VALUE £3 UPWARDS POST FREE. ALL VALVES BOXED, FULLY GUARANTEED. AND SPECIALLY SELECTED FROM THE WORLD'S FINEST MANUFACTURERS. PERSONAL SHOPPERS WELCOME FROM 8.30 TO 5.30, SATURDAYS 1 p.m. CATALOGUE OF OVER 1,000 DIFFERENT VALVES, WITH FULL TERMS OF BUSINESS PRICE 6d. PLEASE ENQUIRE FOR ANY ITEM NOT LISTED WITH S.A.E.

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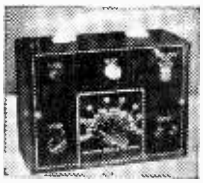
EASY AS A.B.C. TO BUILD

37/6

The new, exciting De Luxe "Gold Star" Pocket Radio in beautiful moulded plastic case—This model is a highly sensitive, self-contained set covering all medium waves. Uses modern miniature "button-base" valve and specially designed high efficiency coil. Exceptionally easy to build from our step-by-step plans—the case is supplied ready drilled! Size of radio only 4¾in. x 2¼in. x 1¼in.!—and batteries fit inside. We can supply all parts including case, detachable aerial, instruction book, wire, screws, etc., for only 37/6, plus 2/6 Post and Packing. C.O.D. 2/- extra. (Parts sold separately, priced parts list 1/6.)

29/6

Our engineers have designed a novel Wrist-Watch Radio using latest Transistor Techniques. Size only 1¼in. x 1in. x ¼in.!!!—"Feather-weight"—yet gives clear, crisp, personal-phone reception over all medium waves. Tiny battery inside lasts months—costs 5d. No Snags, anyone can build it in an hour or two using our pictorial step-by-step simple plans. All parts supplied (including case and strap) for only 29/6 (add 2/6 Post, etc.). C.O.D. 2/- extra. (All parts sold separately, priced parts list 1/6.) Send Now!

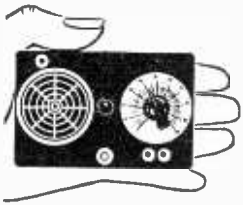


47/6

Can Be Built for 47/6. Build this exceptionally sensitive high efficiency personal phone radio. Uses unique assembly system and can be built by anyone without out any radio knowledge whatever in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6¼in. x 5in. x 3in. Covers all medium and long waves. H.T. consumption only 1 to 1.5 mA. Ideal for Bedroom, Garden, Holiday, etc. BUILD THE "SKY-ROMA" NOW! Total building cost—everything down to the last nut and bolt, 47/6 (Postage, etc., 2/-)—with full set of clear, easy-to-follow plans. (Parts sold separately. Priced parts list and plans 1/6.) C.O.D. 2/- extra.

29/6

The sensational "Silvertone" model! A highly compact self-contained miniature "button-base" valve pocket radio at absolute "rockbottom" building cost! Covers all the medium waves with the very latest circuitry bringing in stations from all over Europe—without fuss. Easy as A.B.C. to assemble, using our step-by-step instruction manual. Size only 4¼in. x 2¼in. x 1¼in.—a fascinating little pocket radio. We can supply all the parts including beautiful two-tone case, detachable aerial, instruction book, screws, wire, etc., for only 29/6 (plus 2/- post and packing). C.O.D. 2/- extra. (Parts sold separately, priced parts list, 1/9.)



29/6

THIS TRANSISTOR SET Can Be Built For Only 29/6. The "Sky-Scout" Pocket two-stage transistor set, size only ¾in. x 3¼in. x 4¼in. Covers all medium waves and works entirely off tiny "penlight" battery which costs 6d. and fits inside case. All parts tested before despatch. Can be built for 29/6, plus 2/- Post and Packing. INCLUDING CASE, TRANSISTOR, STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS, nuts, bolts, etc. (C.O.D. 2/- extra.) Parts sold separately, priced parts list and plans, 1/6. VERY SIMPLE TO BUILD.

15/-

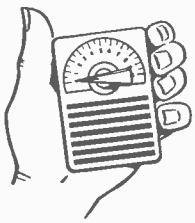
This amazing "Tiny-Tim" model—no larger than a matchbox—costs nothing to run—ever! No batteries! No Valves! No electricity! Will *never* run down or burn out. Uses the latest TRANSISTOR TYPE GERMANIUM DIODE, receives local stations anywhere—without extra aerial. Clear, Crisp Tone. No snags, anyone can build it within an hour using our step-by-step instruction book, etc., for only 15/-, plus 2/- Post and Packing (C.O.D. 2/- extra). (Parts sold separately, priced parts list 1/9.)

39/6

Anyone can build this beautiful precision Pocket Radio in an hour or two. No knowledge whatever needed. Our simple pictorial plans take you step-by-step! Remarkably sensitive—covers all medium waves, inc. Luxembourg, Home, Light. Size only 2in. x 3in. x 5¼in.—Not a Toy! But a Real, Personal-phone. Valve Radio With Detachable Aerial! IDEAL FOR BEDROOM, GARDEN, etc. We supply ALL parts necessary, together with plans, etc., for the special price of 39/6, plus 2/6 post and packing. (C.O.D. 2/- extra.) BUILD YOURS NOW! (All parts sold separately, priced parts list 1/9.) Send Today! Money refunded if parts returned intact within 7 days.

107/6

Choice of beautiful walnut veneered cabinet or ivory 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. The terrific new circuit of the "Ocean-Hopper" covers all medium and long waves, has razor-edge selectivity and exceptionally good tone. Price also includes ready drilled and punched chassis, set of simple-to-follow plans—in fact everything! Parts tested before despatch! Uses standard octal-base valves. (Low running costs—approximately 18 watts.) Size 12in. x 6in. x 5in. Build this long-range powerful midget NOW. TOTAL BUILDING COST INCLUDING PLANS, ETC., £5/7/6. (Post and Packing 3/6.) Parts sold separately. Priced parts list and plans. 1/9. C.O.D. 2/- extra.



45/-

TWO-TRANSISTOR POCKET SET. Can Be Built for 45/-. BUILD THE "SKY-GNOME" VEST-POCKET TWO TRANSISTOR RADIO which gives a superb performance and is highly sensitive. Weight under 7 ozs.—yet it is a THREE-STAGE receiver covering all medium waves, working entirely off a "penlight" battery. Every part tested before despatch! SPECIAL, STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS. Total building cost including case, transistors, etc.—everything down to the last nut and bolt—ONLY 45/- with plans. Postage, etc., 2/- (C.O.D. 2/- extra.) (Parts sold separately. Priced parts list and plans 1/6.) RUSH YOUR ORDER TODAY!

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Orders receive prompt attention. Cheques accepted. Cash on delivery 2/- extra. Please print name and address in block letters. Suppliers to Schools, Universities, Government and Research Establishments. **Complete range of components and valves stocked.** *Regret no C.O.D. abroad.*

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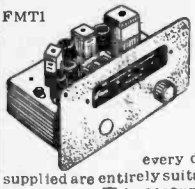
RETURN-OF-POST SERVICE

JASON FM TUNER

FMT1



There are no less than four different Jason FM Tuner Kits now available to the Home Constructor. Brief details are given here and individual lists on any are available free.

MOST IMPORTANT. We take great pains to see that the kits we supply are *absolutely complete* in every detail and also that all components supplied are entirely suitable in every way. This accounts for differences in price you may notice between our prices and those of some of our competitors. THIS SHOULD BE BORNE IN MIND WHEN COMPARING PRICES.

Hire Purchase Terms available.

FMT2 & 3

STANDARD TUNERS

STANDARD TUNER. FMT1. The very popular tuner which is supplied with a chassis assembly fitted with a gold hammer finish front panel and glass dial. Employs four EF91 valves. External power supply is required. Complete kit £6.19.6 Power pack kit, 39/-.

STANDARD TUNER IN SHELF MOUNTING CASE. FMT2. This is a new version of the above tuner. The circuit has been brought up to date and is built into the very attractive shelf mounting case of the new Fringe Tuner mentioned below. The circuit uses four EF80 valves and the power supply can be built into the case if desired. Complete Kit £7.17.6 without power supply components. £9.16.0. with power supply.

MERCURY SWITCHED TUNER. This is a tuner in chassis form which has a three position switch for the three BBC programmes. Uses one ECF80 and four EF80 valves. External power supply is required. Complete Kit £9.19.0. Power Pack Kit 39/-.

FRINGE TUNERS

NEW FRINGE TUNER IN SHELF MOUNTING CASE. FMT3. This is an entirely new Fringe Tuner and is supplied complete with a very attractive green shelf mounting case with Perspex dial. The tuner is fitted with variable AFC. Internal power supply if desired. Valves used are one ECC81 and five EF80. Complete Kit £9.19.6 without power supply components. £11.18.0 with power supply.

INSTRUCTION MANUALS

All our kits include the appropriate instruction manual. All available separately as follows:—
Manual covering both Standard Tuners and the new Fringe Area model, 2/10 ; "Mercury," 2/3 ;
All post free.

TRANSISTORISE YOUR CRYSTAL SET

A kit to construct a single transistor amplifier for any Crystal Set. Increases the volume many times. No soldering required and full instructions supplied. Complete kit with brand new Transistor, 21/6. Post free.

LATEST AVO TEST METERS

AVOMETER MODEL 8. The finest multi-range meter available. 20,000 ohms per volt on D.C. ranges. Eight D.C. Voltage ranges 2.5 v. to 2,500 v. Seven D.C. current ranges 50 microamps. to 10 amps. Seven A.C. Voltage ranges 2.5 v. to 2,500 v. Four current ranges 100 mA. to 10 amps. Three resistance ranges. Fully detailed leaflet available. Price £23.10.0. H. P. Deposit £4.14.0 and 12 monthly payments of £1.14.6. Price with leather carrying case. £27.8.0. H.P. Deposit £5.8.0 and 12 payments of £2.0.4.

Other AVO Meters available include the Model 7. £19.10.0. H.P. Deposit £3.18.0 and 12 payments of £1.8.8 and the Multiminor price £9.10.0. H.P. Deposit £1.18.0 and 12 monthly payments of 14/4.

NEW ILLUSTRATED LISTS

New illustrated lists are available on all the following. Any will be sent free upon request.

GRAMOPHONE EQUIPMENT. Details of many types of Auto Changers, Single Record Players and Transcription Units including all the latest models. Many at special prices.

TEST GEAR. Test meters, Signal Generators, etc., by AVO, Jason, Pullin and Taylor.

LOUDSPEAKERS. Full details of Goodmans, Whiteley, Wharfdale and Elac types.

TAPE DECKS. All popular makes with a special offer.

RECORDING TAPES. A very wide range of all tapes and accessories.

MULLARD TAPE PRE-AMPLIFIER

This unit is intended for use with an existing amplifier and provides all the circuits necessary for tape recording and playback. Instruction manual, giving full constructional information is available price. 2/10, post free.

COMPLETE KIT containing every item required down to the last nut and bolt. First-class items only included. £14.7.0. H.P. Deposit £2.17.0 and six monthly payments of £2.2.6. Kit less valves. £10.19.6. H.P. Deposit. £1.19.6 and six payments of £1.13.4. Power Unit kit. £3.19.6.

AMPLIFIER KITS

We carry in stock all the items needed for the following amplifiers. Fully detailed lists are available.

MULLARD 3-3 and 510 Amplifiers.
Two- and Three-valve Pre-Amplifiers.
Four Channel Mixer Unit.
G.E.C. 912 Plus Amplifier.
JASON. Jupiter and JSA2 Stereo Amplifiers.

Publications giving full details of the above are available as follows : Mullard "Circuits for Audio Amplifiers," 9/4 ; G.E.C. 912, 4/6 ; Jason Jupiter, 2/10 ; Jason JSA2, 2/4. All post free.

TRANSISTORS

All at the new reduced prices.

AUDIO. B.T.H. Red Spot, 7/6. G.E.C. Yellow/Green, 7/6.
BRIMAR. TS1, 5/-. TS2, 21/-. TS3, 13/6.
EDISWAN. XB102, 10/-. XB104, 10/-.
MULLARD. OC70, 14/-. OC71, 14/-.
GOLDTOP. V10/15A, 15/-.
AUDIO OUTPUT. Matched Pairs. Mullard OC72, 34/-. Ediswan XC101, 32/-.
R.F. G.E.C. Yellow/Red, 15/-. GOLDTOP V6/R2, 24/-.
EDISWAN. XA101, 23/-. XA102, 26/-. XA103, 15/-. XA104, 18/-.
MULLARD. OC44, 26/-. OC45, 23/-.
All transistors post free.

OUTPUT TRANSFORMERS

We can supply a wide range of High Quality Output Transformers and full details are given below. All are fitted with sectionalised secondaries and can be connected for either 3 or 15 ohm speakers.

PARTRIDGE
P3591A. Ultra Linear. Push Pull EL84. 20% Taps. 7,000 ohm load. Specified for GEC 912. 99/-.
P5202. Ultra Linear. Push Pull EL84. 43% Taps. 7,000-9,000 ohm load. Suitable for the Mullard 510. 95/-.
P5203. Ultra Linear. Push Pull EL84. 20% Taps. 5,000-7,000 ohm load. Suitable for the G.E.C. 912. 95/-.
P4014. "C" Core. Push Pull Ultra Linear EL84. 8,000 ohm load. 43% Taps. Specified for the Mullard 510. 98/6.
P4131. Push Pull Ultra Linear EL84. 43% Taps. 8,000 ohm load. Specified for the Mullard 510. 60/-.
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GILSON
W0696A. Push Pull EL84. Load 8,000 ohms. Specified for the Mullard 510. 50/6.
W0696B. Push Pull EL84. Load 6,000 ohms. Specified for the Mullard 510. 50/6.
W0710. Push Pull Ultra Linear EL84. Load 7,000 ohms. 20% Taps. Specified for the G.E.C. 912. 55/6.
W0710/8K. Push Pull Ultra Linear EL84. Load 8,000 ohms. 43% Taps. Specified for the Mullard 510. 55/6.
W0892. Push Pull Ultra Linear EL84. Load 8,000 ohms. 43% Taps. Specified for the Mullard 510. 62/6.

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OT/ML. Push Pull Ultra Linear EL84. 8,000 ohm load. 43% Taps. 45/-.
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New Axiom 112 10" ...	£8.10.0	£1.14.0	6 of	£1.6.0
Axiom 300 12"	£11. 5.9	£2. 5.9	12 of	16.8
Axiom 400 12"	£16. 1.0	£3. 4.0	12 of	£1.3.7
Axiette 8"	£6.12.0	£1. 6.0	6 of	£1.1.0
Trebax Tweeter ...	£6. 4.0	£1. 4.0	6 of	£1.0.0
N05000 Crossover Unit	£1.19.0	—		—
WHITELEY				
HF1016 10"	£7.12.3	£1.10.3	6 of	£1.3.8
HF1012 10"	£4.15.0	£1.10.0	3 of	£1.5.0
HF816 8"	£6.10.6	£1. 6.6	6 of	£1.0.8
HF817 8"	£10.16.6	£2. 3.6	12 of	16.1
T816 Cone Tweeter ...	£6. 3.9	£1. 3.9	6 of	£1.0.0
T10 Tweeter	£4. 4.0	£1. 4.0	3 of	£1.3.4
T359 Cone Tweeter ...	£1.13.3	—		—
Crossover CX3000 ...	£1.10.0	—		—
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Other Goodmans and Whiteley Speakers available, also full range of Wharfedale.

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G.E.C. GEX34, GEX35, **4/-.** Surplus type, **1/3.**
Mullard. OA79, OA81, **4/-.**

GRAMOPHONE EQUIPMENT

ALL LATEST MODELS

	Cash Price	Hire Purchase Deposit	Mthly.	Pmts.
RECORD CHANGERS				
COLLARO Conquest (Studio O PU) ...	£7.19. 6	£1.12. 0	6 of	£1. 4.7
GARRARD RC121 (GC8 PU)	£9.19. 6	£1.19. 6	12 of	15/-
GARRARD RC88 (GC8 PU)	£16. 8. 0	£3. 6. 0	12 of	£1. 4.0
GARRARD RC98 (GC8 PU)	£18.12. 8	£3.15. 8	12 of	£1. 7.3
B.S.R. UA8 Monarch (TC8 PU)	£7. 5. 0	£1. 9. 0	6 of	£1. 2.8
BSR UA12 Monarch (TC8 PU)	£9.19. 6	£1.19. 6	12 of	15/-
BSR UA12 Monarch (TC8S Stereo PU) ...	£10.17. 6	£2. 3. 6	12 of	16/2
SINGLE RECORD PLAYERS				
GARRARD TA (GC8 PU)	£8.10. 0	£1.14. 0	12 of	13/-
BSR TU9 (TC8 PU) ...	£4.10. 0	£1. 5. 0	3 of	£1. 5.0
COLLARO RP584 (O, P or T PU)	£8.18.11	£1.15.11	12 of	13/7
COLLARO RP594 (O, P or T PU)	£9.18. 9	£1.18. 9	12 of	15/-
E.M.I. (Acos Stereo P.U.) ...	£6.15. 0	£1. 7. 0	12 of	10/8
TRANSCRIPTION UNITS				
COLLARO 4T/200 (TX88 PU)	£18.13. 0	£3.15. 0	12 of	£1. 7.4
COLLARO 4TR/200 Motor only	£13.18. 3	£2.15. 3	12 of	£1. 0.5
GARRARD 4HP (GC8 PU)	£18. 9. 9	£3.15. 9	12 of	£1. 7.0

Many of the above can be supplied for stereo working. See our Gramophone Equipment List for details.

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DOUBLE PLAY

BASF. 300ft. (3in.), **14/-**; 600ft. (4in.), **25/-**; 1,200ft. (5in.), **42/-**; 1,800ft. (5¾in.), **52/6**; 2,400ft. (7in.), **77/6.**
SCOTCH BOY 200. 400ft. (3¾in.), **17/-**; 1,200ft. (5in.), **45/-**; 2,400ft. (7in.), **80/-.**
TELEFUNKEN. 1,200ft. (5in.). In plastic container, **40/-.** 2,400ft. (7in.), **75/-.**

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BASF. 210ft. (3in.), **9/-**; 850ft. (5in.), **28/-**; 1,200ft. (5¾in.), **35/-**; 1,800ft. (7in.), **50/-.**
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MISS. 225ft. (3in.), **8/6**; 450ft. (4in.), **14/6**; 850ft. (5in.), **28/-**; 1,200ft. (5¾in.), **35/-**; 1,800ft. (7in.), **50/-**; 2,400ft. (8¾in.), **70/-.**
PHILIPS. 850ft. (5in.). In plastic container, **28/-.** 1,800ft. (7in.), **50/-.**
SCOTCH BOY 150. 300ft (3¾in.), **9/6.**; 900 ft. (5in.), **28/-**; 1,275ft. (5¾in.), **35/-**; 1,800ft. (7in.), **50/-**
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Full range of standard tape and accessories also stocked. Send for list. All tape post free.

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B.S.R. TC8S. Will replace the TC8H or TC8M in any Monarch Changer. Plays 78/LP Stereo records. **£3.6.0.**

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MODEL A-10. Sensitivity 2,000 ohms per volt A.C. and D.C. Five voltage ranges 10-1,000 volts A.C. and D.C. Three D.C. current ranges .5-250 ma. Two resistance ranges. Size 5¼in. x 3¼in. x 1¾in. Price. **£4.17.6.** H.P. Deposit **£1.7.6** and three monthly payments of **£1.6.8.**

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EBC90	12/7
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EBL21	23/3
EBL31	23/3
EC31	7/6
ECC40	23/3
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ECC82	7/6
ECC83	9/-
ECC84	10/-
ECC85	9/6
ECF80	12/-
ECF82	13/-
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ECH21	23/3
ECH35	23/3
ECH42	9/6
ECH81	9/-
ECH83	13/11
ECL80	10/-
ECL82	12/6
ECL83	19/3
EF9	23/3
EF22	8/6
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EF40	14/6
EF41	9/9
EF42	11/-
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EF55	10/-
EF80	7/6
EF85	7/6
EF86	13/-
EF89	8/9
EF91	5/9
EF91(BVA)	7/6
EF97	13/3
EF98	13/3
EL32	5/6
EL33	14/-
EL34	15/-
EL36	19/11
EL38	26/6
EL41	10/6
EL42	10/6
EL81	16/7
EL83	19/11
EL84	9/-
EL821	26/6
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EM80	10/-
EM81	10/6
EY51	10/-
EY81	13/3
EY86	10/-
EZ35	16/7
EZ40	7/6
EZ41	7/6
EZ80	7/-
EZ81	7/-
EZ90	7/6
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KT36	29/10
KT61	13/6
KT63	7/6
KT66	17/6
KT88	22/6
KTW61	6/6
KTW63	7/6
KTZ41	3/6
MH41	7/9
ML4	8/6
MSP4/5	7/6
MSP4/7	7/6
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N339	22/6
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P61	3/6
PABC80	13/11
PCC84	9/-
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PCC89	19/11
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PCF82	12/6
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PCL82	12/-
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PCL84	16/7
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PL38	17/6
PL81	12/6
PL82	8/6
PL83	11/6
PL84	12/7
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PY32	17/11
PY80	7/6
PY81	8/6
PY82	7/-
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PEN4VA	12/6
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PENA4	15/-
PM12M	8/-
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SP41	3/-
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SP4/5	10/6
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T41	23/3
TDD13C	7/6
TH233	18/6
TP25	26/6
U10	10/6
U14	8/6
U16	12/6
U22	8/-
U25	14/-
U37	26/6
U45	15/-
U50	8/-
U76	8/-
U191	11/6
U339	12/-
U403	16/7
U404	11/4
U801	29/10
UABC80	10/-
UAF42	9/6
UBC41	9/-
UBC81	11/4
UBF80	9/6
UBF89	13/11
UBL21	23/3
UC92	13/3
UCC84	10/11
UCC85	10/6
UCF80	16/7
UCH21	23/3
UCH42	10/6
UCH81	10/6
UCL82	16/7
UCL83	13/6
UF41	9/-
UF42	17/3
UF80	13/11
UF85	9/-
UF86	17/11
UF89	9/-
UL41	10/-
UL44	26/6
UL46	26/6
UL84	9/-
UU6	19/11
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ID6	12/6
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IN5	10/6
IR5	7/6
IS4	10/6
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3A4	7/-
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3Q4	8/-
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5R4GY	9/6
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6A7	10/-
6A8G	9/-
6AC7	6/6
6AG5	5/6
6AK5	6/6
6AL5	5/6
6AM5	12/6
6AM6	5/-
6AQ5	7/6
6AT6	8/6
6AU6	10/6
6B8G	4/-
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6BE6	8/-
6BG6G	23/3
6BH6	9/-
6BJ6	9/-
6BR7	12/6
6BW6	9/-
6BW7	8/6
6C4	6/-
6C5GT	6/6
6C6	5/-
6C9	17/3
6C31	7/6
6CD6G	29/10
6D6	5/-
6CH6	10/6
6F6G	7/6
6F6M	7/6
6F1	14/-
6F13	14/-
6F14	26/6
6F15	14/-
6F18	15/3
6F23	18/7
6F33	7/6
6H6	2/6
6H6GT	2/6
6J5GT	5/-
6J5M	6/6
6J6	6/-
6J7G	6/6
6J7M	9/-
6K7G	4/-
6K7M	6/9
6K8G	7/6
6K6GT	7/-
6K7GT	5/9
6K8GT	10/-
6K25	19/11
6L6G	8/-
6L6M	9/6
6L7G	7/6
6L1	23/3
6L18	11/6
6L19	23/3
6LD20	15/11
6M1	17/3
6N7GT	7/6
6P1	19/3
6P26	19/11
6P28	26/6
6Q7G	7/6
6Q7GT	9/6
6SA7GT	8/-
6SG7	7/6
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6V6GT	7/9
6X4	7/6
6X5G	7/-
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6/30L2	12/6
7B6	10/6
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7C5	8/-
7C6	8/-
7D6	13/6
7H7	9/-
7Q7	9/-
7S7	9/6
7Y4	8/6
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9D2	3/6
10C1	17/3
10C2	17/6
10D2	12/-
10F1	12/6
10F3	23/3
10F9	15/3
10F18	15/3
10L1	15/11
10LD11	15/11
10M2	23/3
10P13	17/6
10P14	19/3
12A6	6/6
12AT6	10/6
12AT7	7/6
12AU6	8/-
12AU7	8/-
12AX7	8/-
12BA6	9/-
12BE6	9/-
12C8	9/-
12H6	3/6
12J5GT	3/-
12J7GT	10/6
12K7GT	7/6
12K8GT	13/6
12Q7GT	7/6
12SG7	7/6
12SH7	6/-
12SJ7	6/-
12SK7	6/-
12SL7	8/-
12SN7GT	15/-
12SQ7	8/6
14S7	17/-
15D2	7/9
19AQ5	9/9
19BG6G	23/3
20D1	15/3
20F2	26/6
20L1	26/6
20P1	26/6
20P3	23/3
20P5	23/3
25A6G	10/6
25L6GT	10/-
25Z4	9/6
25Z5	8/-
25Z6	10/-
27SU	19/11
30C1	10/6
30F5	10/6
30FL1	10/6
30L1	19/11
30L15	23/3
30P4	15/-
30P12	12/6
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30PL1	12/6
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25Y5	9/9
35W4	7/6
35Z4GT	8/-
42	8/-
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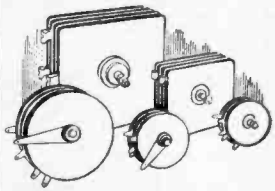

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Types HGP 37/1. HGP/59/5C GC2. TC8 Power Point, etc., 15/6 each. Acostereo. Type 73 35/- each.

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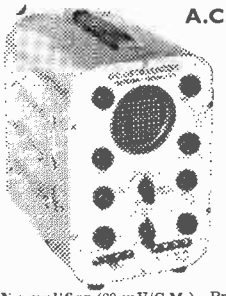
D.C. OSCILLOSCOPE

A.C. MAINS 200-250 VOLTS



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Engineered to precision standards, this high-grade instrument is made available at the **lowest possible price**, incorporating the essential features usually associated with luxury instruments.

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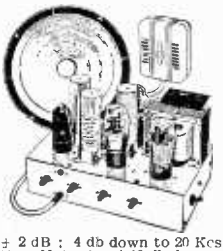


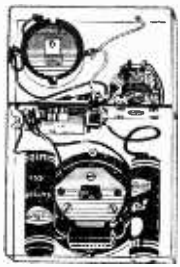
8-WATT PUSH-PULL AMPLIFIER

COMPLETE WITH CRYSTAL MIKE AND 8in. LOUDSPEAKER

A.C. mains 200-250 v. Size 10½in. x 6½in. x 2½in. Incorporating 6 valves. H.F. pen., 2 triodes, 2 output pens and rectifier. For use with all makes and type of pick-up and mike. Negative feed back. Two inputs, mike and gram. and controls for same. Separate controls for Bass and Treble lift. Response flat from 40 cycles to 15 Kcs., ± 2 dB; 4 db down to 20 Kcs. Output 8 watts at 5%, total distortion. Noise level 40 db down all hum. Output transformer tapped for 3 and 15 ohm speech coils. For use with Std. or L.P. records, musical instruments such as Guitars, etc. **£4.19.6** Plus P. & P. 7/6.

Or 20/- deposit Plus P. & P. 7/6, and 4 monthly payments of 23/-.

2-TRANSISTOR POCKET RADIO



Plus Germanium diode, fully tuneable over medium and long waves. Size 3½in. x 4½in. x 1in. Complete set of components including case, 2 transistors and earpiece (less batteries).

19/6 Plus P. & P. 1/6.

Point to point wiring diagram 1/6 free with kit

PUSH-PULL OUTPUT STAGE

Inclusive of transistors with input and output transformers to match 3 ohms speech coil, suitable for use with the above kit. Complete kit of parts including transistors.

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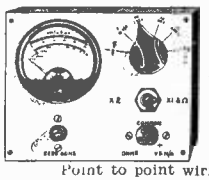
Point to point wiring diagram 1/6 free with kit

AC/DC POCKET MULTI-METER KIT



Comprising 2in. moving coil meter, scale calibrated in AC/DC volts, ohms and milliamps. Voltage range AC/DC 0-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms range 0-10,000. Front panel, range switch, wire-wound pot (for ohms zero setting), toggle switch, resistor and rectifier. In grey hammer finish case.

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Point to point wiring diagram 1/-, free with kit.

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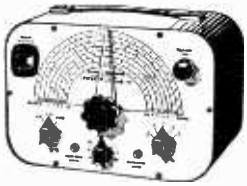
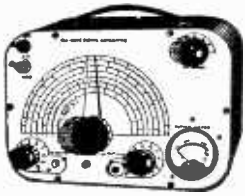


Cash **£6.19.6** or 25/- deposit and 6 monthly payments of **21/6.** Post and Packing 5/- extra.

Coverage 100 Kc/s-100 Mc/s on fundamentals and 100Mc/s to 200 Mc/s on harmonics. Metal case 10in. x 6½in. x 5½in., grey hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C. Mains 200/250 v. Internal Modulation of 400 c.p.s. to a depth of 30%; Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Incorporating magic eye as output indicator. Accuracy plus or minus 2%.



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4-speed plays 10 records 12in., 10in or 7in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position; colour brown. Dimensions: 12½in. x 10½in. Space required above baseboard 4½in., below baseboard 2½in. Fitted with Full-Fi turnover crystal head.

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With Stereo Head, £7.19.6, plus 5/- P. & P.

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Will tune to all Band I and Band III stations. BRAND NEW by famous manufacturer. Complete with PCC84 and PCF80 valves (in series) **I.F. 16-19 or 33-38.** Also can be modified as an aerial convertor (instructions supplied). Complete with knobs. **22/6** Plus 3/6 P. & P.

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All with tapped primaries. 200-250 volts. 0-160, 180, 200 v., 60 ma., 6.3 v. 2 amps. **10/6.** 320-0-320 v. 75 ma., 6.3 v., 2.5 amp., 5 v., 2 amp., **10/6.** 280-0-280. 80 ma, 6.3 v. 2 amp., 6.3 v. 1 amp., **10/6.** Postage and packing on the above 3/-.

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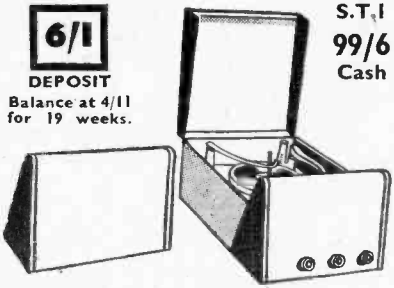
STEREOPHONIC PLAYER CABINET

6/1 DEPOSIT
Balance at 4/11 for 19 weeks.

S.T.1 **99/6** Cash



Continental style cabinet including extra clip-on speaker cabinet. 15⅜ x 10⅜ x 24¾in. deep Takes B.S.R. 4-speed stereo autochanger. Printed circuit amplifier. Two 8in. speakers. Carr. & Ins. 6/6.

STEREOPHONIC AMPLIFIER

9/1 DEPOSIT. Balance at 7/11 for 19 weeks.

12 MONTHS GUARANTEE

Beautifully made for portable stereophonic record players. Latest design with printed circuit. Dimensions 3 x 5½ x 9¾in. A.C. only. Mains isolated. Twin amplifiers each side giving 3-4 watts output. Incorporating ECL82 triode pentode valve. Full tone, volume and balance controls. Complete and ready to fit. Knobs 3/6 per set extra. Carr. & Ins. 3/6.
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EXTENSION SPEAKERS

19/9

Polished oak cabinet of attractive appearance. Fitted with 8in. P.M. speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5 ohms.) Switch and flex included. Ins. carr. 3/9.

8in. P.M. SPEAKER 8/9
Std; 2-5 ohms. With O.P. Trans., 10/-. P. & P. 2/6.

Elliptical SPEAKER 19/6
7" x 4".

Elliptical SPEAKER 22/6
9½" x 4½".

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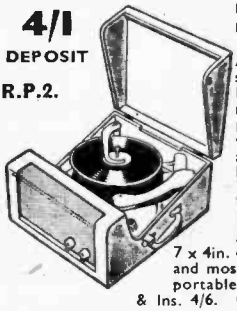
Similar cabinet to the S.T.1 less extra clip-on speaker cabinet. Size 15¾ x 19¾ x 10¾in. Takes B.S.R. U.A.8 4-speed autochanger, twin speakers 3 control amplifier. Ins., carr., 4/6.

RP6 29/6
Elegant cabinet, cloth covered in grey or red with sunken control panel and speaker fret. Size 13 x 17 x 8in. deep. Takes a B.S.R. Monarch 4-speed autochanger. 7 x 4in. elliptical speaker and most of the modern portable amplifiers. Carr. & ins. 4/6.

4/1 DEPOSIT

R.P.2.



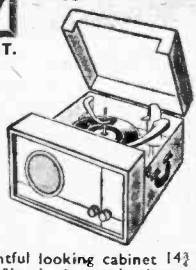
Balance at 2/11 per week for 19 weeks.

A beautifully styled cabinet. Made by a famous manufacturer. In polka dot cloth with clipped lid and carrying handle. Size 16 x 14½ x 8½ deep. Will take B.S.R. Monarch 4-speed Autochanger and 7 x 4in. elliptical speaker and most of the modern portable amplifiers. Carr. & Ins. 4/6. Cash price 59/6.

4/7 DEPOSIT.

Balance at 3/5 per week for 19 weeks.

R.P.3.



A delightful looking cabinet 14¾ x 17¾ x 8¾in. in 2-tone leatherette. Will take a B.S.R. Monarch 4-speed autochanger and 6½in. round speaker. Carr. & Ins. 4/6. Cash price 69/6.

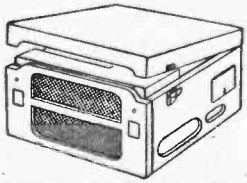
P.L.10 CABINET

Size 14¾ x 12½ x 6in. Takes B.S.R. T.U.9 4-speed record player unit. 8 x 3in. elliptical speaker. Single control amplifier. Carr. & Ins. 4/6.

39/6

TAPE RECORDER CABINET

19/6



A MUST if you are building your own tape. Suitable for the Truvox Tape Recording Deck. Less front cast speaker panel. Size 13¾ x 15 x 8¾in. deep. Detachable lid with compartment for spare tape. Covered in green washable plastic material. P. & P. 4/6.

B.S.R. MONARCH U.A.8 4-SPEED AUTOCHANGER £6.19.6

U.A.12 LATEST B.S.R. MONARCH 4-SPEED MIXER £8/9/6
COLLARO CONQUEST 4-SPEED AUTOCHANGER £6/19/6
COLLARO CONQUEST STEREO AUTOCHANGER 11 gns.
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56 Resist ; incl. 7 variable. Controls. Condensers, incl. electrolytics. Coils, 7 I.F. and R.F. Trans. 14 valve holders. 9 B7G, 5 B5G, 3 octal, 4 Trans. Mains—O.PP.—Line—Frame. Chokes. 250 m.a. Metal rec. 300 volt 250 m.a. Fuse panel—scanning coils—focus magnet. Plugs—sockets—switch—chassis screws—tag strips, etc. I.F. strip in separate Power Pack can be used without dismantling. Chassis have been used, but were working when stored. 7 pages of circuits and instructions showing position of each component. Carriage. 10/6.

MODERN 17" T/V CHASSIS

COMPLETE AND WORKING

24 GNS.

Complete chassis including 17in. tube, permanent magnet speaker, 13 channel Turret Tuner (any two selected channels fitted). Other channels supplied on request at 7/6 each. 13 valves. Chassis and valves guaranteed for three months. MW. CRT. 2 months' full guarantee. Sound I.F. 19.5 Mc/s. Vision 16 Mc/s. A.C. only. Ready and working to fit into your own cabinet. Carr. & Ins. 25/-. As above, with 14in. tube, complete and working, £19.19.0.

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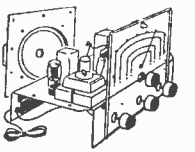
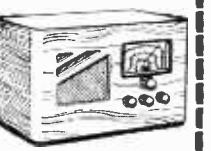


On the initial payment of 5/1 plus carr. of 5/6, this chassis will be despatched. Balance at 3/11 for 19 weeks. Cash Price 79/6. 5-valve Superhet chassis including 8in. P.M. speaker and valves. Four control knobs (tone, volume, tuning, w/change switch). Four wavebands with position for gram .p.u. and extension speaker. A.C. Ins., carr. 5/6.

SUPER SUPERIOR RADIO 89/6

4 waveband. 5 valve superhet radio. 2-tone covered metal cabinet size 24½ x 12 x 10in. deep. 4 control knobs. Positions for gram., p.u. and extension speaker. A.C. only. Ins. carr. 8/6.

HOME RADIO A.C. or Universal 79/6



A.C./D.C. Universal mains 5-valve octal superhet. 3 waveband receiver can be adapted to gram p.u. In attractive wooden cabinet. 9¾ x 18½ x 11¾in. Ins., carr., 4/6. Terms available.

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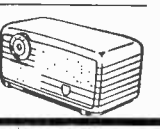
BAKELITE CABINETS 5/9



Brand new. Colour brown. Attractive design. Size 12 x 7 x 5½in. Ideal for small receivers, converters, etc. P. & P. 3/9.

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Low impedance. 38 mm. Brand new. P. & P. 1/3.

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Gold plastic for 15in. tubes. Post 1/3.

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Primary 200-250. Secondary 300-0-300. 6 v. at 3.3 amps. P. & P. 2/9.

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Isolated windings of 6.3 v. at 2-6 amp. 6.3 volt at 3-6 amp. 2 v. 1-4 amp. P. & P. 3/9.

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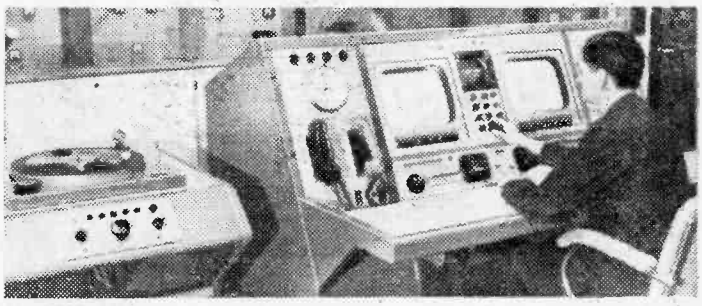

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Complete station (as illus.) comprising: 19 Set, Supply Unit, Control Box, Headphones, Microphone, Morse Key, Variometer, Short Wave and V.H.F. Aerials and Bases and full set of leads. All for only £9. Carr. 25/-.

WIRELESS SET No. 19. MK. II.

This most famous Army Trans/Receiver covers 2-8 Mc/s. (150-37 metres) in two bands and 230-240 Mc/s. V.H.F. Has an intercom. amplifier. Designed for 12 and 24 volt operation. Uses a 6-valve superhet receiver. I.F. being 465 kc/s., and a 6-valve transmitter designed for voice and C.W. operation. Incorporates test and tuning meter for voltages, aerial loading and current tests. Panel Controls: Frequency tuning, P.A. tuning, Gain control, M.C.W., C.W., R/T. switch. Het-tone, netting, off-on, Quench, aerial—A.V.C.—L.T.—H.T.—Drive tests. Supplied complete with 15 valves and instruction book.

SET ONLY **65/-** Carr. 10/-

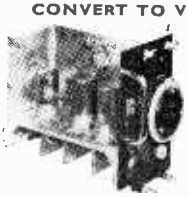
LIGHT-WEIGHT HEAD-SET. These H.S. 30 phones are the smallest used by the U.S. Air Force. 250Ω imp. using soft rubber miniature ear moulds for maximum music and voice reproduction of the finest quality. Supplied free is a small transformer unit with cord and plug which steps impedance up to 4,000Ω. ONLY 15/-. P. & P. 2/6.

MICROPHONES — BRAND NEW. Throat magnetic 4/6; Throat carbon 3/6; No. 8 carbon with switch 6/6; No. 7 moving coil 6/6. Tannoy power mikes only 5/-.

POCKET MULTIMETER

2,500 o.p.v. Multi range 6/30/120/300/1,200 v. A.C., ditto D.C. 0-1 K., 0-1 megohm: 400 Micro-A., 12 mA., 300 mA. —00 to +64 db 5 ranges; 3in. x 4¼ in. x 1¾in. Large clear dial. Leads supplied. List Price £6.19.6. **OUR PRICE £4.7.6.** Saving you £2.12.0. P. & P. 2/6.

CONVERT TO V.H.F.



Within minutes you can extend the frequency of your receiver to cover V.H.F. by using our brand new V.H.F. Converter. **R.F.26** covers 50-65 Mc/s. vernier calibrated tuning. **20/-.** **R.F.25** covers 40-50 Mc/s. Switched tuning. **8/6.** Circuits supplied. P. & P. 3/6 on each.

MORSE CODE SET
WITH HEADPHONES!

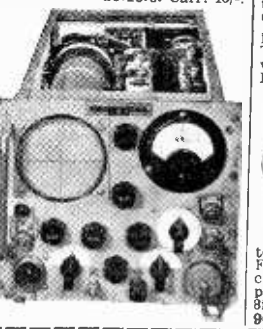
Complete morse code set, includes headphones, morse key, buzzer, pitch control, internal battery. Magnificent appearance and housed in portable wooden case with carrying strap. A wonderful instrument to thrill boys of all ages! Supplied complete and ready for immediate use. Original cost over £6.

ONLY **15/-** P. & P. 3/6

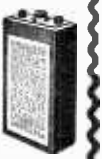
T.C.S. RECEIVER

1.5 to 12 Mc/s. 7-valve superhet, built like a dream. 12SK7-RF, 12SA7 Mixer, 12A6 Oscillator, 12Q7 Detector, AVC-BFO-1st AF, 12SK7-I.F.'s. The 12A6 final puts 1.4 watts into 500 ohms with an input modulated only 30%. Panel controls: R.F. Gain, A.F. Gain, C.W. Pitch, band-switch, mod-C.W. switch, power switch, ground and aerial posts. M.O. or crystal frequency switch, speaker jack, card holder to log 30 stations, hand vernier tuning knob turning a large etched calibrated plate behind hair lined window, anti-backlash gears used. Used condition. **£8.10.0.** Carr. 15/-. **T.C.S. TRANSMITTER** available at **£9.10.0.** Carr. 15/-. **Note.**—If both items purchased together. **£17.** Carr. 25/-.

MONITOR TYPE 28.



Consists of VCR138, 6-SP61, 1-5U4, 1-VU120, 3-EA50. 1 m/a meter scaled 100-0-100 volts. Incorporates Y shift. X shift in μ/secs. Focus. sync. bias. Input to X plates switched X 20, X 5 and direct, requires only suitable power pack for use as oscilloscope. carr. 10/-. **70/-**



ACCUMULATORS. 2 volts 16 A.H. (unspillable). Ideal for 6 and 12 volts supply, etc. Brand new. Original cartons. Size 4in. x 7in. x 2in. **5/6** each. P. & P. 1/6. 3 for **15/-**. P. & P. 3/6. 6 for **27/6**. P. & P. 5/-.

BUILD AN F.M. TUNER with this miniature 9.72 Mc/s. I.F. Strip. Has 6 modern miniature valves. I.F.T.'s, etc., supplied with full F.M. Tuner conversion details. Hailed by all our previous purchasers as a wonderful F.M. Tuner. Brand new, only 40/-. P. & P. 3/6.

MARCONI CR100 RECEIVER 60 kc/s.-30 Mc/s. Internal A.C. power supply, crystal and audio filters, variable selectivity. Output for phones and speaker. Fully guaranteed. **£18.10.0.** Carr. 30/-.

SIGNAL GENERATOR Coverage 100 kc/s.-100 Mc/s. on fundamentals and 100 Mc/s. to 200 Mc/s. on harmonics. Metal case 10in. x 6¼in. x 5¼in., grey hammer finish. Incorporating three miniature valves and Metal Rectifier. A.C. Mains 200/250 v. Internal Modulation of 400 c.p.s. to a depth of 30%; modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Incorporating magic eye as output indicator. Accuracy plus or minus 2%. ONLY **£6.19.6.** Carr. 5/-.

BRAND NEW VARIABLE TRANSFORMERS. Input 230 volts. Output 0-240 volts, 5 amps. Brand new, only **£8.** Carr. 12/6.

HI-FI CO-AX SPEAKERS BRAND NEW—U.S.A. MADE 12in. Co-axial Speaker. The woofer uses 6.8 oz. Alinco 5 magnet. Has 3in. tweeter and an electronic crossover network to separate the speaker functions. Frequency response: 40-17,000 cycles. Output 12 watts. impedance 8 ohms. ONLY **160/-**. 8in. 2½in. tweeter. 10 watts. etc., **90/-**. P. & P. 4/- on each.

PORTABLE TRANSMITTER RECEIVER No. 18

Entirely self contained 6-valve Transmitter Receiver for voice and C.W. Frequency: 6-9 Mc/s. (50-33 metres). The Transmitter signal is generated by a master oscillator circuit followed by a power amplifier. The aerial is auto-coupled to the power amplifier by aerial taps to a parallel tuned output circuit. The Receiver is a 4-valve superhet, comprising signal frequency amplifier, frequency changer, I.F. amplifier, 2nd det. —A.V.C.—A.F. Stage. Selectivity: The resonance curve of the I.F. amplifier has a width of 7 kc/s. with an average cut-off of 5 db/kc's. Full netting facilities. circuit set for full modulation. operated by standard dry batteries. range approximately 10 miles. Incorporates Test Meter for aerial loading, H.T. & L.T. readings. Supplied Brand New complete with Power Microphone, Headphones, Morse Key, Aerials, Webbing and full instruction book all for only **80/-**. Carriage 10/-. 18 Set as above less attachments **60/-**. Carriage 10/-.

80/- Carr. 10/-

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R.S.C. HI-FI TAPE RECORDER KIT

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN 1 HOUR The Recorder incorporates the Latest Collaro Mark IV Tape Transcriptor listed £25. The Linear LT45 High Quality Tape Amplifier listed £12.12.0. High Flux P.M. Speaker listed 30/-, empty Tape Spool, a Reel of Best Quality Tape listed 22/6. and a Handsome Portable carrying Cabinet finished in veneered walnut, size 18in. x 13in. x 9in. high, listed £4 10.0, and circuit. Total cost if purchased individually approx. £45. Performance equal to units in the £60-£80 class. Send S.A.E. for leaflet.

29½ GNS. H.P. TERMS. Deposit 3 gns. and 12 monthly payments 53/9. Cash price if settled in 3 mths. Carr. 17/6

HI-FI 10 WATT AMPLIFIERS

Slightly store soiled but guaranteed unused and in perfect order. Fitted Mullard valves. Dual inputs for "mike" and gram. etc. Bass and Treble Controls. High sensitivity and quality. For 200-250 v. A.C. mains.

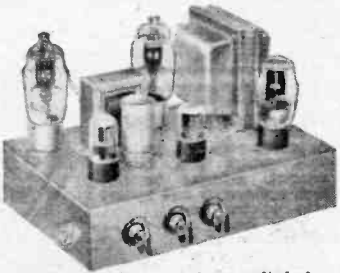
£5-19-9 Carr. 7/6

R.S.C. A8 HIGH FIDELITY 12 WATT AMPLIFIER

Ultra Linear 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 STANDING or LONG - PLAYING RECORDS. For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS,** etc. **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5a. For supply of a **RADIO FEEDER UNIT.** 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/-.
If required louvred metal cover with 2 carrying handles can be supplied for 18/9. Additional input sockets. 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. Guaranteed 12 months.
TERMS on assembled two input model: **DEPOSIT** 18/9 and 12 monthly payments. 18/9.
HIGH FIDELITY MICROPHONES and **SPEAKERS** in stock. Keen cash prices or credit terms if supplied with amplifier.

£7-15-0



STAAR GALAXY 4-SPEED MIXER AUTO-CHANGERS

Brand new, cartoned. Turnover sapphire styli. Many exclusive features. Unique design motor virtually free from rumble. For 200-250 v. A.C. mains. Only £5.19.6.

PORTABLE CABINETS

Full range of attractive designs from **15/9**

SPECIAL OFFER. Two tone Portable cabinet. Gram amplifier. Staar. Changer and 7in. x 4in. P.M. Speaker. **10 gns.** Carr. 10/- with B.S.R. UA8. **12 gns.**

THE SKYFOUR T.R.F. RECEIVER. A design of a 3-valve Long and Medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Power pentode output. Valve line-up SK7, SP61, 6V6G. 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. Maximum building costs £4.19.6. inc. attractive Walnut veneered wood cabinet 12in. x 6½in. x 5½in.

R.S.C. PORTABLE TAPE RECORDER

A completely assembled unit in attractive two-tone rexine covered carrying case. Excellent frequency response. Auto-erase. Fast rewind. Takes up to 5½in. tape spools. High Flux speaker, 3 watts output. Inputs for Radio/Gram and 'Mike.' For 230/250 v. 50 c.p.s. A.C. mains. Sensational value! Price, including 'Mike' Reel of best quality tape and empty spool. Usual 12 months' guarantee. H.P. Terms: Deposit 44/- and 12 monthly payments of 33/4.

19 GNS. Carr. 10/6

PICK-UP ARMS complete with Hi-Fi turnover crystal head. Acos GP54. Limited number brand new, perfect, at approx. half price. Only 29/11.

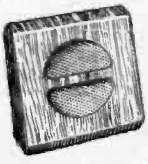
ACOS CRYSTAL MICROPHONES. Mic 40 hand or desk. Listed 45/-. Only 29/9. Type 33-1, hand or desk. List price 50/-. Brand new, cartoned. 35/9.
39-1 Stick type, list price 5 gns. Brand new. 39/6.

COSSOR VHF/FM RADIO RECEIVER KITS

Including 6 valves, Printed Circuit and Goodmans 10" x 6" Elliptical Speaker. Pre-aligned I.F.T.s Made to retail at 15 GNS. limited number at **£8-19-6**

EXTENSION SPEAKERS

Ready for use in walnut veneered cabinet.
6½in. 2-3 ohms, 29/11.
8in. 2-3 ohms, 35/9.
10in. 2-3 ohms, 58/9.
Very limited number.



SENSATIONAL TRANSISTOR OFFER 3 for 10/9. A huge purchase enables us to offer Brand New. Guaranteed Brimar TS1 Audio Transistors at a small fraction of list price.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. **Suitable for all battery portable receivers requiring 1.4 v. and 90 v.** This includes latest low consumption types. Complete kit with diagrams, 39/9. or ready to use, 46/9.

Type BM2. Size 8 x 5½ x 2½in. Supplies 120v. 90 v. and 60 v., 40 mA. and 2 v. 0.4 a. to 1 amp. fully smoothed. **Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators** when connected to A.C. mains supply 200-250 v. 50 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulator. Complete kit of parts with diagrams and instructions. 49/9. or ready for use. 59/6.

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 a. 5 v. 2 a... 17/9
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... 25/9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a... 25/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a... 25/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 4 a. C.T. 0-4-5 v. 3 a.... ... ... 25/9
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. 17/9
250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a... 26/9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a... 26/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a... 26/9
300-0-300 v. 130 mA. 6.3 v. 4 a. 6.3 v. 1 a. for Mullard 510 Amplifier 35/9
350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a... 35/9
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

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.

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4, etc. 3/9
Small Pentode, 5000Ω to 3Ω... ... 3/9
Small Pentode 7/8,000Ω to 3Ω 3/9
Standard Pentode 5,000Ω to 3Ω ... 5/6
Standard Pentode, 7/8,000Ω to 3Ω ... 5/6
10,000Ω to 3Ω 5/6
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω 18/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω 19/9
Push-Pull EL84 to 3 or 15Ω 18/9
Push-Pull 15-18 watts, 6L6, KT66 ... 22/9
Push-Pull for Mullard 510 Ultra Linear 29/9
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 to 15Ω... 47/9

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s.
120 v. 40 mA. 5-0-5 v. 1 a. 15/9
90 v. 15 mA. 4-0-4 v. 500 mA. 9/9

SMOOTHING CHOKES

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

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ a. 12/9; 0-9-15 v. 3 a. 16/9; 0-9-15 v. 5 a. 19/9; 0-9-15 v. 6 a. 23/9.

AUTO TRANSFORMERS. 50 watt 0-110/115—230/250 v. 8/11 each.

COLLARO CONQUEST 4-SPEED AUTO-CHANGER with high fidelity Studio pick-up. Latest model. Brand new. Cartoned. For 200-250 v. 50 c.p.s. A.C. mains. Our price £7.19.8. Carr. 5/6.

COLLARO 4-SPEED SINGLE PLAYER UNITS. Type AC/4/564 with turnover crystal head. £6.12.6. Carr. 4/6.

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R.S.C. A12 STEREOPHONIC AMPLIFIER KIT

A complete set of parts to construct a Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Outputs for matched 2-3 ohm speakers. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and point-to-point wiring diagrams supplied. Only good quality components and latest high grade valves used. Exceptionally realistic reproduction can be obtained at ample volume for the home, as can be demonstrated in typical surroundings at our County Arcade premises. A really sensational offer.

£3-19-6 Carr. and pkg. 5/-

STEREO EQUIPMENT OFFER. Comprising A12 Kit, 2 matched 8in. L/Speakers, and Acos T/O Stereo head with diamond stylus suitable most pick-ups. **£6-19-6** Carr. 7/6

BUILD A TRANSISTORISED RECORD PLAYER to operate from 6 v. Dry Batteries. Total cost of parts Only **£7-19-6** Unit is housed in attractive portable cabinet and will play standard 7in. 45 r.p.m. records at ample output level. All parts available separately, i.e., Garrard Player Unit with pick-up. £3.19.6. Portable Cabinet 29/6.

R.S.C. 30 WATT ULTRA LINEAR HIGH FIDELITY AMPLIFIER A10

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, EF86, EF86, ECC83, 807, 807, GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 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.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and 'Mike' can be mixed. Amplifier operates on 200-250 v. 50 c/cs. A.C. Mains and has output 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 18/9. The amplifier can be supplied, factory built with 12 months' guarantee, for **£13.19.6. TERMS: DEPOSIT 24/9** and 12 monthly payments of 24/9.

11 GNS. Carr. 10/-

LINEAR 'DIATONIC' 10-14 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER. For 200-250 v. A.C. mains. Valves ECC83, ECC83, EL84, EL84, EZ81. Self-contained Pre-amp Tone Control stage. Separate Bass and Treble Controls. Independent 'Mike' and Gram input sockets. Outputs for 3 and 15 ohm speakers. Only **12 GNS.**; or Deposit 22/3 plus 10/- carr. and 12 monthly payments of 22/3. Send S.A.E. for leaflet.

LINEAR L50 50 WATT P.A. AMPLIFIER. High quality and sensitivity. **19 GNS.** Send S.A.E. for leaflet.

GARRARD 4-SPEED AUTO-CHANGERS. Type RC120H. Very limited number at only £9.19.6. Carr. 5/6.

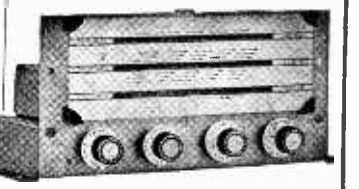
R.S.C. 3-4 WATT A7 HIGH-GAIN AMPLIFIER

For 200/250 v. 50 c/cs. Mains input. Appearance and Specification, with exception of output wattage, as A5. amplifier. Complete Kit with diagrams. £3.15.0. Carr. 3/6.

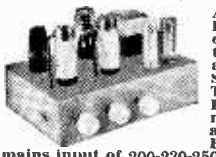
LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for use with any record playing unit, and most microphones. Negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-5½in. high. Guaranteed for 12 months. Only £5/19/6. Send S.A.E. for illustrated leaflet. Terms. Deposit 22/6 and 5 monthly payments of 22/6.

AM/FM RADIOGRAM CHASSIS HIGH QUALITY 6-8 WATT PUSH-PULL OUTPUT

For 200-250 v. Mains. Long wave, Medium, F.M. and Gram. Complete with 8 B.V.A. valves. Guaranteed 12 months. Only **22 GNS.** Or Deposit £2.12.0 and 9 monthly payments of £2.12.0.



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 71db. 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 pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4/15/-, or assembled ready for use £5/- extra, plus 3/6 carr. : or Deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

R.S.C. PORTABLE GUITAR AMPLIFIERS

Junior 5 watts High Quality output. Separate Bass and Treble 'Cut' and 'Boost' controls. Sensitivity 15 m.v., Twin inputs. High Flux 8in. Lousdpeaker 'built-in'. Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in satin walnut, and fitted carrying handle. H.P. Terms. Deposit £1 and 9 monthly payments of £1. **£8-19-6** Carr. 7/6

Senior 10 watts High Fidelity output. Separate Bass and Treble 'Cut' and 'Boost' controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12 in. for Bass notes and a 7 x 4 m. elliptical for Treble. Cabinet is well made and finished satin walnut. Size approx. 18 x 18 x 8 in. H.P. Terms. Deposit 23/6 and 12 monthly payments of 23/6. Both models for 200-250 v. A.C. mains. **15 GNS.** Carr. 10/-

12in. 10 WATT HIGH QUALITY LOUDSPEAKERS IN POLISHED WALNUT FINISHED CABINET

Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only £4.19.6 Carr. 5/-. Terms : Deposit 11/- and 9 monthly payments of 11/-.

12 in. 20 WATT HI-FI LOUDSPEAKERS IN CABINETS. Size 18 x 18 x 8 in. Finish as above. Terms: Deposit 13/10 and 12 monthly payments of 13/10. Only £7.19.6. Carr. 8/6.

PHILIPS CONCENTRIC (Dual Cone) 10in. P.M. SPEAKERS. 3-5 ohms. Limited number at only 29/9.

PLESSEY DUAL CONCENTRIC 12in. 15 ohms HIGH FIDELITY SPEAKER (12,000 lines) with built-in tweeter (completely separate elliptical speaker with choke, condensers, etc.), providing extraordinarily realistic reproduction when used with our A8 or similar amplifier. Rated 10 watts. Price only £5/17/6.

Hi-Fi CRYSTAL PICK-UP HEADS. (Turnover type with sapphire stylus). HGP59. Standard replacement for Garrard and B.S.R. B.S.R. Ful-fi, Garrard GC2. 19/9.

POWER PACK KIT. Output 250 v. 50 mA, fully smoothed and 6.3 v. 1.5 a. Consisting of Mains Trans., Selenium Rectifier, Smoothing Choke, Double Electrolytic Condenser. Chassis 6in. x 3½in. and Circuit. Only 18/9.

P.M. SPEAKERS. 2-3 ohm, 2½in. Perdio 21/9. 5in., 17/9. 6½in., 16/9. 8in., 19/9. 8 x 5in. 25/9. 10in. 26/9. 10 x 6in. 29/9. 12in. 29/11. 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A8 Amplifier, £4.10.9. 12in. Plessey 3 ohms 10 watts (12,000 lines), 59/6.

TWEETERS. Plessey 3 ohms 19/9.

LG3 MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. 50 c p.s. A.C. mains. Over-all size 6¾ x 4½ x 2½in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 57/9.

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.Ch. Sw. incorporates Gram position. Controls are Tuning, W.Ch. and Vol. only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustration. 2/6. Total building cost £4/15/-. For descriptive leaflet send S.A.E.

E.M.I. 4-SPEED SINGLE RECORD PLAYER UNITS with turn-over crystal head for Stereo and Monaural. Only £6/19/9, carr. 4/6.

TERMS : C.W.O. or C.O.D. No C.O.D. under £1. Post 1/9 extra under £2 ; 2/9 extra under £5.
Open 9 to 6 ; Weds. until 1 p.m. Trade supplied. S.A.E. with all enquiries.

R.S.C. (Leeds) Ltd. **BRADFORD, MANCHESTER and LEEDS**

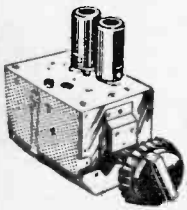
Mail Orders to 29-31 Moorfield Rd., Leeds 12.
Callers to 5 and 7 County (Mecca) Arcade, Briggate, Leeds 1, and 8-10 Brown St. (Market St.), Manchester 2, or 56, Morley Street, (Next to Majestic Ballroom) Bradford.

www.americanradiohistory.com

For Your Lab.

Resistance substitution boxes are great time savers and you really cannot have too many of them ; here then, is an opportunity to acquire these at a very low rate. Our R.S. kit available for only 8/6, plus 1/6 postage, comprises one 50 W. precision variable resistor 0-100 K., six 2-3 watt fixed resistors, one 6-position switch, one pointer knob and one ordinary knob and instructions. This unit when made up will give an infinite variability over the range 100 ohm to 2 meg.

12-CHANNEL TURRET TUNER



Ideal for converting an old or building into new T.V. These are brand new stock, not surplus, supplied complete with valves and coils for local Band I and Band III stations. **Model 1.** I.F. Output 33/38 Mc/s series heaters (parallel heaters. 5/- extra).
Model 2. I.F. Output 16/19 Mc/s parallel heaters (series heaters. 5/- extra). With instructions and circuit diagram, 79/6, knobs 3/6 extra, postage and insurance 2/6.

Avo Prodclips

The advantage of these test prods is that by pressing the trigger at the side they become crocodile clips and can be left in circuit. This is a great time saver when servicing. Price 15/- Pair.

Our 68-page Hi-Fi Catalogue is now being sent out to customers —gives details of the latest and best Hi-Fi equipment with over 400 illustrations. Price 2/6 per copy which is refundable from purchases.

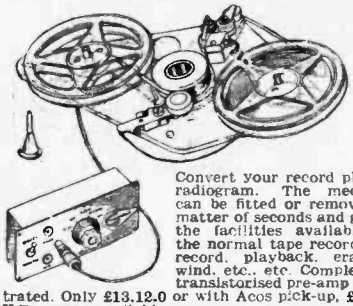
A.C./D.C. Multimeter Kit

Ranges : D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000 with internal batteries. 0-500,000 with external batteries. Measures A.C./D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions price 19/6, plus 2/6 post and insurance.

Miniature Microphone

American made. Dynamic type, real bargain at 2/6, plus 6d. postage.

Your Radiogram into Tape Recorder



Convert your record player or radiogram. The mechanism can be fitted or removed in a matter of seconds and gives all the facilities available with the normal tape recorder, i.e., record, playback, erase, rewind, etc., etc. Complete with transistorised pre-amp as illustrated. Only £13.12.0 or with Acos pick-up, £15.12.0. H.P. terms available.

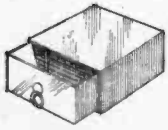
Unique Opportunity to build Fine Transistor Set

Constructor's parcel : to build Pocket 6 Transistor Set as currently being sold at £17.17.0. Parcel comprises Motiffed two-tone cabinet as illustrated, tuning dial, two gang tuning condenser, combined bakelite chassis / printed circuit and easy to follow circuit. Costing value 57/6—offered while supplies last at only 29/6, plus 2/6 post. Suitable for your own circuit or to build original circuit. All parts available at highly competitive prices. Do not miss the tremendous bargain.

American Receiver C646068

This is a 12-valve receiver originally designed for military operation on the 60-80 M c band. One stage of R.F. and three stages of I.F. with additional stages for noise suppression and A.V.C. make this an extremely versatile receiver, also crystal in oscillator provides highest stability. On the front panel are all controls and moving coil input and output meters. Complete with its own power supplies, these, however, are intended to operate on American voltage 115 v. So with each receiver we supply a step down transformer. A limited quantity only of these offered at the extremely low price of £6.10.0. Plus 12/6 carriage and packing. Size approx. 26in. x 9in. x 17in. Note : These sets are unused but have been in store for some years and may therefore require servicing before being put into operation. At the low price charged we cannot test these nor do we give any guarantee. Complete with valves and one crystal. Circuit diagram and technical notes free with equipment or separately price 2/6.

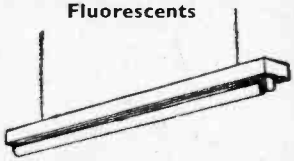
Component Storage Drawers



Stout board construction these drawers are ideal for small parts. Supplied complete with simple erection instructions—1/6 each or 12 drawers each 6 x 2½ x 6½in., 13/6, post 2/-.

FOR ADDRESS SEE OPPOSITE PAGE

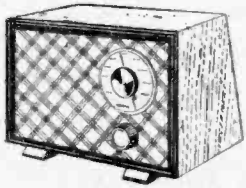
Fluorescents



All complete with polyester filled choke and interference suppressors, starters and fluorescent tube—all ready, in fact, to switch on.
5ft. 80 watt, 54/9 plus 5/6 carriage and insurance.
4ft. 40 watt, 39/6 plus 5/6 carriage and insurance.
3ft. 40 watt, 39/6 plus 4/6 carriage and insurance.
2ft. 20 watt, 39/6 plus 4/6 carriage and insurance.
Circular 40 watt, 87/- plus 5/6 carriage and insurance.
Circular 80 watt, 104/6 plus 5/6 carriage and insurance.
These fittings are suitable for hanging or direct fixing—carriage and insurance applies for distances up to 250 miles, over and above this carriage will be extra.

Connecting Wire

P.V.C. covered in 100ft. coils—2/9 a coil or four coils different colours, 10/-, post free.



New Improved Circuit for the 1960 Skysearcher

This is a three valve receiver kit using modern circuitry. Ideal as a second set for the bedroom, workshop, etc. All parts including mains transformer, valves, resistors, coils, etc., but not cabinet, chassis or speaker. 29/6, plus post and ins. 3/6. Data free with parts or available separately 1/6.

Battery Charger Rectifier. Selenium 12-15 v., 5 amp., 12/6.

Metal Chassis. Punched for Mullard 510 Amplifier, complete with inner screening sections and stove enamelled, 12/6 set.

Geiger Counter Tubes. 20th Century type. Type No. G24, with circuit of geiger counter, 29/6.

Heavy Duty Test Prods. Red and black with plug-in lead attachments, 8/6.

Metal Rectifier

80 mA. 300 volt, 5/6 each, plus post 1/-.

Novelty Radio

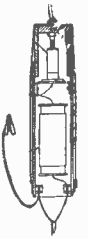
Completely wired tunable medium and long wave, originally intended for B/G valves and external batteries but could easily be converted for transistors with internal batteries. Less valves and speaker, otherwise complete. 15/-, plus 1/6 postage.

www.americanradiohistory.com

Wondergram

This is a record player which operates from torch batteries. It is amazingly small and can, in fact, be carried in the pocket—it weighs only about 2lb. Despite its small size it will play all modern records, 7in., 10in. and 12in. at 33 r.p.m. or 45 r.p.m. Completely transistorised, it gives 100 milliwatt undistorted output. Price **£15.15.0.** H.P. terms available.

Radio Stethoscope



This can be slipped into the pocket rather like a fountain pen. With it in most districts a receiver can be checked from the grid of the first valve right through to the output without a signal generator, the stethoscope will operate in both L.F. and R.F. circuits without alteration. It is a complete fault-finder. All the necessary parts to make this tracer 9/6, post 1/-.

Crystal Mike by Acos

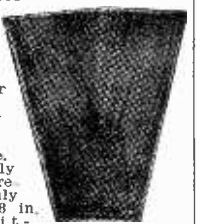
Model 39/1, this is ideal for tape or general amplifiers, complete with screened lead **39/6**, plus 1/- post.

"Dim and Full" Switch

Particularly useful for controlling photoflood lamps which have only a short life at full brilliance. This toggle switch has three positions: the first position puts two lamps in series at half brilliance for setting up, the second position is off and the third position full brilliance for the operation shots. Also useful for controlling night lights, heaters, etc., etc. Price 3/9 each, post 9d. Circuit diagram included.

Hi-Fi Snip

Infinite Wall Baffle



Nicely veneered and polished. Corner fitting (attaches to picture rail). Takes up no floor space. Gives really fantastic results with only low-priced 8 in. speaker. Fitting for tweeter. Only **45/-** each, carriage and insurance 3/6.

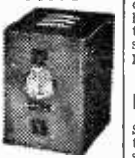
ASSURE YOUR FUTURE

The ownership of a good instrument has been the turning point in many a career, it could easily be yours, for you can own the latest Avo Test Instrument for the initial payment of only **10/-**. This test instrument is ultra-modern, has a sensitivity of 10,000 Ohms per Volt, measures A.C. Volts 0-1,000 in 5 ranges, D.C. Volts 0-1,000 in 7 ranges, D.C. current at 1 Amp. in 5 ranges and resistance up to 2 Megs. in two ranges.

Free Gift. To extend the uses of this instrument, for instance, to measure capacity, inductance, E.H.T., etc., we have developed a range extender scale and operating notes, these will be sent free to purchasers of this instrument.

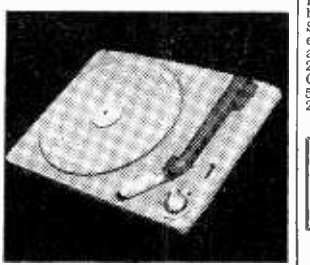
All sent immediately for **10/-** deposit, balance by 21 payments of **10/-**, which includes free insurance against accidental damage for 12 months. Non-callers add 3/6 post and insurance. Cash price, **£9.10.0.**

Components Would Cost More



Car Battery Charger—ready-made high output battery charger in stove enamelled sheet steel louvred case. New, complete and ready to work. Rated at 12 v. 4 amps. and variable rate selector for trickle charging, also a meter to show charging rate. Suitable for 230/250 A.C. mains. Special snip price of **55/-**, plus 3/6 post and ins.

Philips AG2009 Transcription Unit

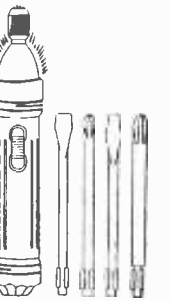


Philips AG2009 Record Player, a modestly priced 4-speed unit with many outstanding features, is ideal for the enthusiast who is assembling his own equipment or modernising an older installation. The pick-up arm is wired for stereo and the Philips stereo head is available as an optional extra.

Eddy Current Brake gives ±2% fine adjustment on all four speeds. **Continuously variable pick-up** playing weight (2-12 gms.).
Supplied with Philips Hi-Fi crystal head, type AG3019 for microgroove and 78 r.p.m.
Frequency response 30-15,000 c/s.
Pick-up lifting and lowering device.
Individually balanced heavy turntable.
Muting switch fitted.
Can be used with any amplifier or radio set.
Complete with monaural pick-up, **£10.10.0.** or **£1** deposit and 21 fortnightly payments of **10/-**.
Available also with stereo head, diamond or sapphire stylus. Prices on request.

Here is a present that will be really appreciated

Motorised food mixer with no irksome lead hanging out and which does not have to be plugged into the mains as it works off three 1½ v. cells in its handle. A really useful mixer ideal for kitchen or anywhere about the house and can also be taken on barbecues, picnics, etc. Price **35/-**, plus 2/6 post and packing.



For Your Service Department

An invaluable tool for working inside a dark cabinet or cupboard. This is a screwdriver with torch and has four interchangeable bits, two for the ordinary slotted screws and two for Philips heads. The torch section operates from 1½ v. batteries in the handle and will save its cost in frayed tempers alone. Why not treat yourself to one of these now? Only **10/6**, plus 1/6 post and packing.

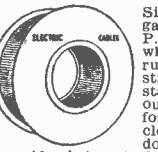
Morganite Potentiometers

Single and 2-gang types available, standard size with good length spindle, all new and boxed. Single types, **1/-** each, values available: 5K, 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg. Gang type **3/-** each—values available: 5K + 5K, 100K + 100K, ½ meg. + ½ meg., 2 meg. + 2 meg.

This Month's Snip

8in. P.M. Speaker in fabric-covered cabinet—size 10in. x 8in. x 4in. Price **29/6**, plus 2/6 post and insurance.

Versatile Wire



Single-strand 18-gauge with P.V.C. covering which makes it rustproof. Extra strong, will stand tremendous strain. Ideal for gardening, clothes lines, indoor aerials, etc. etc. Also being steel alloy and having a resistance of approximately ½ ohm per yard this can be used for electrical work, soil heating, wrapping round water pipes, etc. New on drum containing 3,000ft. Price **8/6**, plus 3/6 carr.

T.V. Service Sheets

200 sheets covering most popular post-war televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc., **£2**, post free. PREVIOUS PURCHASERS OF THESE SHEETS PLEASE NOTE: WE CAN SUPPLY SHEETS Nos. 100-200, **£1**, or 150-200, **10/-**.

All items advertised can be obtained from the following Companies.
If ordering by post, address your order to the Company nearest to you and please include postage.

Electronics (Manor Park) Ltd.
520, High St. North, Manor Park, E.12.

Electronics (Ruislip) Ltd.
42-46, Windmill Hill, Ruislip, Middx.
Phone: RUISLIP 5780.
Half day Wednesday.

Electronics (Croydon) Ltd.
266, London Road, Croydon.
Phone: CRO 6558.
Half day Wednesday.

Electronics (Finsbury Park) Ltd.
29, Stroud Green Rd., Finsbury Park, N.4.
Phone: ARChway 1049.
Half day Thursday.

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Here are some new Heathkit DAYSTROM models

F.M. TUNER
£13.12.6

R.F. TUNING UNIT and I.F. AMPLIFIER AVAILABLE SEPARATELY

F.M. TUNER. Tuning range 88-108 Mc/s. Three I.F. stages with pre-aligned transformers. Complete R.F. Unit is despatched wired, pre-aligned and tested. Built-in power supply. 7 valves. Sensitivity 2.5μV for 20 dB. noise quieting.

RP-1U
£12.10.0

TRANSCRIPTION RECORD PLAYER. Embodies new Collaro RP594 unit with the Ronette Stereo Pick-up. Gives excellent results on stereo or mono. (16, 33⅓, 45 L.P. or 78 r.p.m.) discs. Detachable head and supplied with wooden plinth.

THE 'COTSWOLD.' An acoustically designed 3-unit Speaker System capable of doing justice to finest programme sources. Range 30-20,000 c/s. All parts left "in the white" for finish to personal taste.

THE "COTSWOLD"
£19.18.6

THE "GLOUCESTER" cabinet has been specially designed to meet the varying needs of different homes. Mk. I houses Record Player Stereo Amplifier, F.M. Tuner and records, etc. The Mk. II will house a Tape Deck in addition.

THE "GLOUCESTER"
Mk. I £15.18.6
Mk. II £17.8.6

"PACKAGED DEALS"

The above models and others, can be obtained as parts of "packaged deals" of **MATCHED STEREO HI-FI EQUIPMENT,** thereby saving you additional money.

FREE DELIVERY IN U.K. DEFERRED TERMS AVAILABLE OVER £10.

Why not send for Free Catalogue!

Other models include

TRANSISTOR PORTABLE model UXR-1. This dual-wave, 6 transistor portable radio, strikingly styled in handsome solid leather case, is universally admired. The tone is rich and brilliant and it performs well everywhere, including in a car. Easily built in 6 hours **£15.18.6**
(Car aerial attachment available 5/- extra)

TRANSISTOR JUNIOR RADIO model UJR-1. Ideal for youngsters. Novel circuit gets lots of stations **£2.16.6**
Suitable for headphones. (Additional amplifier stage, 16/6 extra)

HI-FI 16 W. STEREO AMPLIFIER model S-88. World's finest 16 Watt Stereo amplifier regardless of price. 0.1% distn. at 6 W./chnl. The attractively styled S-88 has many excellent features **£25. 5.6**

HI-FI 6 W. STEREO AMPLIFIER model S-33. World's best value in low-price Stereo. 0.3% distortion at 2.5 W./chnl. ideal for average room **£11. 8.0**

HI-FI SPEAKER SYSTEM model SSU-1. Ideal for Stereo in average living-room where cost must be low. Two speakers in the enclosure. Legs, £1.7.0 optional extra **£10. 5.6**

R/C BRIDGE MODEL C-3U. Measures Capacitance, 10 pF (0.00001μF) to 1,000 μF; Power Factor; Resistance, 100Ω to 5 MΩ and indicates leakage. Automatic Discharge Safety-Switch **£7.19.6**

AUDIO SIGNAL GENERATOR model AG-9U. 10 c/s to 100 Kc/s. Sine-wave output 10V f.s.d. down to 3 mV f.s.d. Less than 0.1% distortion (20 c/s to 20 Kc/s). Decade frequency selection. Decibel ranges, −60 to +22. 1% precision resistors **£19. 3.0**

VALVE VOLTMETER model V-7A. World's most popular VVM. Measures volts, ohms and decibels. D.C. sensitivity 7.3 megohms per Volt. D.C. input resistance 11 megohms **£13. 0.0**

5 in. OSCILLOSCOPE model O-12U. This fine general-purpose 'scope has "Y" sensitivity of 10 mV/cm, and covers 3 c/s to over 5 Mc/s. Rise time is 0.08 μ secs or less. Timebase 10 c/s to 500 Kc/s in 5 steps. Electronically stabilised. Voltage calibrator **£34.15.0**

DIRECT READING CAPACITANCE METER model CM-1U. 4½in. meter scale calibrated in μF and pF. Full scale deflection 100 micro-microfarads, 1,000 micro-microfarads, 0.01 microfarad, 0.1 microfarad **£14.10.0**

DX-100U AMATEUR TRANSMITTER. The most popular Amateur transmitter in the world. 100-140 watts output. 160, 80, 40, 20, 15 or 10 metres **£78.10.0**

DX-40U AMATEUR TRANSMITTER. 40 Watts to aerial. Input power 75 W. C.W., 60 W. pk. C.C. 'phone. Provision for V.F.O. Designed by "Hams" for "Hams" **£29.10.0**

VARIABLE FREQUENCY OSCILLATOR model VF-1U. 10V output. Covers 10 to 160 metres **£10.12.0**

Without obligation please send me FREE CATALOGUE (Yes/No) .....

Full details of model(s) ..... Deferred Payments (Yes/No) .....

NAME .....
(BLOCK CAPITALS)

ADDRESS .....

.....

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Practical Wireless

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PARLIAMENTARY BROADCASTS

THE question of broadcasting Parliamentary proceedings has been raised again recently. It has been mooted that the proceedings should be televised but there are a number of technical difficulties. It would be far easier, however, to provide sound broadcasting coverage, although wavelengths would have to be freed for the purpose. In our opinion, any attempt to broadcast all the proceedings of Parliament would be money wasted; the potential audience is far, far smaller than that at present enjoyed by the Third Programme. It would be more sensible to broadcast only a selection of the more interesting Debates in the course of, say, the Home Service Programme. The expense incurred would be of the same order as those of normal programmes. However, we think, that in view of the present-day apathy towards Parliamentary activity, it would hardly be worthwhile to increase the present coverage.

RADIOS IN CARS

THE number of car owners in this country is rising steadily and many wish to be able to listen to radio programmes while travelling. Several years ago the only method of achieving satisfactory radio reception was to install a "car radio" with all the associated equipment including a power pack for obtaining H.T. from the normal 6 or 12V car battery. Such radios were frequently difficult to fix in position, large in size, and caused a heavy drain on the battery. However, with the advent of the transistor, conventional portable radio receivers can be sufficiently sensitive to work satisfactorily inside most cars and form a convenient source of entertainment.

Some car owners, particularly radio amateurs, have improved reception by employing a standard car radio aerial with these portable receivers and from correspondence we have received it is clear that the majority do not appreciate the radio licence regulations. Provided a normal wireless licence is possessed a battery portable receiver can be used in a car without the need of any other licence, but if any form of car aerial is used in conjunction with the receiver, or the receiver can in any way be said to become a fixture in the car, then a separate car radio licence is required.

THE "P.W." AND "P.T." FILM SHOW

ANOTHER film show, sponsored by this journal and our companion journal *Practical Television*, is to be held at Caxton Hall, Westminster, as previously announced, on Friday, January 22nd, at 7.30 p.m. The Editor will take the chair and admission will be by ticket only. The event is being arranged in conjunction with Mullard Limited. The films are entitled, "Mirror in the Sky", "From Us to View", and "Photo Emission." There is still a small number of tickets remaining and applications for these should, therefore, be made now. Please mark your envelopes "Caxton Hall" in the top left-hand corner, and include a stamped, addressed envelope for the tickets.

Our next issue, dated March, will be published on February 5th

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Round the World of Wireless

POTENTIAL AND CURRENT NEWS

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of October, 1959, 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.

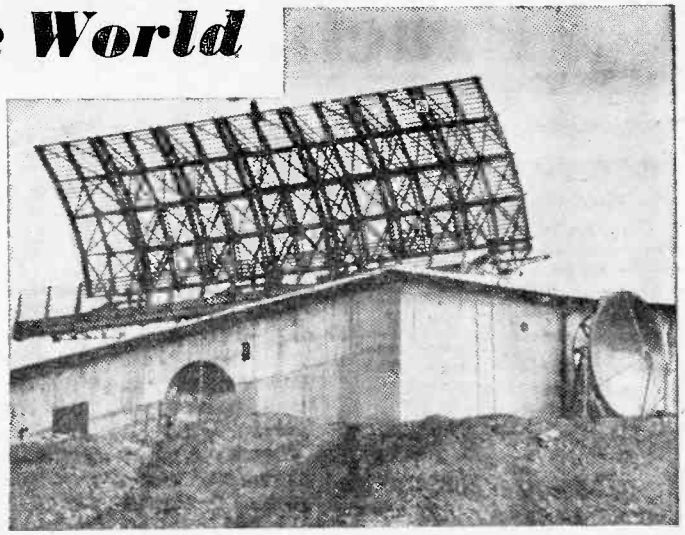
Region	*Total*
London Postal	860,803
Home Counties	836,989
Midland	620,487
North Eastern	710,288
North Western	571,594
South Western	500,205
Wales and Border Counties ...	308,125
Total England and Wales ...	4,408,491
Scotland	523,970
Northern Ireland	151,919
Grand Total	5,084,380

Radio Research Station

THE Council for Scientific and Industrial Research has authorised changes in the terms of reference of the Radio Research Station, D.S.I.R., and has appointed Mr. J. A. Ratcliffe, C.B.E., F.R.S., to be the new Director from October 1, 1960, when the present Director, Dr. R. L. Smith-Rose, C.B.E., retires.

The Radio Research Station has earned for itself an international reputation for its detailed studies of the propagation of radio waves by way of the ionosphere and the troposphere. Recently the programme has been reviewed and its scope has been extended so as to take advantage of the new techniques provided by rockets and artificial earth satellites.

Under its new terms of reference the station will undertake investigations of the upper atmosphere and outer space by both radio and non-radio methods. Half the total staff effort of the station (amounting to about 80 scientists and assistants) will be made available for this purpose. The necessary additional staff is being recruited.



Wellington (New Zealand) Airport, which has just been officially opened, is the first in the world to have a high-power (500kW) 50cm radar installation. This, together with a similar one at Ohakea Airfield, has been supplied and installed by Marconi's.

The Wellington installation posed many unusual engineering problems. The radar head, with duplicated transmitter/receivers, was sited on the highest point of a razor-back ridge, 1,630ft. high, control being effected from the Airways Control Centre four miles away, via a microwave radio link.

The received radar signals are also sent by microwave radio link to the airport and by a separate radio path to the Airways Control Centre for display on the radar screens.

Electronic Control Systems

A NEW electronically controlled positioning system, which when used in conjunction with a conventional drill, or other tool, enables very high degrees of accuracy to be obtained without a skilled operator, has been producing jet engine components at the Derby factory of Rolls-Royce Limited's Aero Engine Division for the past five months.

The system, which has been developed by E.M.I. Electronics Ltd., in collaboration with Optical Measuring Tools Ltd., uses a 30in. rotary table, and results obtained have been so satisfactory that Rolls-Royce has now placed orders for two more.

The new equipment allows work to be carried out to accuracies never before possible, and because it dispenses with expensive jigs and templates is particularly suitable for small batch working.

BBC's Sound Services

THE BBC issued the following statement on Friday, November 27th:

"The BBC has been considering for some time the development of its sound services in general, and their extension into local broadcasting. Any major extension of the existing services, particularly for local broadcasting, depends, in the first instance, on the allocation of additional frequencies in the V.H.F. Band. The BBC has already made known to the Post Office its desire to use further V.H.F. frequencies to fill gaps in its present V.H.F. coverage and for local broadcasting. These frequencies, which are allocated internationally for broadcasting, are at present used in this country by other services, and their release for broadcasting is problematical. Until this question is resolved it is not possible to proceed with detailed plans."

Agreement

AN agreement has been concluded between Marconi's Wireless Telegraph Company

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and the Government of India (Ministry of Defence) for the manufacture under licence in India of Marconi V.H.F. Multi-channel Radio Terminals and Repeaters, and ancillary equipment. The agreement underlines the importance the Indian Government places on the development and expansion of internal communications.

Under the terms of the agreement Marconi's are to supply all necessary technical assistance for indigenous manufacture.

Dounreay's "Hot" Laboratory

ONE of the world's most elaborate "'hot" radioactivity laboratories is a vital feature of Britain's new fast breeder reactor at Dounreay, Caithness. No similar reactor has ever operated before and, because of its unusual features, it is essential for nuclear scientists to carry out laboratory examination of intensely radioactive fuel elements.

Everything in the laboratory is done by remote control, using closed-circuit television and protective windows. Engineers and scientists operate the complicated equipment from behind concrete walls. Mechanical hands, called Master Slave Manipulators, follow precisely the movements of an operator's fingers and are sufficiently sensitive to pick up a pin.

Appointment

IT is announced by the Plessey Co. Ltd., that Mr. R. G. Kenwright has joined the Company as Chief Engineer, Television Components Division, Components Group, Ilford.

Mr. Kenwright joined Pilot Radio Limited in 1940 and was appointed Chief Engineer of that Company in 1946. In this capacity he was responsible for the complete production programme for radio, television and other equipment.

Before joining Pilot Radio Limited, Mr. Kenwright was a radio design engineer with The Plessey Company Limited.

Sales and Production of Gramophone Records in September

MANUFACTURERS' sales of gramophone records in September were valued at £1.290.000 which was 3 per cent. higher than in September 1958. Total sales for the third quarter of last year were 1 per cent. higher than in the corresponding quarter of 1958 but export sales were 6 per cent. lower.

In September the production of 45 rev/min. records was 51 per cent. greater and 33⅓ rev./min. records 23 per cent. greater than in September 1958 but 60 per cent. fewer 78 rev./min. records were produced.

The total production of gramophone records during the third quarter of last year was 5 per cent. higher than the third quarter of 1958; 66 per cent. fewer 78 rev./min. records, 56 per cent. more 45 rev./min. records and 11 per cent. more 33⅓ rev./min. records were produced than in the corresponding quarter of 1958.

Trade Fair in Moscow

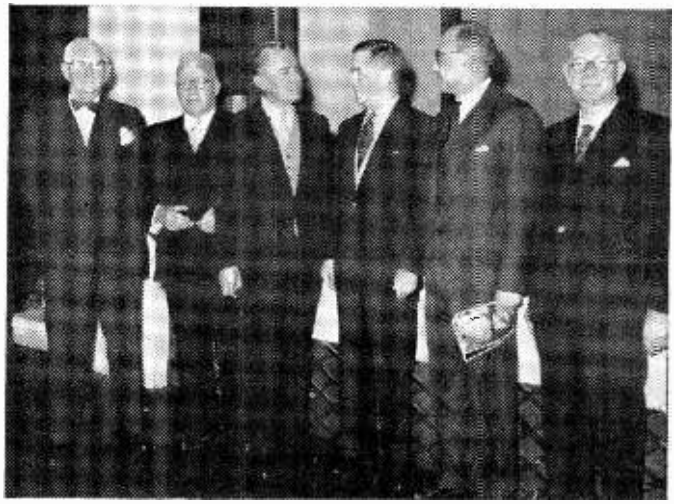
AN Advisory Council of leading industrialists with wide experience of trading with the Soviet Union has been set up to advise on the organisation of the British Trade Fair to be held in Moscow in 1961. The Council will hold joint meetings at regular intervals with the Working Committee on the Fair. It will also act as an Exhibitors' Committee to ensure that the Fair is organised in the best interests of British industry.

Mr. V. G. Sherren, Managing Director of Industrial & Trade Fairs Limited, organisers of the Fair, and Chairman of the Working Committee, said at today's first meeting of the Joint Committee that the response from British industry to the Anglo-Russian Trade Agreement signed last year has been immediate and a large number of British companies regard the Fair as the ideal "stepping-off ground" for future trade relations.

Tape Services for the Sick and the Blind

ON Friday, 30th October, the arrangements for the first steps in the co-ordination of tape-recording services for the sick and the blind were formally agreed on at the offices of the British Recording Club, 145, Fleet Street, London, E.C.4.

The organisations which will now work in co-ordination with the British Recording Club are The Hospital Broadcasting Services, The Tape Reading Circle for the Blind, and the British Recording Club Braille Services.



Top telephone men of Britain get together. Left to right in this group, seen at the G.P.O.'s Dollis Hill, London, Research Station, when Britain's first experimental electronic telephone exchange was opened on November 10th, are: Sir Thomas Eades, Chairman of the Automatic Telephone and Electric Co.; Sir Lionel Harris, Engineer-in-Chief of the Post Office; Mr. J. R. Bevins, Britain's new Postmaster-General; Dr. J. N Aldington, Group Managing Director of Standard Telephones and Cables; and Mr. R. Robinson, Director in Charge of G.E.C's Telephone, Radio and Televison Works.

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Beginner's Test-Meter

No. 6.—THE WIRING OF THE A.C. RANGES OF THE MULTI-METER

By E. V. King

THIS final article will enable the construction of the multimeter to be completed. Few extra parts are required and none of the wiring so far carried out has to be altered or removed.

The A.C. Range (Volts)

In order that the meter may be used for testing the mains side of a receiver, the unrectified transformer output for H.T. or the audio-output, the meter must respond to A.C. voltage. A moving coil instrument will flicker on A.C. so that we must accept A.C. into the test leads, pass it through the dropping resistors and then rectify it to D.C. before application to the meter. Full wave rectification is necessary to obtain a correct deflection and a special "meter rectifier" is usually employed to do the job. The author believes these are of the copper oxide type, but are basically no different from any other rectifier. They are very small and compact, being about the size of six shillings piled one on another. This rectifier must match the full scale deflection of the meter. That is, in our meter, it must be bought as a "one milliamp meter rectifier (bridge type)" (see Fig. 30). These vary in cost between 6s. 6d. and 14s.

The author tried the use of four ordinary

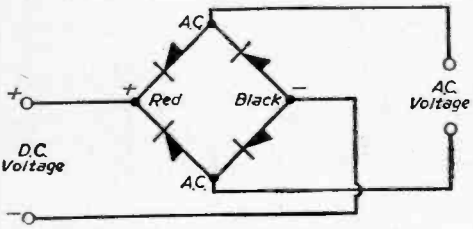
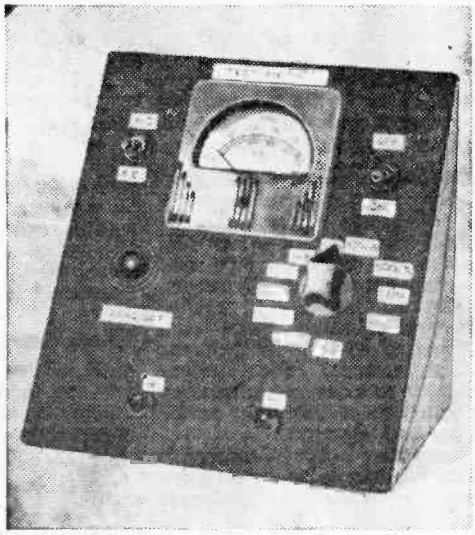


Fig. 30.—Circuit of the meter rectifier.

cheap germanium diodes and had reasonable success, the results of which will be given later. The use of four diodes would, of course, lower the cost considerably as they are very cheaply available on the surplus market. They would probably be harder to burn out than the copper oxide type rectifier which is very easily damaged by overload or by overheating when fixing the wires.

The low ranges of Volts are not accurate when the rectifier is in circuit so a switch is fitted to give direct connection to the meter for ordinary D.C. use, the rectifier being switched in for A.C. operation. The input to the meter at "c" and



The completed meter.

"d" is always connected to the rectifier, but this has no affect on the meter (i.e., does not shunt it) as the rectifier resistance is very high.

Wiring the A.C. Range

The switch S4, which must be a two-pole, throw-over type is fitted as shown in Fig. 31. Find out with a torch battery and lamp or by using the multi-meter on the resistance range when the contacts "a" and "b" are making with "f" and "e" and arrange the switch as shown. Then the down position will be "A.C." and the up or "Off" position will be D.C. It you did make an error, however, it would not be serious and would soon be discovered for the meter would refuse to work on "A.C." but would work on D.C. or A.C. when switched to D.C.

The meter rectifier is attached to the panel with a small bolt as shown in Fig. 31. Do not shorten the leads already attached. Now examine the rectifier. Two leads are green, one is red and one is black, or two tags have no colour, one is red and one is black. Or engraved in the black plastic near each tag is a sign, one +, one −, and two ~. The green leads, the colourless tags or the tags marked ~ are those which accept A.C., the others obviously passing on positive and negative polarity respectively. The rectifier must not on any account be touched with a soldering iron. The leads should have sleeving slipped over them and they may be lengthened as required.

Here is a suggested plan to be carried out with careful reference to Figs. 31 and 27.

1. Unsolder the lead going to plus of milli-

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ammeter and solder it to tag "d" on S4.

2. Unsolder leads from negative of meter, join them together and lengthen if necessary (or make fresh connections) so that they connect to "c" on S4. This has been done on Fig. 31 by taking a wire from R5 to "c" and from R5 to pin 6 on S2 and then on to the busbar joining R6, 7, 8 and 9.

All we have done so far is to connect leads which did go to the milliammeter to "c" and "d" on the switch.

3. Join "b" of S4 to plus of milliammeter.

4. Join "a" of switch to minus of milliammeter.

Now put switch in D.C. position and test that the meter still works properly on all ranges as it did before. Do not proceed to wire in the rectifier until you are sure of this.

5. Take the two A.C. leads (green, colourless tags or marked ~) and connect one to the plus terminal of the multimeter ((that makes three leads to this terminal in all). Connect the other to the busbar joining R1, 2, 3, 4 and 5 together. Make sure no shorts can occur as the leads will be rather on the long side.

Now put the switch to D.C. as before and check again that the meter still works perfectly on all ranges. If it does not, then the rectifier is faulty unless you have caused other wiring trouble. Again, *do not* proceed if the meter does not work at this stage.

6. Solder the positive lead from the rectifier to tag "f" on S4.

7. Solder the negative lead from the rectifier to tag "e" on S4.

Now test on D.C. again: there should be no difference. You may now switch to A.C. and try it on a battery or A.C. voltage from a transformer. The same rules apply to this as applied to the D.C. meter, always start with S1 off, and on the highest range. Never overload the meter.

An interesting point when using a copper oxide rectifier is that if the meter is overloaded on D.C. ranges with the circuit of the multimeter the rectifier is much more likely to break down than the meter. This is a good point as on the whole the rectifiers are cheaper and easier to come by than meters, but it also means that if an obscure fault occurs and no deflection can be obtained on any range it could be rectifier trouble. This would soon show up on removal of the rectifier, the remainder of the circuit being left intact and the switch S4 being put on D.C.

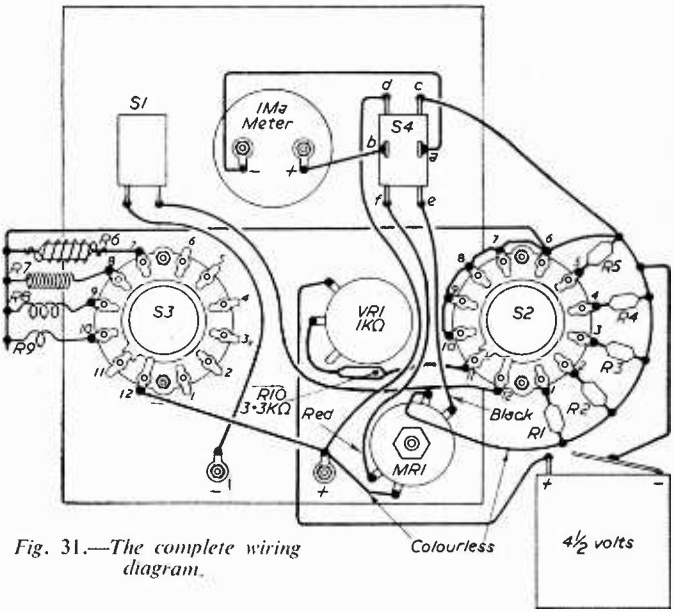

Fig. 31.—The complete wiring diagram.

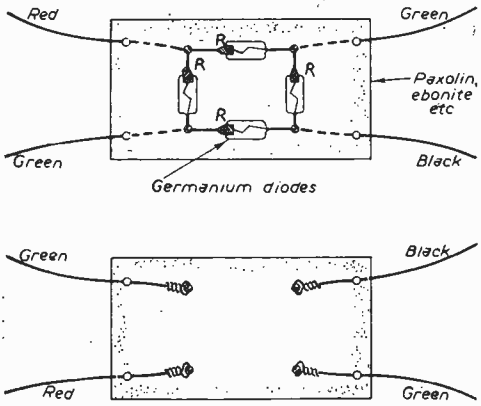

Fig. 32.—Making a meter rectifier from four germanium diodes.

Making a Meter Rectifier with Four Germanium Diodes (Fig. 32)

Four diodes are mounted by passing the leads through four holes spaced about ¾in. apart in some paxolin. The leads are twisted and soldered at their ends on the other side. Leads coded by colour are taken through four more holes to guard against accidental pulling.

The diodes should be tested on the resistance range and four with the lowest resistance chosen for use. If the meter shows a very high resistance reverse the connections in the above test.

The germanium diodes have an appreciable resistance in the forward direction so that the ranges will read low on A.C. but in ordinary servicing this will not matter.

Full details are given in the sketches of Fig. 32. Some diodes may be coloured the reverse way round so if, when wired in circuit, the meter tends to move backwards, simply change over the red and black leads from the rectifier bridge.

Using the A.C. Ranges in Receiver Testing

The meter is switched to A.C. 1,000V range and the voltage range reduced with caution as each test is in progress. On Fig. 10 the meter may be

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clipped across the mains leads (8 and 9) to test if the voltage is actually there and across at points 7 and 10 to test the switch (e and s).

In Fig 11 the meter would be used across the mains at 18 and 16 and then at 17 and 16 to test the switch. When connected across from 17 to 18 with the switch off it will tell you if the transformer winding is open circuit, it should show the full voltage of the mains. Test the secondary of the transformer by putting the meter between point 15 (usually chassis) and each anode of the rectifier valve at 14 and then 13. The readings should be identical. If not, remove the valve and test again. The voltages will be higher but should be identical. If not H.T. windings are shorting, if they are the rectifier valve is faulty. The reading from 13 to 14 is not of much use but will be the sum of the other two readings. Test here with care as a 500-0-500 transformer will have well over 1,000V on this test.

Filament windings may be tested, but since the filament voltage should be fairly accurate and the meter is not, especially on the low (A.C) ranges, refer to the graph given (Fig. 33) or test a receiver known to be in working order and note the 5V, 4V and 6.3V positions.

Using the Meter to Test Condensers

The meter is put on D.C. ranges, to resistance test. One lead is clipped to the condenser and the other lead is touched, without contact with the hand, on to the other side of the condenser. For condensers of 0.01μF and less, no deflection of the needle should be noticed. If there is, the condenser should be discarded. If the condenser is over 0.01μF and up to about 0.1μF, there should be a very small flick after which the needle should return to zero. If it does not, the

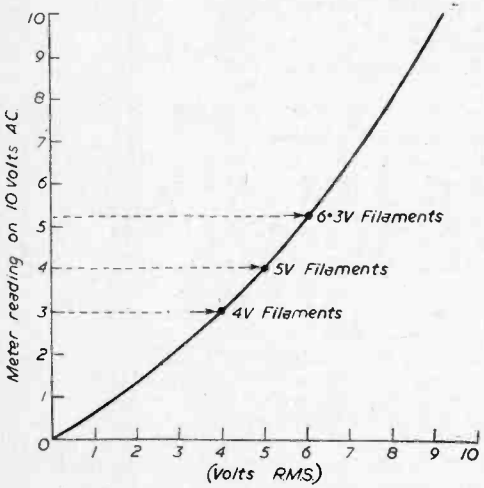
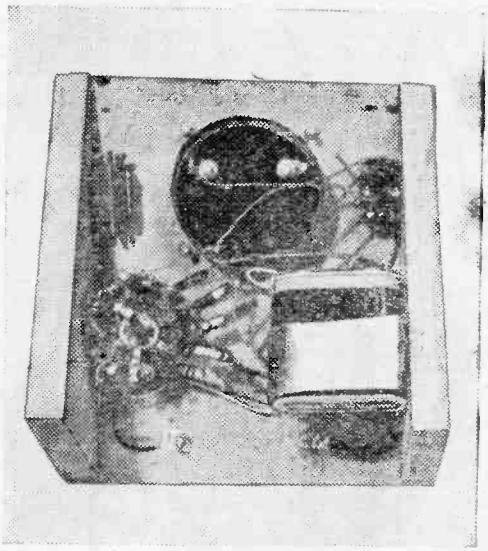


Fig. 33.—Reading filament voltages from a graph.

condenser is no use, having a high leakage value. If the condenser is 0.1μF (or over) the flick will be more apparent (about 1/20 full deflection), but should still settle to zero if the condenser is not electrolytic. In testing larger condensers the same idea is applied, but the original deflection



Rear view of the completed meter.

will be greater. This gives a rough estimation of capacity. When testing electrolytics, the meter will probably move right over the scale and should return rapidly to almost zero. The nearer to zero it goes the better the condenser, and the more the initial flick the higher the capacity or the better polarised the condenser is. If the needle moves back slowly, over, say, one minute, it shows usually that the condenser needs polarising on a D.C. source. When testing electrolytics, the plus terminal of the meter should be connected to the minus of the condenser.

Trimmers may be tested for the usual fault of a dead short in the same way. Disconnect from circuit on one side first (as a tuning coil may be shunted across them).

Conclusion

The radio enthusiast will now have a strong, serviceable meter with which he should be able to carry out all normal tests, and fault detection should become much easier. Above all he will, in the construction of the meter, have gained much useful knowledge. If a commercial instrument is overloaded and damage is done it is often necessary to return it to the makers, but the beginner with this meter should be able to trace any damage and repair it himself. Even if it happened to be the movement itself which needed replacing, this would be a small cost compared with a makers' overhaul.

If you are not in the habit of filing your PRACTICAL WIRELESS you should copy out the circuit of the completed meter, put it in an envelope, and pin it inside the meter for reference in the future if necessary. This is always a useful procedure, even if some apparatus is made for a friend, as one's memory of particular jobs often fades surprisingly over a few years.

The author will be pleased to deal with any queries concerning this particular instrument through the usual query coupon service.

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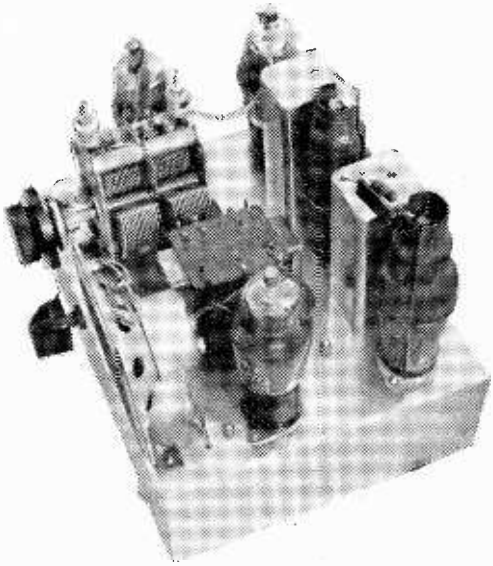
A 6K7 Superhet



A CIRCUIT USING FIVE IDENTICAL VALVES

By J. Heath

THE 6K7 type of valve can be obtained very cheaply indeed, and in the receiver described here this valve is common to all stages. This fact much reduces the cost of building the set, and means that only one extra valve is needed for replacement in any stage throughout the whole receiver.

Circuit

The circuit is shown in Fig. 1, and is for A.C. mains only. The first valve is employed as a suppressor grid mixer, with separate oscillator. Coils are for medium waves only, but a pair of long wave coils, with switching, can always be added easily. The third valve acts as a conventional intermediate frequency amplifier, and is followed by a grid detector, the valve being wired as a triode. This is a sensitive detector and requires few components. The last valve acts as output, with a screen grid dropper to prevent the maximum rating being exceeded. A contact-cooled metal rectifier provides H.T., but there is plenty of space for other types of rectifier.

It should be noted that equivalents of the 6K7 may be inserted instead, and these include the CV1941, CV1943, EF39, KTW63, OM6, and W63. The 6K7G and 6K7GT types are also equally suitable, these having glass and glass tubular bulbs respectively. Looking at the valve or holder from below, and counting pins clockwise from the key-way, connections are as follows:—

1. unused, but metal shell in metal types, and therefore wired to chassis.
2 and 7. heater.
3. anode.
4. screen grid.
5. suppressor grid.
6. unused.
8. cathode.
Top cap, control grid.

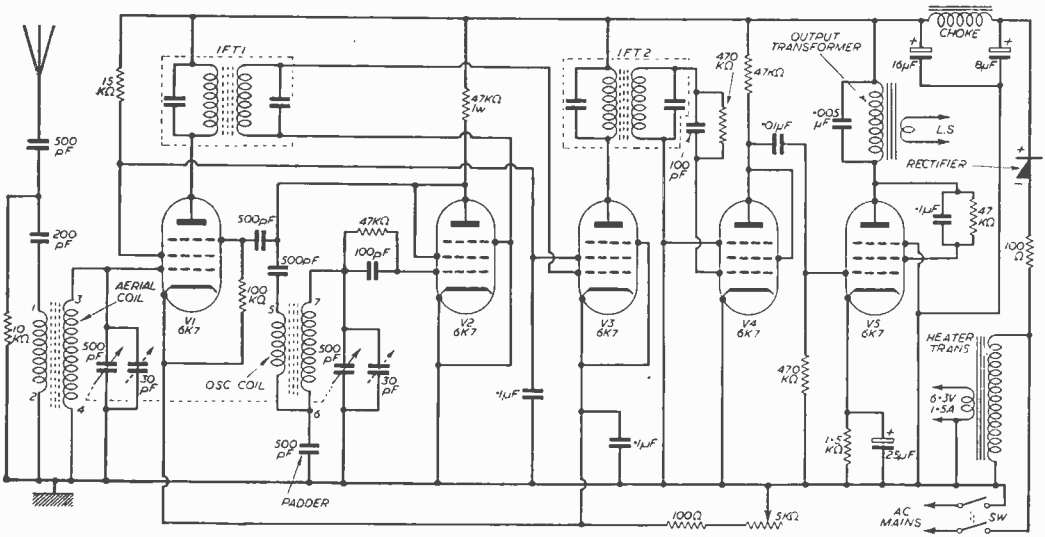


Fig. 1.—The circuit diagram.

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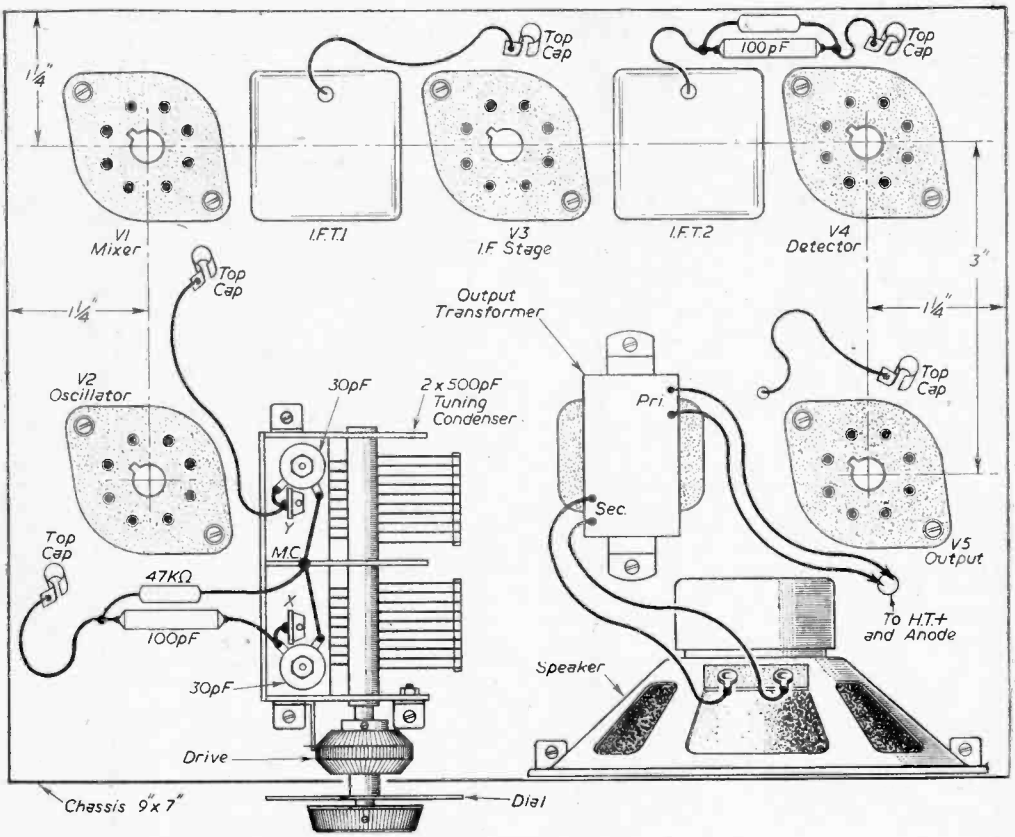


Fig. 2.—Chassis layout.

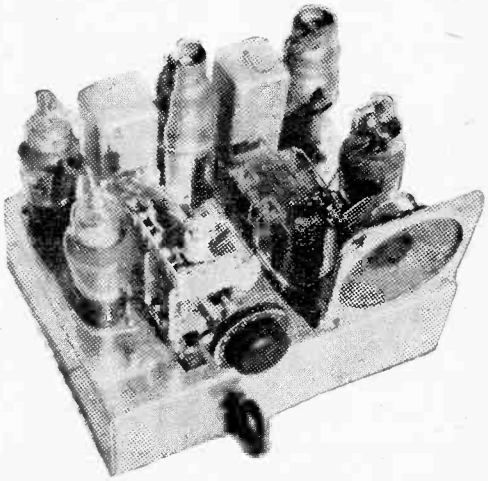
These pin connections are, of course, common to all the stages throughout the receiver. It is thus easy to make a final check of valveholder wiring, before trying the set.

Chassis Layout

A chassis 9in. × 7in. × 2½in. deep will easily accommodate the parts, including a 4in. or similar speaker, and the layout is shown in Fig. 2. A sensitive speaker of the type used in battery portables will be satisfactory, and its output transformer may generally be retained because the primary current is only some 12mA or so. A transformer for mains output valves, of larger type and greater current rating, is equally satisfactory.

Separate trimmers of 30pF or 50pF maximum capacity must be wired in parallel with each section of the gang condenser, as shown in Fig. 2, if this item does not have trimmers already fitted. Any type of reduction drive is satisfactory. The small drives made to fit directly on the condenser spindle have a projecting lug which must be held by a bracket or long bolt and lock nuts, or the drive cannot function.

The first I.F. transformer will normally have a lead issuing from the top, unless it is a midget component. This lead is for I.F. stage grid connection. With the second transformer, all leads normally issue from the bottom, and the wire which would normally go to the diode can



The parts shown in the chassis layout diagram can be identified in this view of the receiver.

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be lengthened, and brought through the chassis, where it is joined to the 100pF condenser and 470k resistor. With some transformers it is quite easy to lift off the can and draw this lead through a top hole, as in Fig. 2, instead.

All connections above the chassis are shown in Fig. 2. With the output transformer, "P" indicates the primary, and "S" the secondary. The ratio is not very critical, and can be around 50:1, for a 3ohm speaker. The speaker itself is best left off until other constructional work and wiring has been completed.

COMPONENTS LIST

Two 465kc/s I.F. transformers.
2-gang 500pF tuning condenser, with 30pF or 50pF trimmers.
Reduction drive and control knobs.
Aerial and oscillator coils, 500pF padder.
Five 6K7 or similar valves. Five octal holders.
Resistors: two 100 ohm, 1.5k, 10k, 15k, 100k, four 47k, two 470k, 5k pot. with double-pole switch.
Fixed Condensers: two 100pF, 200pF, three 500pF, 0.005μF, 0.01μF, two 0.1μF, 25μF, 12V.W., or 25V.W., 8 plus 16μF, 350V.W. or similar.
6.3V, 1.5A heater transformer.
50mA, 250V metal rectifier.
Small smoothing choke.
Chassis: about 9in. x 7in. x 2½in.

Underneath the Chassis

Wiring and components are shown in Fig. 3. The heater circuit is best connected up first, the insulated wire being run close against the chassis. With the heater transformer, the primary should be for 230/250V and the transformer should supply 6.3V, 1.5A.

Mains connections should be made with good quality flex, that side of the circuit which goes to receiver chassis (via switch) being taken to mains neutral. This is easily arranged if a 3-pin plug is used to draw current from a 3-socket wall outlet.

Rectifier

The contact-cooled rectifier should be bolted securely to the chassis, burr being removed from the holes so that good thermal contact arises between rectifier and chassis. The ordinary type of rectifier can be mounted on brackets above the chassis.

(To be continued)

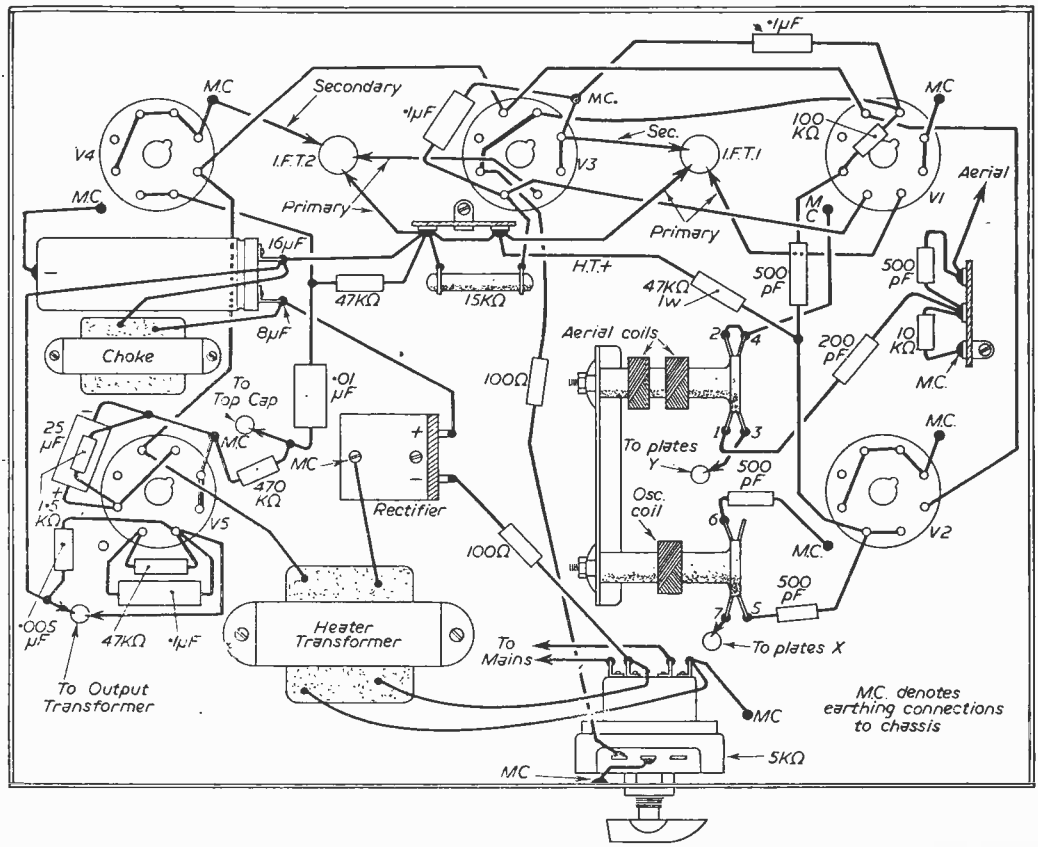

Fig. 3.—Wiring of the receiver.

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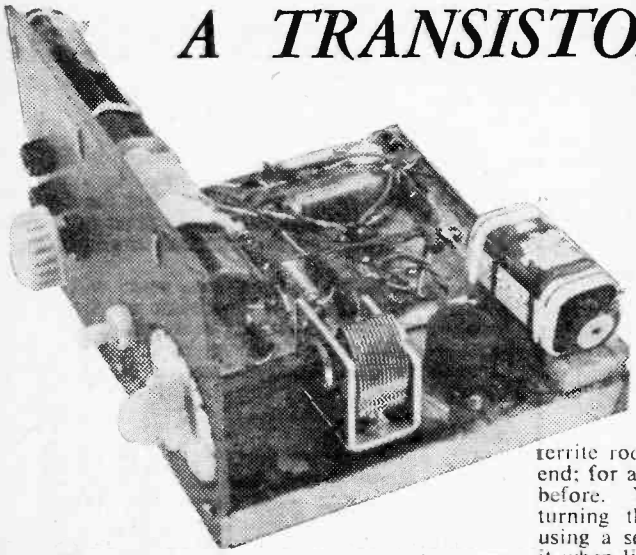
A TRANSISTOR REFLEX RECEIVER



COMPLETING AND TESTING THE SET

(Continued from page 744 of the January issue)

By D. B. Pitt

THE circuit diagram of this receiver was given in the previous article (January issue) and its operation was discussed. The construction of the receiver was begun and the two brass busbars used can be seen clearly in the illustration on the opposite page. When the ferrite rod has been mounted, as described last month, the stand and core of the pot should be fixed in the set with woodscrews or the bolts provided with it, making sure that it is not too near the ferrite rod. Failure to separate L1 and L2 by a gap of several inches may result in unpleasant howls and distortion.

We will now assume that all the components have been wired up and firmly fixed, with the exception of the battery, L1 and L2. Turn R5 to its fully negative position (i.e., rotor-arm shorted to emitter of T1). Now take 5ft. of thin coil wire (the gauge is not important, but you should be able to handle it without breaking it) and wind 33 turns tightly on the middle groove of the bobbin. Secure the coil with thread or a very small rubber band that does not protrude beyond the rim of the groove, and reassemble the pot in its proper position, making sure that the wires emerge from the holes without being trapped between the cups, and that the plastic screw is turned up firmly but gently.

Testing

Next, connect up the two ends of the coil temporarily to the correct circuit points (across C1) and also connect a temporary aerial to T1 collector terminal via a 47pF capacitor. Do not shorten the coil leads yet; you may need the extra for adjustments.

Now take another 5ft. length of coil wire and connect its ends (temporarily) to the proper points for L2 (i.e., base of T1 and junction of R1 and R2).

Next, take the ferrite rod (or the second pot-core, if a fixed receiver with aerial is planned) and wind on about 20 turns of the wire. For a ferrite rod this means bunch-wound towards one end; for a pot core it means the middle groove as before. You should now be able to hear, on turning the tuner, a local station or two. If using a second pot you must remember to close it when listening.

Sensitivity

Carry on in this way, adding turns one by one, until heterodyne squeaks straddle each station. You must now judge the right moment to stop. An excessive number of turns will make the receiver over-sensitive and exasperatingly difficult

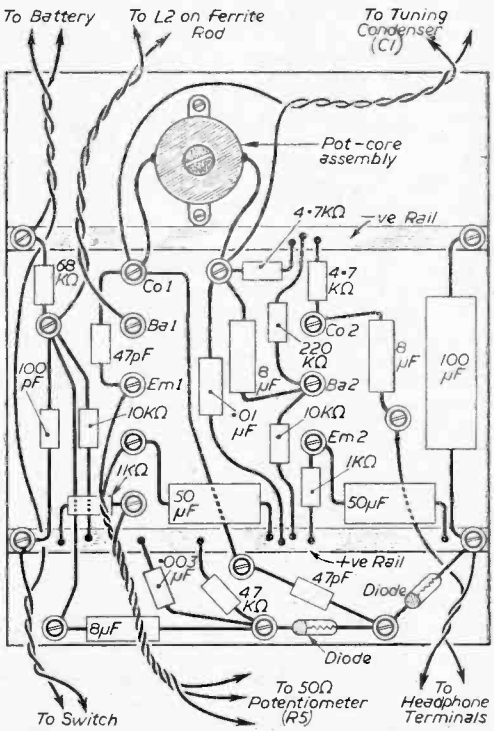


Fig. 2.—The wiring diagram.

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to control without geared tuning. A slow, rhythmical chirping or "motor-boating" indicates a serious fault caused by insufficient separation of L1 and L2, cramping of wires and components, or failure of C11 or C12, and should be remedied before proceeding further.

When satisfied that the best degree of sensitivity has been reached, try the effect of using C1 and R5 controls together. Notice that although R5 has little effect on tuning-scale positions, the loudest reception of a given station is by no means always achieved with the highest level of regeneration.

If you do not intend to use an aerial, you should now disconnect the temporary one and readjust the turns of L2 for ferrite rod alone. This will mean a few extra turns for best results.

Finally, shorten the leads of L1 and L2 and fasten the ends properly, making sure that the two coils keep their proper distance apart.

Notes

For really long-range reception, obtain two shaft-extension bushes and shorten the shafts of L1 and C5 and use the coupling bushes to attach lengths of ¼in. plastic rod or dowelling to these two components. If you can obtain a geared drive for C1, so much the better. Fix the two components at the back of the receiver and allow the ends of the plastic rods to project through the front of it sufficiently to attach the knobs. A last refinement which may be tried is to connect a small capacitor (maximum value 47pF) between the collector and emitter terminals of T1. By the use of these three stratagems the turns on L2 may be considerably increased whilst control is maintained. Superhet sensitivity is thus achieved without instability. The receiver will not break into self-sustained oscillation, anyway, the above measures being remedies for hand-capacitance, etc. To constructors familiar with the temperament of orthodox regenerators, this automatic suppression of oscillation at the central tuning point of each station may come as a pleasant change.

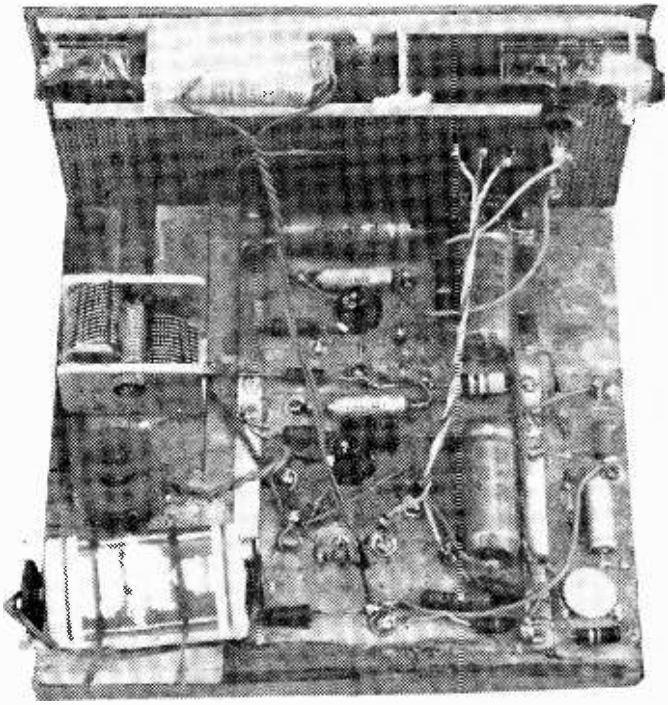
Screening

Screening has not been mentioned in the above note because no part of R5 or C1 is at the same potential and so it is difficult to apply. If you would like to try the effect, then place a large sheet of aluminium at the front of the receiver, electrically isolated from the circuit, drilling two holes for the plastic control shafts. If this is unsatisfactory, connect a high resistance potentiometer across the battery and take a wire from its middle terminal to the screen. Adjust the potentiometer setting for best results.

The use of Litz (stranded) wire for L1 and L2 will improve performance. If you use this wire, clean the insulation from the ends of all the strands. Join all the strands together with solder and treat as one wire for fixing. Failure to observe these precautions will mean losing the advantages that this wire offers.

Earth

The use of an earth wire is not recommended, but if you intend to try one, connect it to various points on the circuit until best results are achieved. If you are using a screen, then connect the earth wire to the screen and nowhere else.



Rear view of the receiver.

H.F. Reception

Reception on the lower (high frequency) end of the medium waveband, for which L1 is designed, will not be very loud. This is not the fault of the set but of the transistor specified when used in the common emitter (high gain) mode. Better results will be obtained with an OC45 for T1 and perfect results with an OC44, but at some extra expense. Alternatively, the waveband may be altered by adding half a dozen extra turns to L1 thus bringing in low-frequency medium-wave stations at high volume. If this is done, the number of turns on L2 may have to be adjusted slightly.

If you use a second pot core for L2 (for a fixed set with an aerial) you may care to use the internal slug for small adjustment of inductance. For this you will have to drill a ¼in. hole in the baseboard or chassis on which L2 is mounted,

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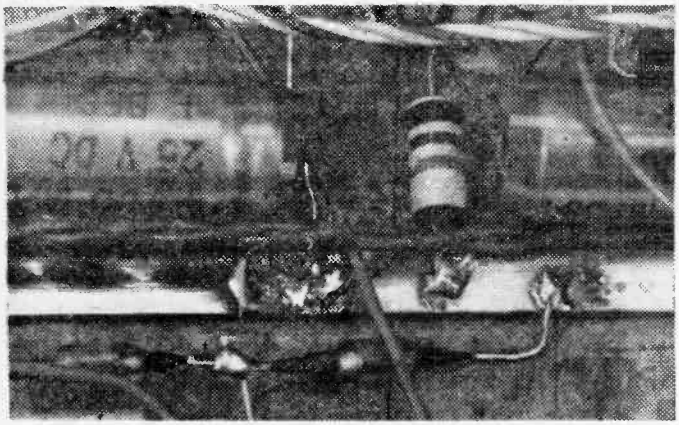

Close-up of part of the wiring.

directly under the centre of the core, so that a screwdriver can be inserted from the far side.

Do not forget that receivers that produce heterodyne whistles can spoil other people's reception if too long an aerial is used.

COMPONENTS LIST

Resistors :

R1—68K, ½W
R2—10k, ½W.
R3—4.7k, ½W.
R4—1k, ½W.
R5—50ohm, wirewound pot.
R6—47k, ½W.
R7—220k, ½W.
R8—10k, ½W.
R9—4.7k, ½W.
R10—10k, ½W.
All resistors are of 10 per cent. tolerance.

Capacitors :

C1—500pF variable (miniature or standard).
C2—50μF, 12VW electrolytic.
C3—100pF ceramic.
C4—47pF ceramic.
C5—0.093μF mica.
C6—8μF 12VW electrolytic.
C7—8μF 12VW electrolytic.
C8—50μF 12VW electrolytic.
C9—8μF 12VW electrolytic.
C10—47pF ceramic.
C11—0.01μF paper.
C12—100μF 12VW electrolytic.
C13 (if needed)—47pF ceramic.

Transistors :

T1—XA104.
T2—XB104.

Coils :

L1—Pot-core assembly, Neosid D10 (Denco).
L2—See text.

Diodes :

X1 and X2—GEX34

Performance

No aerial or earth connection has been shown in the diagrams. Reception of local stations on the ferrite rod alone was adequate during daylight, and after nightfall all the strongest medium-wave stations above about 230 metres were received at good volume, using standard high-impedance headphones. The addition of one more transistor audio stage gave good loudspeaker loading with sufficient volume for an average domestic room. Tone, using a good 12in. speaker, was apparently undistorted, and background noise (with this speaker) was negligible. This performance refers to Nottingham, which is not an especially good location for the reception of Continental transmissions on the medium waveband.

Readers constructing this receiver should note that its performance depends, more than anything else, on the winding of L2. A little extra time spent in adjusting the number of turns, spacing of turns along the sleeve, and position of the sleeve on the rod, will be amply repaid in terms of results.

Books Received

R.S.G.B. AMATEUR RADIO CALL BOOK. 1960 edition. 72 pp. 10in. × 7in. Published by The Radio Society of Great Britain, New Ruskin House, Little Russell Street, London, W.C.1. Price 3s. 6d. 4s. by post.

The previous edition of the R.S.G.B. Amateur Radio Call Book appeared in November, 1958, and since then more than 350 new calls have been issued. More than 300 calls cancelled, 100 old calls re-issued and more than 900 changes of address recorded. The popularity of the book can be judged from the fact that practically all copies of the 1959 issue were sold within a few months of publication.

AUTO RADIOS, by Jack Darr. 154 pp. 8½in. × 5½in. Published by John F. Rider Publisher Inc., 116 West 14th Street, New York, 11, N.Y., U.S.A., and obtainable from Chapman and Hall, 37, Essex Street, London, W.C.2. Price 26s.

This American book deals with the installation and servicing of car radio receivers and although many American expressions and technical terms are used, much of the information would prove of value to the serviceman in this country. Chapters deal with installation, servicing, 6-12V conversions, hybrid radios and the workshop.

BASIC AUDIO (three volumes), by Norman H. Crowhurst. 448 pages in all. 9in. × 6in. Published by John F. Rider Publisher Inc., 116 West 14th Street, New York 11, N.Y. Obtainable from Chapman and Hall, 37, Essex Street, London, W.C.2. Price 23s. per set.

These three volumes deal with almost every aspect of A.F. theory and are illustrated throughout with line drawings. The treatment may seem rather elementary to some British readers, but no knowledge is assumed and the books should prove valuable to the practical man. The illustrations follow the typical American style.

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6BH6	10/6	12AX7	9/6	EF50 5/6	PY82 8/6
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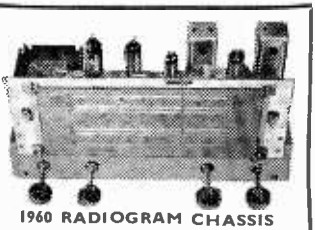
6K6GT	6/6	954	1/6	EZ80 8/6	VR105 8/6
6K7G	5/6	EA50	1/6	E1148 1/6	VR150 8/6



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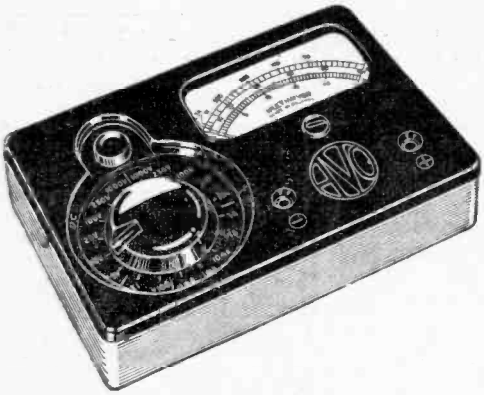

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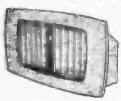

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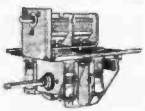

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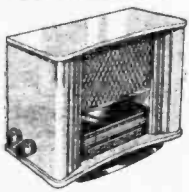

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Versatile V.F.O.

FREQUENCY STABILITY IS A VALUABLE FEATURE

By R. H. Wright

ALTHOUGH use of a quartz crystal is the ideally safe method of controlling the frequency of a transmitter (and incidentally crystal control frequently leads to a reduction of TVI.) there are practical advantages to be gained from V.F.O.

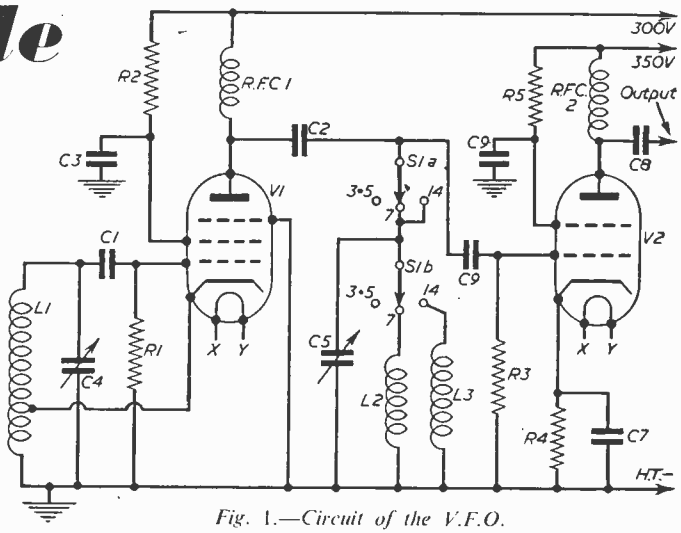

Fig. 1.—Circuit of the V.F.O.

Advantages

With a V.F.O. it is usually possible to find a spot in the band which is free from interference and thus a call may be made without causing QRM to stations already working. Also, if two—or more—stations in contact use the same frequency, less crowding of the band will result than if each operated on a different crystal, frequency.

In developing the V.F.O. described below, and shown in circuit form in Fig. 1, the writer had a number of factors in mind. It should, first of all, have excellent frequency stability particularly in the event of supply voltage variations, and also when the output circuit is tuned. The effects of supply voltage variations are reduced by the use of the voltage stabilisers (Type VR150/30) shown in the power supply circuit, Fig. 2. The effects of tuning the output circuit are minimised by running "straight through" when transmitting the fundamental V.F.O. frequency and only tuning the output when harmonic operation is required.

COMPONENT FOR V.HF.

R1, R3—100,000ohms, ½W.
R2—22,000ohms, 1W.
R4—220ohms, 2W.
R5—4,700ohms, 1W.
C1, C9—100pF.
C2, C3, C7, C8, C9—0.01μF (mica).
C4—500pF variable, see text.
C5—100pF variable.
RFC1, 2—R.F. choke. 2.4mH. Denco type RFC.5.
L1—36 turns, 26 D.C.C. wire on ⅜in. diameter former, close wound and tapped 12 turns from earth.
L2—7Mc/s coil. 40 turns 26 D.C.C. wire on ½in. diameter former.
L3—14Mc/s coil. 25 turns 18 D.C.C. evenly spread over 1⅜in. on ½in. diameter former.
V1—6CH6, or octal-based 6AG7.
V2—6V6.

Hartley Circuit

The oscillator section of the circuit is an electron-coupled Hartley type oscillator operating on 3.5Mc/s. Output on the second and fourth harmonics (7.0 and 14.0Mc/s) will be sufficient to drive an amplifier if the output circuit (C5 and L2 or L3) is tuned to either frequency. Thus, output can be obtained from the unit on three bands without the need of further doubling. A 6CH6 valve was used in the prototype, but the larger 6AG7 can also be used successfully. V2 is an untuned buffer, isolating the V.F.O. from any effects that the following amplifier may have. The oscillatory circuit is tuned by a 500pF variable capacitor and with this capacitor a good slow motion dial is an absolute necessity. Alternatively, a 500pF capacitor may be used to "set" the band and the actual tuning then carried out by means of a 50pF variable connected in parallel.

Harmonic Operation

When output is required on 3.5Mc/s band, the oscillator is tuned to the required frequency and switch S1 (a) and (b) turned to the blank position. The oscillatory voltage developed across RFC1 is then applied directly across grid and cathode of the buffer valve. If output is required on 7Mc/s the oscillator is tuned still on 3.5Mc/s and the output circuit of C5/L2 switched into use through switch S1 (a) and (b), this circuit is then tuned to the second harmonic of 3.5Mc/s. For 14Mc/s output the oscillator is still left on 3.5Mc/s but L2 is now replaced by L3 by means of the switch S1, and the circuit C5/L3 is tuned to the 14Mc/s harmonic. Output on this frequency—the fourth harmonic—will, of course, be less than on the fundamental frequency of 3.5Mc/s or on the second harmonic of 7.0Mc/s but nevertheless will be sufficient to drive an amplifier.

If the V.F.O. unit is followed by an amplifier, the whole arrangement forms a useful low-power transmitter, with an input to the final stage of about 15W. Fig. 3 shows the circuit of such an amplifier which may be operated from the power

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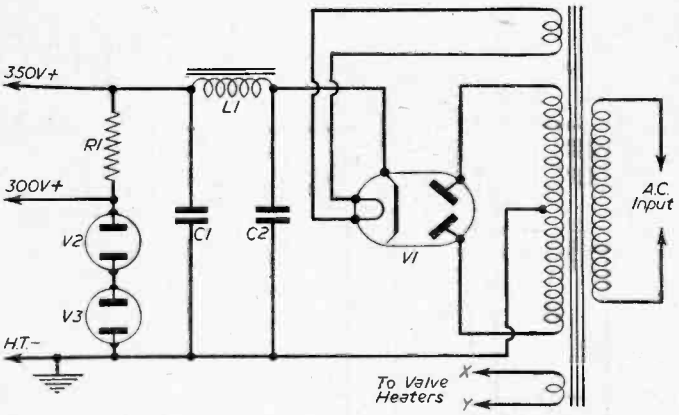

Fig. 2.—Circuit of a suitable power supply.

COMPONENTS FOR POWER UNIT

T1—350-0-350, 150mA sec. 5V, 3A, 6.3V, 5A.
L—L.F. choke. 20H, 150mA.
C1, C2—16+16μF electrolytic capacitors. 500VW.
V1—5Y3 or 5Z4.
V2/V3—Stabiliser type VR150/30.
R—2,000ohms, 10W fixed resistor.

unit normally supplying the V.F.O. This amplifier, if used as a doubler as well as an output stage, will enable the transmitter to operate on 28Mc/s, if C5/L3 is tuned to 14Mc/s, thus increasing the versatility of the unit. If this procedure is followed, no alteration to the power amplifier stage is required beyond tuning the aerial circuit to 28Mc/s.

Power Amplifier

Only a little comment is required here since the amplifier is quite a normal circuit. The meter in the grid circuit (M1) is more of a necessity than a luxury since it permits accurate tuning of the circuit C5/L2 or L3 when using the oscillator on 7 and 14Mc/s. The tuned circuit should be adjusted to give maximum power amplifier grid current reading. The inductive part of the π—output coupling into the aerial (L1) may be one inductance tapped for use on the various bands and the tapping points then connected to a switch. However, plug-in coils are generally used by the writer since their use eliminates the losses normally associated with a switched inductance. Details of coils suitable for use on the popular 80, 40 and 20m bands are given below.

L2 and C6 are included as a series filter to reduce interference with the local Band I television (BBC) reception. L2 should be formed from nine turns of 18 gauge enamelled wire close-

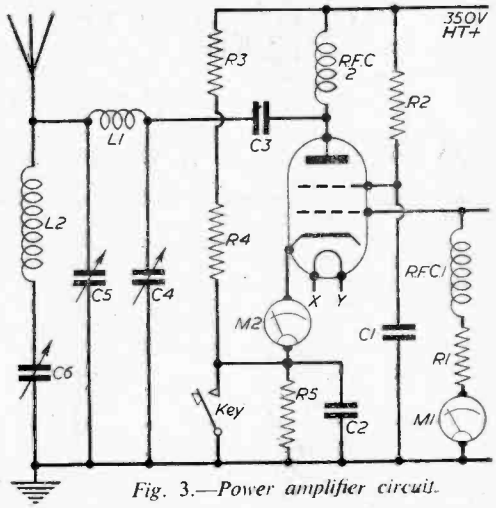

Fig. 3.—Power amplifier circuit.

wound on a half-inch diameter former and C6 is a 25pF variable capacitor. When the transmitter has been tuned up, as described below, the capacitor C6 should be adjusted so as to give minimum interference on a nearby television receiver tuned to the local BBC station.

With the addition of six turns to the grid end of the oscillatory circuit inductance, L1 (Fig. 1), C4 will tune over both the 1.8 to 2.0Mc/s and 3.5Mc/s bands. With the oscillator circuit tuned to 2.6 to 2.7Mc/s, a suitable inductance wired to switch S1 (b), can be resonated at the fourth harmonic of 10.5Mc/s and then, by doubling in the aerial circuit output can be obtained on the 21Mc/s band.

Finally, a word of warning. Although the V.F.O. has obvious advantages, it has two particular disadvantages: (i) It is very easy to slip outside the allocated frequency band, (ii) When harmonic operation is being used, it is also very easy to tune the amplifier to the wrong harmonic.

COMPONENTS FOR AMPLIFIER UNIT

C1, C2, C3—0.01μF (mica).
C4—500μF variable.
C5—0.001μF variable (2 x 0.0005μF units in parallel).
R1, R2—22,000ohms. 1W.
R3, R4, R5—68,000ohms 1W.
RFC1, RFC2—R.F. choke 2.5mH. Denco type RFC5.
M1—0-5mA moving-coil meter.
M2—0-50mA moving-coil meter.
L1—1.8Mc/s : 48 turns, close wound.
3.5Mc/s : 32 turns, close wound.
7.0Mc/s : 20 turns, 1½in. long.
14Mc/s : 10 turns, 1½in. long.
All coils wound with 22s.w.g. enamelled wire in Eddystone 1½in. diameter coil formers, type 538. If these plug-in coils are used, then a chassis-mounting base, type No. 964, will also be required.
L2/C6—See text.

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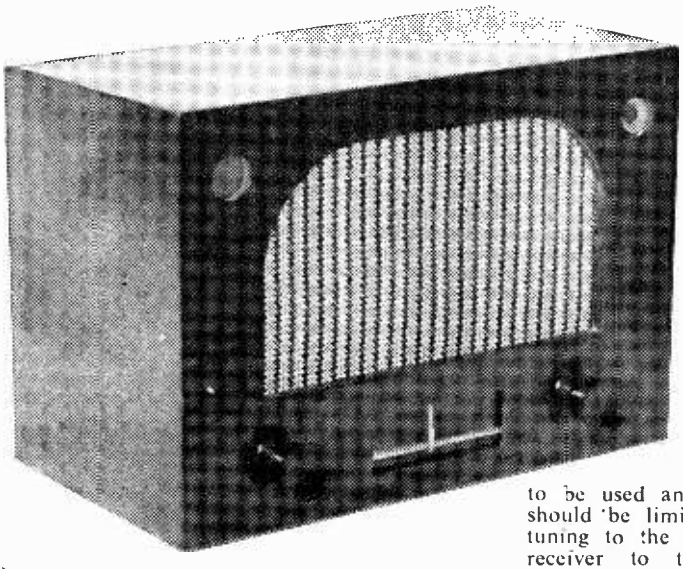

A Quality V.H.F./F.M. Receiver

No. 2.—ALIGNMENT WITHOUT INSTRUMENTS AND THE A.F. AMPLIFIER

(*Continued from page 785 of the January issue*)

By V. E. Holley

AFTER the I.F. circuits of the receiver have been aligned with the signal generator as described in last month's article an aerial should be connected and probably transmissions will be heard somewhere in the first 90deg. of rotation of the tuning condenser. Stations will probably be heard at near minimum capacity also, but the lower oscillator frequency is the one to be used and the rotation of the condenser should be limited by suitable stops to restrict tuning to the desired range. Then, tune the receiver to the centre one of the three transmissions it is desired to receive and adjust the core of L1 for maximum response. The inductance of L3 may also be checked now by parting or closing the turns and observing the result on the meter connected between earth and the junction of R11 and C15 by way of a 100k isolating resistor. Adjust for maximum volts negative. If the coil is of the correct length and diameter, not much improvement is to be expected.

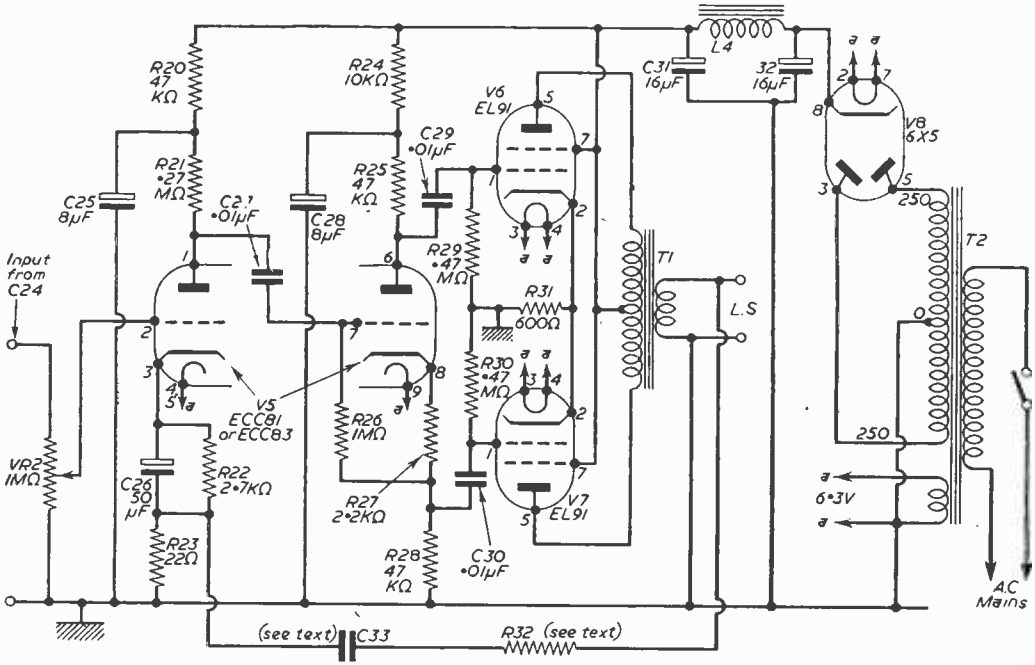

Fig. 4.—The circuit diagram of the A.F. amplifier and power pack.

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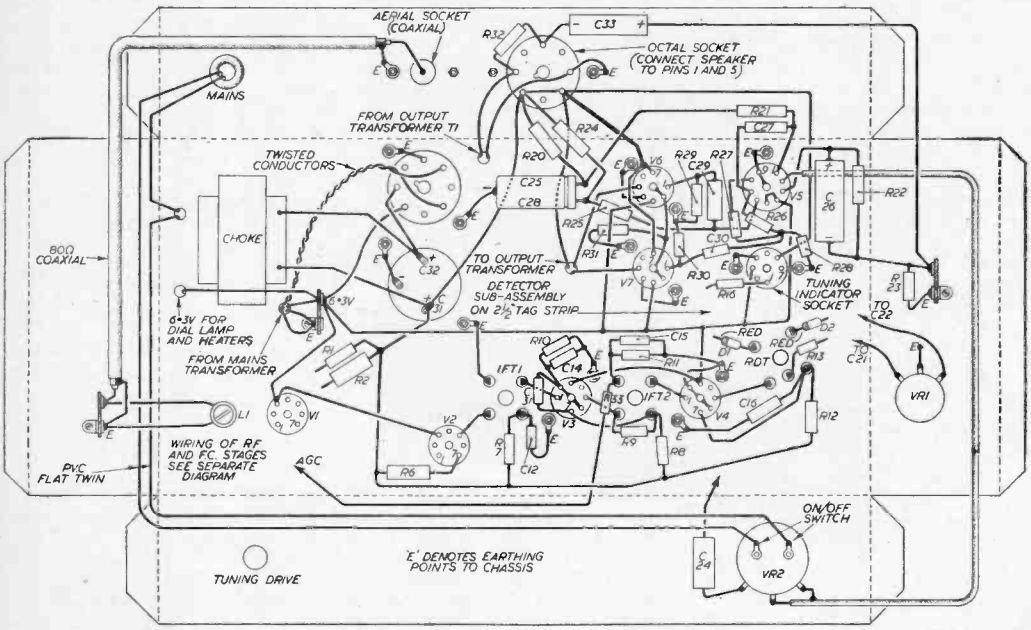

Fig. 5.—Wiring diagram of the receiver omitting the detector sub-assembly and the R.F. and F.C. wiring.

Alignment Without Instruments

The prototype receiver was first aligned by this method to establish its feasability. Pre-tuned I.F. transformers were not used. A subsequent check with instruments showed satisfactory alignment except that the I.F. was 11Mc/s, a discrepancy of no importance.

First detach the control grid cable of the EM34 tuning indicator from its connection to R16, fit a small crocodile clip to the end and re-connect. In the cathode lead of the indicator, insert a wire-wound potentiometer of from 25k to 50k with its slider connected to earth. Clip the control grid to earth and adjust the potentiometer from maximum shadow angle; re-connect to R16. Connect the tuner to an audio amplifier and advance the volume control. A subdued "rushing" noise should be heard in the speaker. If it is not, there is probably a fault somewhere, which must be rectified before proceeding further. Check in particular that V2 is oscillating, by noting the voltage drop across R7; it should not be more than about 20. Assuming all is well, adjust the core of L1 so that it is about ⅛in. below the open end of the former. Connect the best available aerial, advance the volume control fully and search for transmissions.

Reception will probably be weak and distorted. Select what appears to be the most powerful and check by reference to the published programmes that it is in fact a BBC F.M. transmission. If the signal is not of sufficient strength to register on the tuning indicator, tune it for maximum volume by moving the cores of the I.F. transformers each a little at a time. Do not make any large adjustments nor any that do not increase the signal. As soon as a clear visual indication is obtained, turn down the volume control and use the indicator for all subsequent adjustments.

The procedure is now the same as when using instruments, the transmission taking the place of the signal generator and the tuning indicator that of the meter. To adjust the bottom core of the detector transformer, first clip the control grid of the indicator to chassis and adjust the

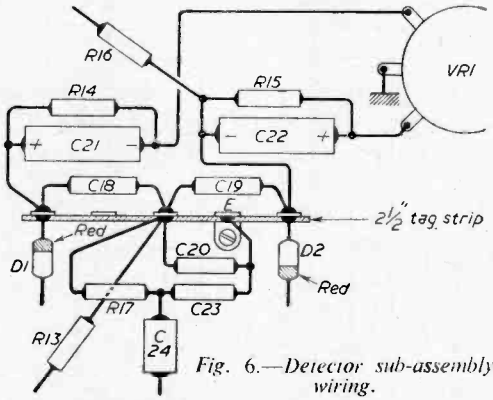

Fig. 6.—Detector sub-assembly wiring.

cathode potentiometer for zero shadow angle on the more sensitive side of the display. The valve will now perform as a sensitive zero indicator, i.e., a positive voltage on the grid will increase the shadow angle on one side of the display while a negative voltage will reduce the angle on the other. Clip the control grid to point Z and adjust the core for zero. An approximate acceptance bandwidth test can now be carried out by

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tuning slowly past the transmission, when the two maxima and centre zero can be observed on the indicator and judgment formed whether the maxima are equal and equidistant from zero. Finally, with the tuning indicator restored to normal, adjust the core of L1 as previously described.

Interference

It is now necessary to find a source of interference for the adjustment of VR1. This can conveniently be arranged with a battery-operated bell or buzzer, the interference output being taken from one side of the contact breaker, via a 0.01μF condenser to the grid of V3 or V4. It is desirable to muffle the bell or buzzer in some way, as for instance, by enclosing it in a small box, so that the position of minimum output from the speaker can the better be determined. If the signal from the buzzer is not loud enough, it can be stepped up with a small output transformer, the secondary winding being included in series with the battery supply and the output taken via a condenser from one side of the primary.

Whatever the method of alignment, no adjustments should be made until the tuner has been switched on for about 15 minutes and has attained operating temperature.

It is inadvisable to attempt alignment without instruments in an area of poor signal strength unless pre-tuned I.F. transformers are used.

Aerial

Within the primary service area of the transmitter, it will usually be found sufficient to use a length of flat twin P.V.C. flex, one end being split and the conductors extended to form a rough horizontal dipole 5ft. long, which can be fixed, for instance, to a picture rail. In less favourable conditions, a loft mounted dipole with reflector is recommended. This can be made from ¾in. aluminium tube, or if the utmost is not required from it, ⅛in. galvanised iron wire will do.

The aerial should be 59½in. in length overall, including a ¼in. space in the centre for connection of the down lead. The reflector should be 62in. long and should be mounted 31½in. in the rear. The addition of further parasitic elements is not usually worthwhile, but where the down lead is long, low-loss coaxial cable will make a noticeable difference.

The minimum desirable signal for first-class reception is that which produces zero shadow angle on the more sensitive side of the tuning indicator. This has been obtained with the prototype at 35 miles from the transmitter using a picture rail aerial and at 80 miles with a loft-mounted dipole and reflector. Worthwhile results can be obtained from a smaller signal. In areas of poor signal strength, the sensitivity of the tuner can be increased by reducing the value of R12. Some of the limiting action will be lost, but this will not be noticeable provided the receiver is accurately tuned.

Alternative Tuning Indicator

A tuning indicator of the less sensitive type as commonly used in A.M. receivers can be employed as a zero indicator with its control grid connected to point Z. Set it up as for alignment without instruments and adjust the potentiometer for zero shadow angle. The effective resistance in the cathode circuit can now be measured and the potentiometer replaced by a fixed resistor of that value. The display will overlap on one side of resonance and open out on the other, providing a very exact tuning indication. There will be some dimming of the display due to loss of volts between the target and cathode, but if the valve is in good condition, acceptable brightness will be obtained.

The A.F. Amplifier

Economy in the power supply being a design feature of the receiver, attention was first directed to the output stage, which is the largest consumer. Push-pull is inexpensive in current apart

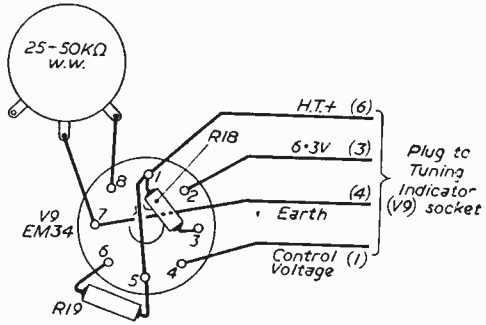

Fig. 7.—Wiring for the EM34.

from its other well-known advantages and it was decided to employ two small pentodes in this model. EL91s were selected. Two of these in push-pull will produce 4W with negligible distortion at the cost of only 25mA. An output transformer with sufficient primary inductance for the high optimum load of 24,000 ohms is not, so far as the author is aware, available commercially, but fortunately it is possible to use one of lower inductance and make good the resultant attenuation of the lower audio frequencies by negative feedback. The component selected for the prototype has a stated primary inductance, anode to anode with no D.C. of 45H. It provides a ratio of 72:1 which is satisfactory for a 3 ohm speaker. There are probably other suitable choices. The circuit of the A.F. section is given in Fig. 4.

Circuit Operation

The EL91s are operated with 250V on anode and screen and a bias resistor of 600 ohms. A by-pass resistor is not required as if the valves are reasonably well-matched, the signal currents will cancel out in the resistor. For 4W output, this stage requires a grid-to-grid signal of 30V peak and this is delivered by one half of V5 arranged as a phase inverter with equal loads of 47k in anode and cathode circuits. These load resistors should be matched as accurately as possible as also should the 0.47M grid resistors in

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the output stage. If matching facilities are not available, 5 per cent. resistors should be used. Decoupling and additional smoothing are provided by R24 and C28, and the stage is completed with a 2.2k bias resistor and a 1M grid resistor. The gain is 0.9 on each side, or 1.8 overall. The required input is therefore 30/1.8 or 17V peak.

The other half of V5 is arranged as a resistance coupled amplifier and with a load resistance of 0.25M affords a stage gain of 60 times. The input to its grid must therefore be 17/60 or slightly less that 0.3V peak, which the ratio detector is well able to produce with something in hand for negative feedback. Decoupling is provided by R20 and C25. In the grid circuit is the volume control with which is incorporated the mains on-off switch. As there are no heterodyne whistles, sideband chatter, etc., to contend with, a conventional tone control is unnecessary and is not included. A wide range of control over the balance of reproduction is, however, available by negative feedback as will be described.

Construction

The construction of this part of the receiver follows standard practice. The layout is not at all critical and more or less follows the circuit diagram. An octal socket was used for connecting the speaker as this is standard in other equipment in use by the author and the spare tags form useful anchorages for small components.

Power Supply

The mains transformer need have only two secondaries, 250-0-250V, 60 mA and 6.3V, 0.3A. If a transformer including a 5V secondary is used, a 5Z4 rectifier would be suitable. It has been noticed that some rectifiers are liable to introduce modulation hum in compact assemblies; the 6X5 and 5Z4 do not offend. A choke is used for smoothing in preference to a resistor to reduce heat generation and avoid voltage drop. The choke should have an inductance of not less than 10H at 50mA.

Negative Feedback

When feedback is carried over three stages as it is in this receiver, it is desirable in the interests of stability that one stage should introduce some attenuation of extreme frequencies, particularly the lower frequencies. The limitations of the output transformer are thus turned to good account and quite a large amount of feedback, either "straight" or frequency selective, may be applied with no untoward consequences. It is suggested that the receiver be completed with a 200 ohm resistor for R32 and temporarily omitting C33 and that the values of these components be decided after listening to the set installed with its speaker in the cabinet. When the prototype was tried with a 6in. speaker in a bass reflex cabinet, crisp, clean and well balanced reproduction was obtained with R32=100 ohms and C33 omitted. When tried in a cabinet with internal speaker, there was some noticeable attenuation of lower frequencies which was remedied by including C33 at 8μF. The values required will vary with the output transformer and speaker used and may be varied between 100 and 300 ohms and 2 to 8μF. The feedback network renders unnecessary the tone correction resistor and condenser customarily employed with pentodes across the primary of the output transformer.

Gain

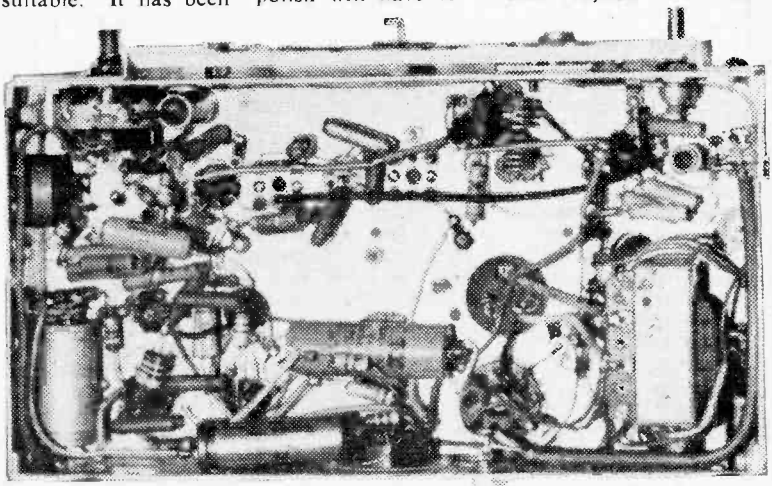
No misgivings need be felt about the loss of gain resulting from feedback. Unlike the conventional A.M. receiver, the set is not required to deal with weak and distant transmissions and no large reserve of gain is required. Sufficient is provided to load the output stage fully.

The combination of modest A.F. gain, good smoothing and negative feedback combine to form a silent background and it should be necessary in the absence of a programme, to listen carefully within 6in. of the speaker to discover by ear whether the set is switched on.

The Cabinet

A suitable cabinet for the receiver may be made from 5-ply wood, ¾in. thick and having an oak, walnut or similar facing. The best source of supply is an old cabinet or piece of furniture made of this material because, although the polish will have to be removed, the wood will need much less subsequent treatment than if it were new.

The constructor will require a sharp tenon saw, a chisel, a carpenter's brace and centre bits, a hacksaw blade, some glue, glass paper and panel pins.



Under chassis view of the receiver.

(To be continued)

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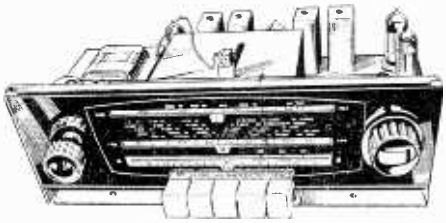

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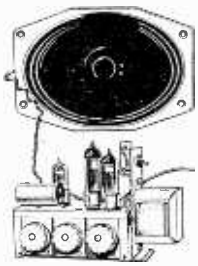

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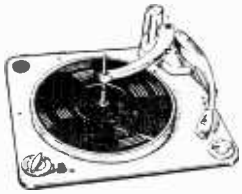

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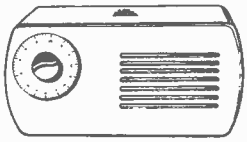

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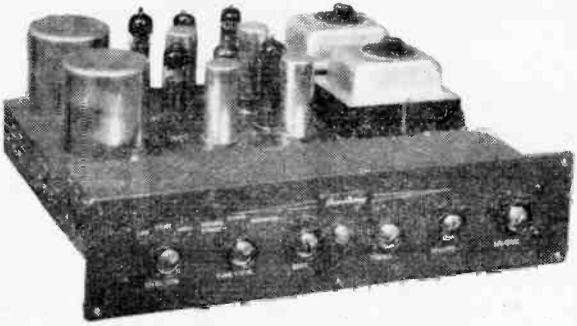

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6BW7	6/6	12K8GT	11/6	DL92	6/9	EL42	10/6	PL83	8/6	UY1N	12/6
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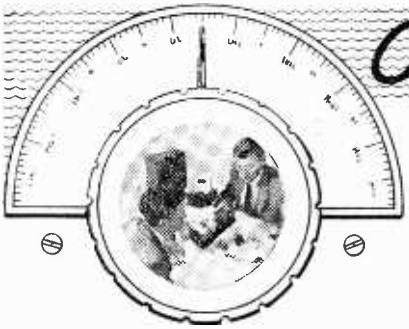


On Your Wavelength

BY THERMION

P.D. and E.M.F.

IN the September/October issue, I tried to make clear the distinction between potential difference (P.D.) and electro-motive force (E.M.F.), but it seems from the letters I have received on the subject that there is still some confusion. For instance, in the letter from Mr. W. F. A. Chambers, who is in Cyprus, is the statement that he thinks the term electro-motive force is superfluous and could be suppressed! Mr. Chambers adds to his confusion by discussing at length several circuits in which the valve is included. As is generally appreciated, valves cannot be treated as resistors, except when certain circuit conditions obtain. When trying to learn and understand the theoretical background to technical terms, it is always best to consider for analysis simple circuits.

There should be no confusion between P.D. and E.M.F. As I stated before, first comes the E.M.F.: you cannot have a current unless you push it around. Then comes the current and, finally, because of the current, the P.D. Just as, in order to produce a pressure difference across a horizontal tube containing water, the water must be flowing. If you go to the source of Ohm's Law, you will find it stated that the P.D. appearing across a conductor is proportional to the corresponding current flowing.

Reminiscences

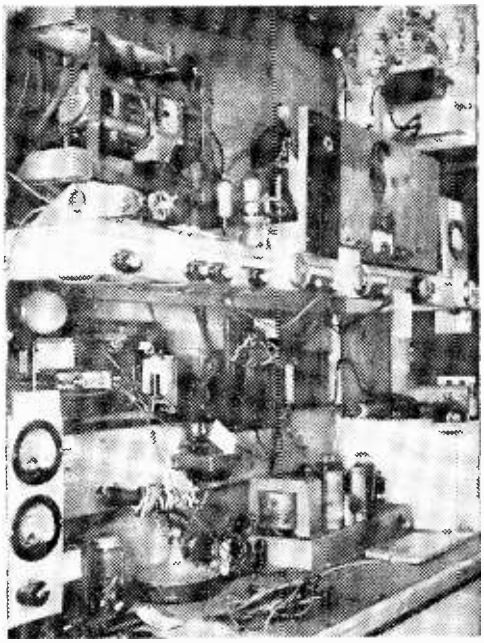
REGULAR readers of this page may remember that on page 215 of the May, 1959, issue I published a photograph of Mr. L. H. Brown, of Abingdon, operating one of his first receivers. Since then, Mr. Brown has sent me another letter enclosing a very interesting selection of photographs of an early den of his fitted up around 1930. The illustration on the right shows part of the den and the scope of Mr. Brown's activities can be judged by the amount of apparatus visible. The room was a portion "abstracted from the coal cellar," and the living room was behind the wall on the left of the photo. As my friends know, I have often advocated placing amplifiers and radio tuners, etc., away from the listening position: in other words, for most listeners, all that is required for radio reception is a loudspeaker and tuning controls, the amplifiers, which are probably home-constructed and without cabinets, being housed in a remote room. Mr. Brown appears to have planned his den with a similar idea in mind. To provide a baffle (so-called "infinite") for the speaker, he made a hole in the wall between his den and the living room and mounted the speaker in it. This method is often said to give especially good results although, of course, it means that the radio programme will be heard in two rooms simultaneously.

In my opinion, a similar plan could be adopted for television receivers, the tube, loudspeaker, and controls being separate from the receiver chassis. This procedure is not as easy as it sounds. Mr. Brown, however, overcame the difficulties by enlarging the hole in the wall, made originally for his loudspeaker, to accommodate a 12in. cathode ray tube so that all that was visible in the living room was a speaker fret and an apparently flat screen. As Mr. Brown states, it was "A case of what the eye didn't see!"

Mr. Brown overcame the problem of tuning the radio from remote positions by the use of relays which were used to operate the motor-driven unit attached to the tuning condenser.

Our Film Show

PRACTICAL WIRELESS and *Practical Television* are again holding a film show at Caxton Hall which will take place on Friday, January 22nd. There are still a few tickets left (which are free) and I advise you to take advantage of this last chance; it is always a most enjoyable evening.



Mr. L. H. Brown's early den.

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EB91 6K7 Z77 UU9

Valve Coding Systems

UCH42 X17 KTW63 6C12

VARIOUS SCHEMES EXPLAINED

By J. Alexander

EACH type of valve is distinguished by a number or by a group of letters and a number. In most coding systems these letters and numbers have a meaning so that anyone who is familiar with the coding system will be able to deduce a number of facts about a valve of which only the coding is known. Most manufacturers have their own codes and in addition the Services have a separate coding system.

CV System

The CV system of valve coding is used by the armed forces and by research stations under Government control. Most readers will meet valves with CV coding when they buy surplus equipment. This system of coding is one of the few in which there is no connection between the type of valve and the code number. Who would imagine, for instance, that the CV448 is a crystal diode, the CV449 a voltage stabiliser and the CV450 a power output valve? The valve type, usually known as the 807, has at least three CV equivalent numbers: CV124, CV1060 and CV1572. In such cases where a single type of valve has more than one CV number, the exact specifications of the various CV types are usually slightly different and they probably come from different manufacturers. A letter X placed between the CV letters and the following number signifies that the valve is still in the experimental stages. Valve types in CV coding are much more difficult to remember than the combinations of letters and numbers used in almost all other systems.

Valves coded under a previous system are sometimes found in surplus equipment. Examples are ATP4 (Army transmitting pentode No. 4) and ARP12 (Army receiving pentode No. 12). Yet another type of coding is the VR system, e.g., VR65 (valve, radio No. 65).

Valves with the above markings are made especially for the services by valve manufacturers who may also make exactly the same valve with their normal coding.

American System

American valves used to have a coding which was merely a number (e.g., 80, 807, etc.), but now they are virtually all coded on a system set out by The Radio Manufacturers' Association (Standard ET-110). Many American-coded valves are found in surplus equipment and some British manufacturers make valves marked with the American coding. The first figure gives the approximate heater voltage as shown below:—

0 Cold cathode.
1 Up to and including 1.6V.
5 4.6 to 5.6V.
6 5.6 to 6.6V.
7. 6.3V loctal types.
12 12.6V approx.
14 12.6V loctal types.
25 25V approx.
35 35V approx.

If the heater has a tapped filament, the first coding figure shows the voltage across the whole of the heater. The usual operating voltages of the American 7 and 14 loctal series are 6.3V and 12.6V respectively, but their maximum ratings are 7 and 14V. They are mainly intended for car radio receivers where the high maximum ratings are necessary because the battery voltage is high when it is being charged by the car dynamo.

Second Symbol

The second symbol is a serial letter allocated in sequence and normally commencing with A. Letters I and O are not used. Rectifiers follow the sequence backwards starting from Z. When the single letters have all been used for a particular group of valves, the system then uses two letters commencing with AB. Two identical letters are not normally used. The single-ended range of valves may have a letter S following the number which indicates the heater voltage. For example, the 6SK7 is the nearest single-ended equivalent to the 6K7 which has the same type of base. Although the 6SL7 is a single-ended valve, it is not related to the 6L7.

The final number in the American coding is intended to indicate the number of electrodes or other useful elements (such as screening) which are brought out to a separate external connection. The heater counts as one electrode for coding purposes, but if it should happen that the heater is tapped, it will count as two electrodes only if the tappings are of unequal voltage or current ratings. In the case of international octal valves with an all-metal envelope, the envelope counts as a useful element. Octal valves with a glass envelope have a similar coding to that of the corresponding valve with a metal envelope, i.e., one electrode is added for coding purposes even if no screening is brought out to a separate connection. An octal-based valve with n useful elements, therefore, has a final figure of (n + 1) in its coding. This does not apply to the few valves in which pin 1 is used for a connection other than screening (e.g., types 6SN7 and 6SL7). If more than one electrode is connected to the same pin, these count as only one useful element.

Suffix

A further letter (a suffix) may be placed after the main coding to show the external construction. Miniature, loctal and metal valves normally have no suffix, but sometimes a letter M is used to show the valve has a metal envelope. The letter M should really only be used for valves which have a metallised glass envelope. Octal-based valves with a comparatively large glass

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envelope are given the suffix G and those with the smaller glass envelope with straight sides (the "T9" bulb) are given the suffix GT (glass tubular). Modified versions of valves are given suffixes starting with A. Suffixes X and Y indicate that the valve has a low loss base, those having the suffix X being the best in this respect. The letter W is used to distinguish military types. Voltage regulators are coded VR followed by a number showing the normal burning voltage. The final number shows the approximate amount by which the striking voltage is higher than the normal burning voltage.

Examples

6C4 (B7G):—6.3V triode.

6C5-GT (octal):—6.3V triode with small glass envelope. (One electrode is added because the base is octal.)

12SK7 (octal):—12.6V pentode with a separate suppressor grid connection.

6F6 (octal):—6.3V pentode with suppressor grid connected to the cathode.

6K8 (octal):—6.3V triode hexode. Hexode grids g_2 and g_4 are connected together and g_1 of the hexode is connected to the triode grid. The cathode is common to each section. One useful element is added because of the octal base, giving a total of eight useful elements.

12AX7 (B9A):—12.6V centre-tapped heater. Double triode with separate cathodes.

VR 150/30:—Voltage stabiliser running at about 150V and striking at about 180V.

Mullard System

In the Mullard system most valves are represented by two or three letters followed by a number. The first letter signifies the heater voltage or, if the valve is intended for series heater connection in A.C./D.C. receivers, the heater current. The heater voltage is one of the most important factors which determines whether it is convenient to use a particular valve in a certain apparatus. The Mullard code for the heater voltage is shown in the table. If the heater is tapped (e.g., ECC81) the voltage indicated by the code is for parallel connection.

The second (and any subsequent) letter indicates the general class to which the valve belongs; the code is shown in the third column of the table. More than one letter may follow the heater voltage if the valve contains two separate sections within the same envelope.

The type of base is indicated by the first figure following the letters as shown below.

1-19	Various.
20-29	B8G loctal.
30-39	International octal.
40-49	B8A rimlock.
50-59	Mainly B9G.
60-79	Sub-miniature.
80-89	B9A noval.
90-99	B7G.

The second or subsequent figure is only a serial number to distinguish valves of the same class which have the same heater voltage or current and the same type of base.

Mullard television tubes are coded MW or AW followed by a number (e.g., MW43-80). The MW tubes are magnetically focused and the AW tubes electrostatically focused. Semi-conductor devices have codes commencing with the letter O. The second letter is an A in the case of germanium diodes (e.g., OA70) or a C in the case of transistors. Zener diodes for voltage stabilisation are coded OAZ followed by a number. Voltage stabiliser tubes sometimes have codes commencing with the average normal burning voltage (e.g., 85A1 or 150B2), but this does not apply to older types (e.g., 7475). Incidentally, Mullard photographic flash tubes have the lettering LSD followed by a serial number!

MULLARD VALVE NOMENCLATURE

	First letter (Heater)	Second or subsequent letter (Class of valve)
A	4V	Single diode
B	—	Double diode
C	200mA	Triode (or Transistor)
D	0.5V to 1.5V (battery)	Power triode
E	6.3V	Tetrode voltage amplifier
F	—	Pentode voltage amplifier
G	5V	—
H	150 mA	Hexode
K	2V (battery)	Heptode or octode
L	—	Output tetrode or pentode
M	—	Tuning indicator
N	—	Thyatron
O	Semi-conductor device	—
P	300mA	—
Q	—	Nonode
U	100mA	—
X	—	Gas-filled full-wave rectifier
Y	—	Half-wave rectifier
Z	—	Full-wave rectifier (Zener diode if third letter)

Examples

EB91. Double diode with a 6.3V heater and a B7G base.

EBC33. Double diode triode with octal base and a 6.3V heater.

DK91. Heptode frequency changer with a 1.4V heater and a B7G base.

UCH42. Triode-hexode frequency changer with a B8A base and a 0.1A heater.

EABC80. Triple diode triode with a B9A (noval) base and a 6.3V heater.

Ediswan-Mazda Code

The Ediswan-Mazda code for current types of valve commences with a number indicating the heater voltage or current as follows:—

1 1.4V.
6 6.3V.
10 0.1A.
20 0.2A.
30 0.3A.

This number is followed by a letter which indicates

(*Continued on page* 862)

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Using High-Cycle Transformers

THESE COMPONENTS CAN BE EMPLOYED ON 50c/s MAINS

By J. B. Willmott

AN extremely useful and informative article on the subject of utilising the high-cycle mains transformer contained in Government Surplus AM.1355 receivers, appeared in June, 1957, issue of PRACTICAL WIRELESS (which is now out of print) and, inspired by the contents, the present author has made further investigation into the uses to which this clas of component can be put. Also, as there may now be many new readers who have not access to the above issue, the following general information relating to high-cycle transformers is given for the guidance of those wishing to experiment further.

Specification

Firstly, then, a word about the type of mains transformer found in most Government surplus equipment. As in the normal domestic receiver, the purpose of the mains transformer is to supply the necessary L.T. voltages for feeding valve heaters, normally 6.3V for all except the rectifier, which is fed from a separate winding rated at 4.0V (or, in some cases, 5.0V); and a centre-tapped H.T. secondary winding is provided to feed the anodes of the rectifier, frequently having a rated output in the region of 250 to 500V.

The primary winding is designed to be fed from an 80V supply at a frequency of 2,000c/s instead of the 200 to 250V at 50c/s which constitutes the normal range of domestic supplies. This means that the existing primary winding is quite unsuitable for connection to normal A.C. house supply, and on no account must this be done. Usually it is quite safe to connect the former H.T. secondary winding across the mains supply, but when making initial tests of this sort, it is essential that a fuse rated at not more than 2A be placed in series with one, or preferably both connections to the mains supply, it is not safe to rely on the house fuses as these will be more highly rated, and give insufficient instantaneous protection in case of accidental short circuit or erroneous conection to a low resistance winding on the transformer under test. Also, never forget to switch off and withdraw the mains plug before making or altering any connections.

Identification

If an ohmmeter is available, it is a simple matter to identify the former H.T. secondary windings, as these will usually have a resistance in the range of 50 to 200 ohms between either end and the centre tap, all other windings being of virtually negligible resistance. Failing the availability of such an instrument, use a torch battery and bulb in series with each group of windings in turn. Disregard all those where the bulb lights up (these will be the low resistance heater and original 80V primary winding). Only those tags connected to the original H.T. secondary will have sufficient resistance to prevent the bulb from lighting. This method does not, of course, immediately indicate which are the "ends" and "centre tap" of the H.T. winding, but the following additional test will quickly establish this point.

Having now identified the former H.T. secondary connections, attach the mains leads (suitably fused as described above) to any two of them, and switch on. If there is no sign of overheating, or other form of distress (such as a loud "buzz" from the transformer core laminations) proceed to measure the A.C. output voltage developed across the various former heater secondaries and the 80V primary winding; in most cases this will be well below the original voltage rating. Now change over one of the mains leads to the formerly unused one of the three H.T. secondary tags, and again take voltage readings at the other windings. If the voltages obtained are the same as in previous case, it is proof that the mains lead which has remained undisturbed is, in fact, connected to the centre tap of the former H.T. winding, but if lower voltages (approximately half the first set of readings) are obtained, one may assume that the mains lead which has been changed, has, in fact, been

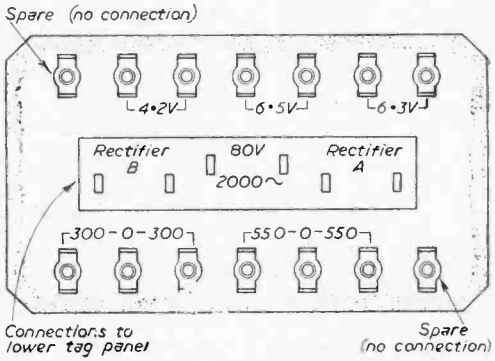

Fig. 1.—Top panel showing tag connections (as printed) including "key" to connections to lower tag panel.

moved from the "centre tap" to the "outer end" of the winding, likewise, if the second set of readings is roughly double the first, one may assume that the mains lead which has been changed over, has, in fact, changed from one of the "outers" to the centre tap. It is a good plan now to clearly label these tags as "Primary Outer (A)," "Primary Outer (B)" and "Primary Centre" respectively, for future reference.

Output Voltages

An examination should now be made of the A.C. output voltages obtained from the various windings, using whole or half of the newly designated primary winding, and quite a useful range of low tension A.C. voltages will be available, especially if various combinations of windings in series (correctly phased) are utilised, and

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these may be used as heater supplies for valves in radio circuits, or, in conjunction with suitable metal rectifier, as source of D.C. for battery charging or running electric model railways.

There are several types of high-cycle transformer readily obtainable on the surplus market at extremely low prices (mainly, no doubt, because they have hitherto been regarded as of very little use by constructors). The author has made considerable use of the component found in Radar Receiver Type 3F, which it is understood is also

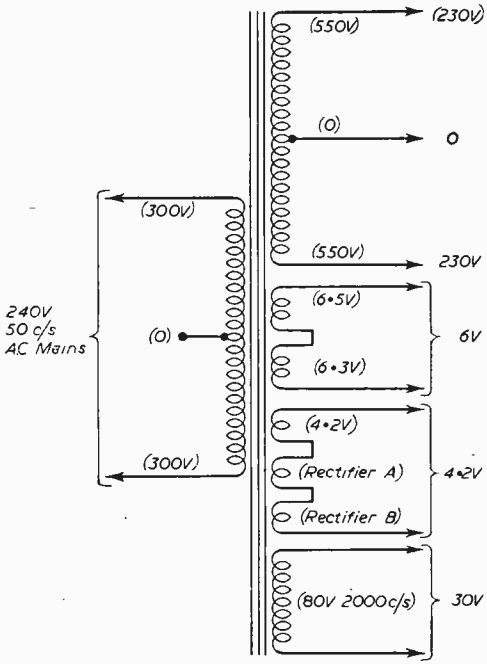

Fig. 2.—Theoretical diagram of connections when used as a mains transformer on domestic 50 c/s A.C. mains. The original designations are given in brackets.

utilised in a number of other radar receivers. This particular component, which is a fairly massive job weighing approximately 14lb., has all its connections brought out to clearly marked solder tags on panels mounted on top and at the base of the component.

The windings, in their original form, comprise an 80V high-cycle primary (two centre tags at the base of the component), two pairs of "rectifier heater windings" (right-hand and left-hand pairs of tags at the base); whilst on the top panel there are heater windings rated at 4.2V, 6.5V and 6.3V together with two entirely separte centre-tapped secondaries rated at 300-0-300V and 550-0550V respectively. Fig. 1 clearly shows the layout of these connections. By virtue of the existence of two isolated H.T. windings, either of which, in whole or in part, can be used as a primary on 50c/s mains, a very wide range of voltages is available from the various other windings. The most useful method of connection seems to be as follows:—

Use the entire 300-0-300 winding as primary, when on 240V mains the following voltages appear:—

The 550-0-550V winding gives 230-0-230V.
The 6.5V and 6.3V windings in series give 6.1V.
The 4.2V, and the two "Rectifier (A and B)" windings in series give a total of 4.2V.

H.T. Supply

The 230-0-230V output is ample for feeding to the anodes of a rectifier, giving a D.C. output after rectification of approximately 235volts "on load." the 6.1V supply appears to be adequate for feeding valve heaters rated at 6.3V, no noticeable reduction in efficiency being observed by the author, and the 4.2V supply can be used to feed the heater of a 4V rectifier valve (such as the MU14). The transformer is readily able to supply the current needed to operate a 5-valve superhet receiver, or single-ended amplifier. It will be noticed that the output from the former 80V primary (which was found to be 30V) is not used in the above arrangement, but there are a number of uses to which it could be put. Firstly, it could be used to supply the heater of a rectifier valve rated in the region of 30V, type UR3C being an obvious choice. A UY41, readily obtainable at cheap prices from advertisers in this magazine, could also be used, but as this is a half-wave rectifier, the output from one half of the H.T. secondary only could be utilised, with a consequent drop in rectified H.T. voltage.

Output Transformers

Quite apart from their employment as mains transformers as outlined above, these high-cycle transformers have a further useful range of applications as output transformers. Although their method of design is not strictly in accordance with audio output transformer requirements, their performance in this respect will usually be found equal, if not superior to that of the cheaper range of output transformers. By using the former high voltage secondary winding as a primary, and one or more of the former heater windings in series as the secondary, a suitable ratio to match the standard 3 or 15ohm loudspeaker can usually be found. The turns ratio which gives greatest output with minimum distortion can usually be accepted as the correct working conditions, and in the case of the Radar Receiver Type 3F transformer referred to above, it has been found that using the whole of the 300-0-300V winding as a primary, and the 6.5V plus 6.3V secondaries in series to feed a 3ohm speaker, gives good results.

Earthing

Finally, it was found that in the original Radar Receiver 3F, one side of each of the 4.2, 6.5 and 6.3V windings was bonded to earth (the frame of the transformer); these connections must be removed by clipping off the interconnecting wires just below the surface of the top tag panel, otherwise windings will be short circuited when any attempt is made to connect them in series. There was also a "flying lead" from one side of the 300-0-300 winding, formerly connected to a high voltage pencil rectifier mounted on brackets at the side of the transformer; this lead (and the pencil rectifier if present) should also be removed.

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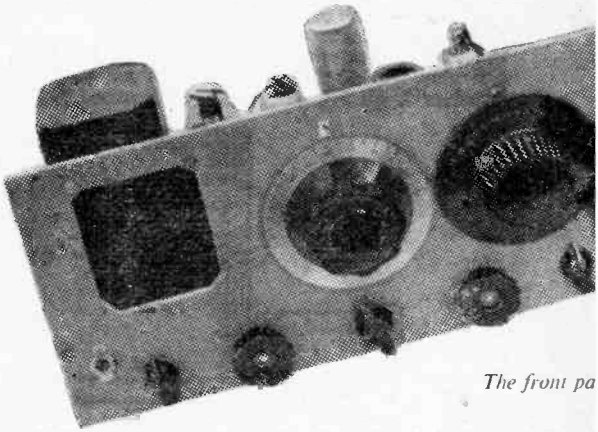
An Experiment

A HIGHLY SENSITIVE CIRCUIT FOR THE SWL

By F. G. Rayer

THIS is a mains operated circuit employing three valves (plus rectifier) and intended particularly for use on wavelengths between 10 and 100m. Bandspread tuning is used to simplify the accurate logging of stations, and Amateur Band reception. The very high sensitivity of the detector stage, in particular, makes long distance reception possible with even a poor aerial.



The front pa

Circuit

The circuit is shown in Fig. 1, and can be modified to some extent to suit valves or other components which may be to hand. The first valve acts as R.F. amplifier, and a switch enables the aerial circuit to be tuned or untuned at will. This means that it can usually be left untuned, tuning being confined to the detector alone. This simplifies operation, and one of the aerial coils can be switched in if conditions make this necessary. Good results will be achieved with the R.F. stage untuned, and this means that these coils can be omitted, together with their associated variable condenser, if a simpler receiver is wanted. Tuning this circuit does, however, improve reception of very weak signals. Connections are for VR65 (SP61) but other R.F. pentodes may be used. The 150k potentiometer controls R.F. gain. With vari-μ valves the usual cathode circuit bias control can be used instead. Plug-in coils are used in the detector stage, with a cheap surplus acorn valve which permits very short wiring. For single band working, a fixed coil can be used and only one aerial coil is then needed. A screen grid potentiometer controls regeneration. A 15pF bandspreading condenser gives good coverage and very easy tuning, but values of 10pF to 20pF or so are practicable. In the same way 100pF is not essential for bandsetting purposes, though a value of about 100pF to 160pF is most suitable.

Output Stage

Another VR65 is used for output, but any 6.3V L.F. or output valve will be satisfactory.

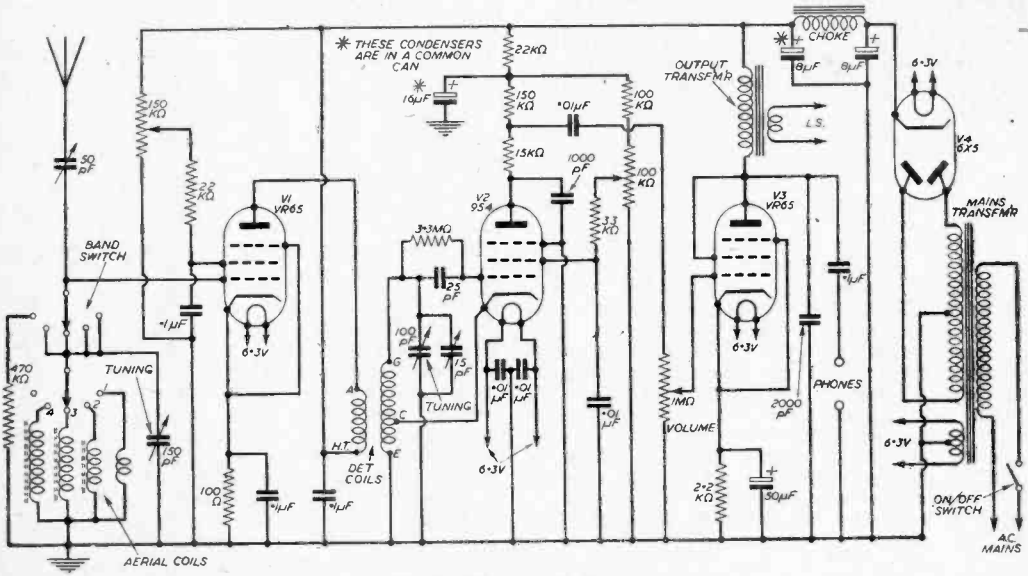


Fig. 1.—The circuit diagram.

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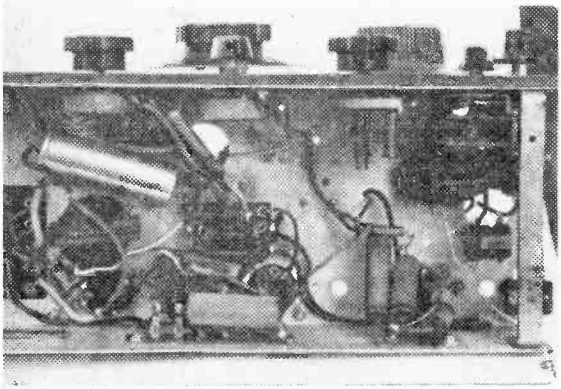
al S.W. Three

with appropriate holder and bias resistor. Loudspeaker reception is generally possible, even with distant stations, but phones can be used when preferred, and the 1M potentiometer allows volume to be kept down to a comfortable level. High impedance phones are necessary and of the usual type, fed through a condenser to keep direct current and H.T. voltages out of them. The speaker transformer primary acts as a choke when using phones, but the speaker can be silenced by wiring a switch in one lead from transformer secondary to speech coil.

In a set of this kind, complete isolation from the mains is wise, so the receiver draws current from a transformer, and the chassis can be earthed. Modification of this part of the circuit,



Underchassis view of the receiver.

to draw H.T. directly from the mains, is not recommended.

Screened Panel

A chassis about 12in. × 5½in. × 2in. deep, and a panel about 12in. × 7in., will be satisfactory. This allows a 3½in. speaker to be accommodated, but a larger panel will be needed for a bigger speaker. Alternatively, the speaker can be in a separate cabinet, and much larger speakers will be satisfactory. A sheet of aluminium of similar dimensions to the panel should be placed behind the panel itself, if this is of three-ply. If a metal panel is used, this should be of stout gauge, or adequately supported with panel brackets.

Fig. 2 shows the chassis layout, the detector stage being most important. Valve connections in Fig. 2 are correct when viewing the 954 from its short end, which carries the grid pin. The long end carries the anode pin. Care is necessary to solder to the extreme end of the pins, and to remove the iron instantly, as excessive heating may crack the glass. The valve is supported by the connections to it, which should be short and direct.

Condensers

The 100pF band setting condenser should have a knob or dial of such a kind that it can be returned accurately to any required reading. The large type of dial knob marked from 0 to 100 or 0 to 180, with a small bracket screwed to the panel and acting as a mark against which to take readings, will permit accurate resetting. It is then possible to tune in logged stations with the 15pF band spreading condenser, which has a similar dial and panel index. The separate logging of stations, by dial reading, will be possible even when they are so near in wavelength that logging would be impossible with an ordinary tuning scale.

Any 8μF or 16μF 350V or similar smoothing condensers are satisfactory. The large type can be mounted on the chassis as in Fig. 2. The output transformer is of the usual type for use with a mains output valve. The lead from the volume control slider to output valve cap should be screened, the braiding being wired to chassis. The cap lead of the other valve is not screened.

Underneath Components

Wiring is shown in Fig. 3. The heater circuit is completed first, leads being run against the chassis. If the mains transformer has a separate winding for rectifier heater, this is best used, but some rectifiers can have the heater wired in parallel with the other valves. Many 5V rectifiers, such as the 5Z4, are suitable, but need a transformer with separate 5V rectifier heater winding. If the transformer has a centre-tap on the 6.3V winding used for the other valves, this tap should be wired to chassis. If no tap is available, take one side of the heater circuit to chassis instead.

Referring to Fig. 3, the 50pF aerial condenser is an insulated surplus type, but may be replaced by a pre-set condenser, or small short wave type condenser on an insulated bracket, operated by an insulated extension rod. The switch is a two-wafer, five-way component, wiring being as shown in Fig. 1. The 150pF aerial tuning condenser requires a fairly large knob, but a dial is not needed because it is easily adjusted for best volume. The maximum capacity is a little larger than that of the detector tuning circuit to provide some overlap in aerial tuning.

The centre 150k potentiometer, acting as R.F. gain control, may be of 100k to 200k or so. The 100k regeneration control can be replaced by 50k, if to hand, provided that the 100k fixed resistor wired to it is reduced to 47k. The 1M volume control can have a switch, for mains switching, or may be of 0.5M value, if to hand.

The values of the various by-pass condensers are not very important. The 0.01μF coupling condenser joined to the 1M volume control should

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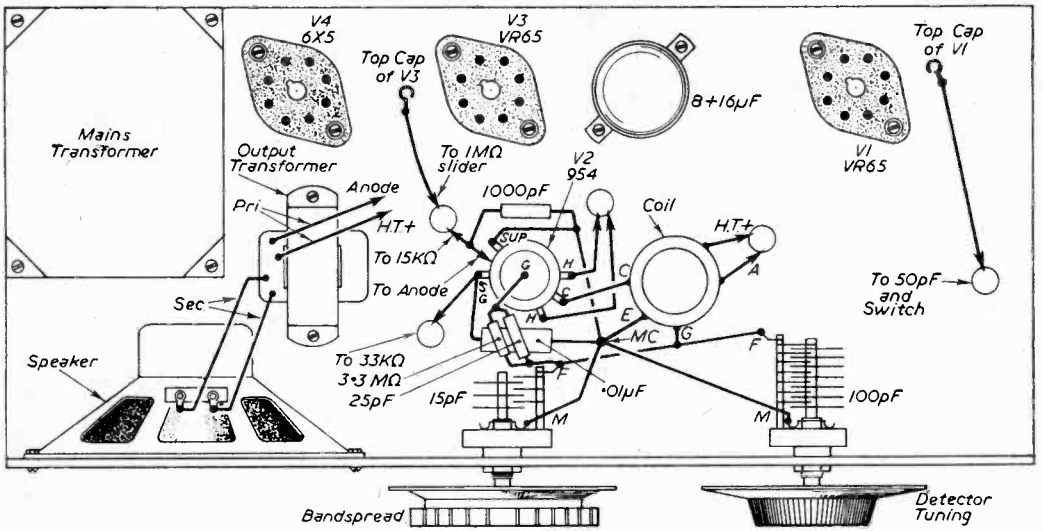

Fig. 2.—Above chassis wiring diagram.

preferably be of mica type as slight leakage will result in H.T. reaching the output valve grid.

The coil formers may be smooth or ribbed, and the diameter and gauge of wire and spacing between turns are not critical. Plug-in formers may be purchased, or made by fixing insulated formers to old valve bases. For one band only, a single coil may be wired directly in circuit.

For approximately 10 to 20m, five turns of 18s.w.g. wire, spaced to occupy 1in., on a 1¼in. dia. former, with the cathode tap half turn from the earthed end, can be used. The primary is three and a half turns.

For about 18 to 30m, 11 turns of 22s.w.g. wire occupying 1½in. on a 1¼in. dia. former, with cathode tap half turn from the earthed end, and six turns for primary, may be used.

The 30 to 60m coil can be wound with 20 turns of 22s.w.g. wire occupying 1½in. on a 1¼in. diameter former, with the cathode tap three-quarter turn from the earthed end and 16 turns for primary.

The largest coil, for approximately 60 to 100m, can have 35 turns of 24s.w.g. wire on a 1¼in. diameter former, with the tapping one and a-half turns from the earthed end and 20 turns for primary.

(To be continued)

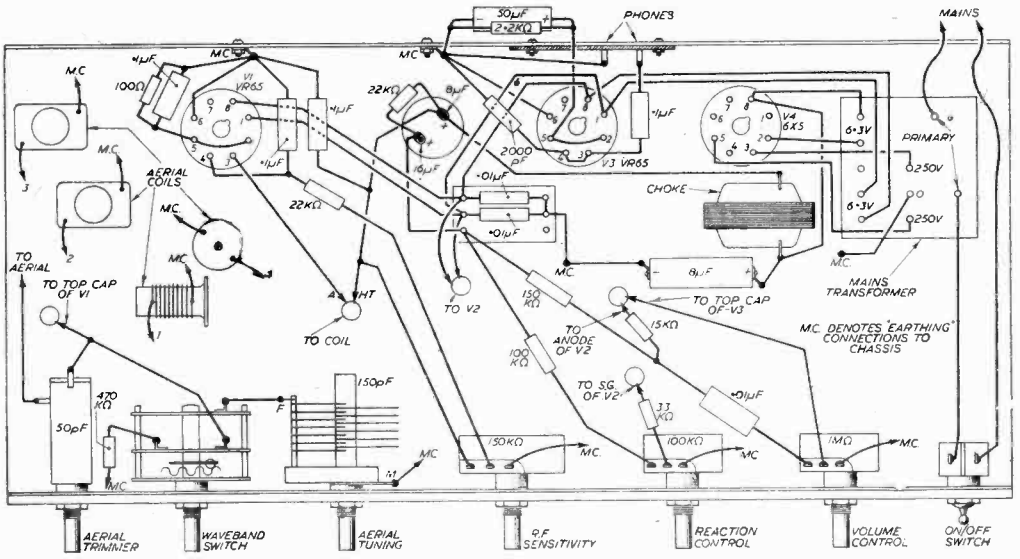

Fig. 3.—Under chassis wiring diagram.

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Test Panel for Transistors

A SIMPLE UNIT FOR DETERMINING α'

By R. Leyland

STANDARD methods of testing transistors include comprehensive series of measurements on input and output currents and voltages, enabling graphs of the D.C. characteristics to be drawn. From these, A.C. characteristics can be derived, but are determined more directly by A.C. methods employing small A.C. inputs to measure the current gain and slope resistances.

Checks on transistors can, however, be made by less elaborate methods, and a circuit comprising the minimum of components will measure the current gain, α', accurately enough for ordinary purposes. The current gain (unlike the leakage current) varies only slightly with temperature changes, and its variation over the maximum range of base currents may be 25 per cent. or less, while a fourfold increase of collector voltage may be expected to increase α' by only a third. Thus a test for the average value of α' over a certain range of currents, and at a certain battery voltage, will serve as a reliable basis for comparing transistors.

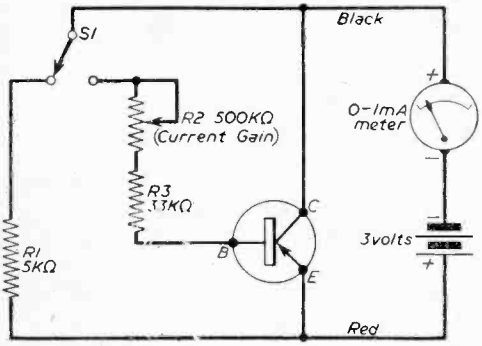
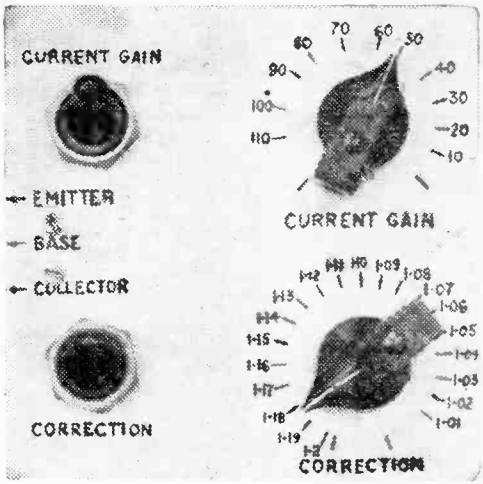


Fig. 1.—Circuit of the test panel in its simpler form.

Basic Circuit

The measurement can be carried out with the circuit of Fig. 1. In one position of the switch a small current is applied to the base of the transistor through R2 and R3 and, is amplified by the transistor to give a considerable increase of collector current. In the other position of the switch, the base current becomes zero, but a resistance R1 is switched in across the transistor to make up the resulting drop in collector current. By adjusting R2, the amplified base current can be made equal to the current in R1, i.e., the milliammeter then reads the same at both positions of the switch.

$$\text{Since } \alpha' = \frac{\text{collector current increase}}{\text{base current increase}} = \frac{R2 + R3}{R1}$$



The panel of the tester.

approximately, the variable resistance R1 can be provided with a scale reading α' directly. The resistance R3 is, of course, required to limit the base current, so avoiding the risk of damaging the transistor.

Corrections

There are two errors in this measurement of α'. One is due to the assumption that the voltage across (R2+R3) is the same as the voltage across R3. Actually it is less by the small potential drop between the base and emitter of the transistor. With 3V on the collector, this P.D. across the input of the transistor is only about 170mV, and means that the value of α' given by the simple formula above should be increased by about 6 per cent. With higher collector voltages, the correction is smaller, and is only

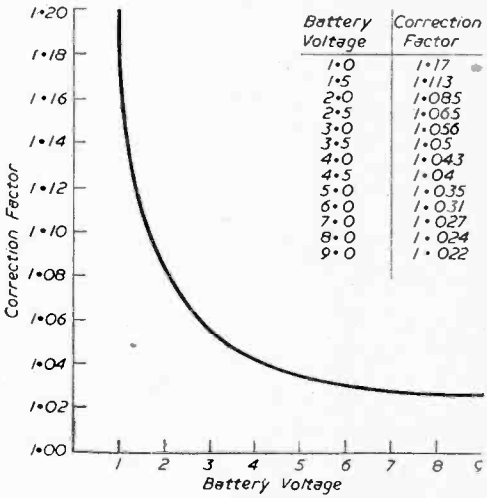


Fig. 2.—Correction factor to allow for P.D. across transistor inputs.

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2 per cent. at 9V. Below 3V, however, the correction increases rapidly. These figures refer specifically to the circuit given, where the ratio of collector volts to the increase of collector

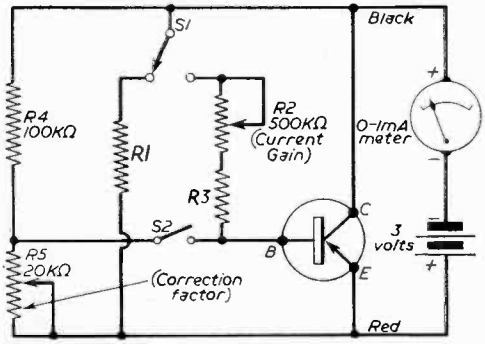

Fig. 3.—Modified circuit enabling the correction factor to be measured.

current is in each case made equal to a resistance of 5kΩ.

Graph

A graph of the correction against collector voltage is given in Fig. 2, and only in exceptional cases will a transistor show a noteworthy deviation from this graph. With a 3V battery, the correction factors for most transistors will be between 1.045 and 1.075. Thus, the assumption that the correction factor is 1.06 is not likely to produce errors greater than 1½ per cent. at the most.

The test is at comparatively low levels of base and collector currents, and in output stages, α' would attain a somewhat higher value. If it is desired to measure α' with battery voltages higher than 3, it will be necessary to replace the 1mA meter with a 5mA meter.

The remaining error is due to ignoring the

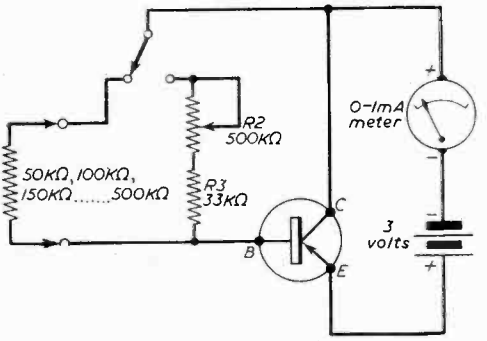

Fig. 4.—Temporary circuit arrangement for calibrating R2.

base current flowing through the meter. This means that (1) has to be subtracted from the result to obtain the actual value of α'.

Scales

It is possible to fix R2 and to vary R1 instead, and this has the advantage that a wire-wound potentiometer can be used for R1, while if R2 is made variable, a carbon-track potentiometer has to be used. There are, however, a number of disadvantages in making R1 variable. The milliammeter current would vary to a much larger extent with different transistors, and the scale of α' would follow a reciprocal law, with the lower end of the scale expanded, and the higher reading cramped. It would also be more difficult to determine the position of the scale markings.

In theory, when R2 is made variable, a linear scale should be obtained, but imperfections in the carbon track tend to make the scale divisions rather erratic in spacing, although something resembling a linear scale will be obtained.

Modified Circuit

The correction factor can be ascertained directly, without knowing the battery voltage accurately, if a simple addition is made to the basic circuit. The modification is shown in Fig. 3, and consists of a potential divider containing a 100kΩ fixed resistance and a variable 20kΩ resistance, R5. By adjusting R5, the closing of switch S2 can be made to have no effect on the meter current. At this setting of R5, the correction factor can be read off directly, the scale

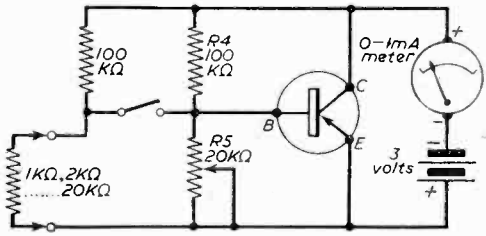

Fig. 5.—Temporary circuit arrangement for calibrating R5.

being marked in accordance with the formula:

$$\text{Correction factor} = \frac{R4 + R5}{R4}$$

its reading is multiplied by the correction factor ranging from 1.01 to 1.2. With a 3V battery, as previously stated, the pointer knob will give an indication in the neighbourhood of 1.06.

The larger test panel has two dials and two switches. One dial gives α' approximately and its reading is multiplied by the correction factor given by the other dial. Then 1 is subtracted to give the final value of α'.

Components

A panel of hardboard measuring 4in. square will serve to mount the two potentiometers and the two toggle switches. The fixed resistors should be high stability types of 1 per cent. tolerance. Two 10kΩ resistors in parallel can be used for the 5kΩ resistance, R1, or a 5.1kΩ resistor can be used, although this means that (R2 + R3) now has to be calibrated in multiples of 51kΩ which is more difficult than in multiples of 50kΩ.

The scale of correction factors is also linear, and can be marked either by setting up a Wheatstone bridge circuit, or as in Fig. 5, by comparison with accurate fixed resistances. When R5 is set

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at 1kΩ, this corresponds to a correction factor of 1.01; 2kΩ corresponds to 1.02, and so on up to 20kΩ which corresponds to 1.2.

To calibrate R2, bridge methods will be less suitable, and accurate resistances of 50kΩ, 100kΩ, and so on (or 51kΩ, etc., if necessary) can be substituted for (R1 + R2) in circuit (Fig. 4), the

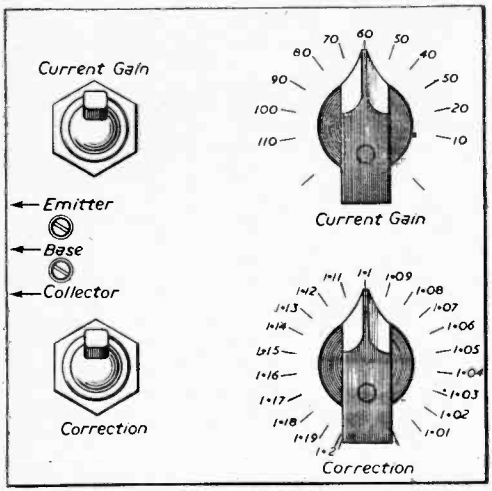

Fig. 6.—The panel layout.

variable R2 being adjusted to give the same readings of collector current.

Panel

The end positions of the pointer knobs should be marked carefully to make it easy to replace them correctly. Paper can be glued to the panel to take the markings made with Indian ink, and this can be covered with cellophane, or transparent plastic.

The toggle switches employed have four tags. When the toggle is to one side, connection is made between the two tags on the opposite side. One switch, S2, is used simply as an on/off switch, but the other, S1, is connected as a single pole, change-over switch.

A three-way connecting block, secured to the underside of the panel, connects the transistor to be tested. Although relatively clumsy for the purpose, it serves reasonably well, enabling all types of transistor to be connected temporarily for checking. The positions of emitter, base, and collector are marked on the top of the panel, and should be carefully observed.

Two insulated wires, each about 2ft. long, lead from the test panel to the milliammeter in series with a battery, and should be coloured red and black to avoid the risk of connecting the battery the wrong way round. With a grid-bias battery, red and black wander plugs should be used. Reversed connections, even if they do not result in damage to the transistor, will give rather puzzling readings.

Measurement

The accuracy of the measurements will depend in part upon the care with which the scales have been calibrated. The steps involved in making a measurement are as follows:

(1) Set R2 at the highest value of current gain, and R5 to the lowest value of correction factor.

(2) Connect the battery and milliammeter, observing the correct polarities and voltage.

(3) Connect the first transistor to be tested, making sure that it is the right way round.

(4) With S1 and S2 at the unmarked positions, note the milliammeter reading carefully.

(5) Switch to "current gain" and adjust the "gain" dial to give the same milliammeter reading.

(6) Leaving S1 switched to "current gain," switch S2 to "correction factor" and adjust the "correction factor" dial to give the same milliammeter reading.

(7) Multiply the readings of the two dials together (a slide rule will do this quickly) and then subtract 1.

It may be found that the milliammeter reading goes on increasing slightly, owing to the gradual rise in junction temperature inside the transistor, and some readjustment of the dials may be required, but it will be found that this makes only a small difference to the value of α'. The difficulty is that if a large current flows through the transistor it will raise the junction temperature and increase the leakage current. If most of the current is now diverted to an external resistance (R1), the junction temperature will begin to fall and the leakage current will decrease slightly, making its value different in the two switch positions.

H.F. Operation

The value of α' measured by the test panel applies at low frequencies, and at a particular value of collector voltage and current. When the transistor is working at higher frequencies this value will be reduced, and an associated phase shift occurs. An R.F. transistor of a particular

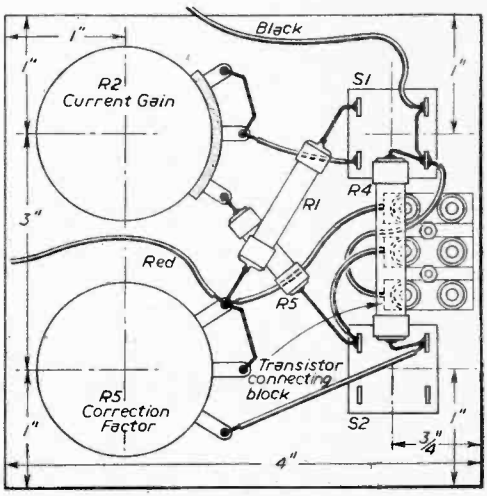

Fig. 7.—The wiring of the test panel.

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type is stated to have a certain typical "cut-off" frequency fc. of. say. 8Mc/s. This is for the grounded-base arrangement. and is divided by α' to obtain the "cut-off frequency", $f'\alpha$ for the grounded emitter arrangement.

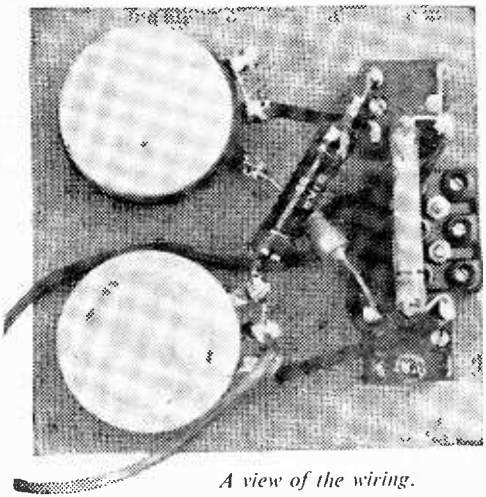
For example, if α' is 40, the grounded-emitter cut-off frequency will be

$$f'\alpha = 8/40\text{Mc/s} = 200\text{kc/s}$$

It does not follow that a high α' is a disadvantage, because the transistor with the higher α' usually has the higher $f'\alpha$ also.

At the frequency fc, the current gain is reduced to 71 per cent. of its low-frequency value. e.g., from 40 to 28. and a phase shift of 45deg. occurs. At ten times this frequency (2Mc/s) the current gain has fallen to 4 and the phase shift approaches 90 deg.

An R.F. transistor of these characteristics will nevertheless serve as a local oscillator over the long and medium waves. Used in the grounded base arrangement. a more level frequency response is obtained. owing to the negative feedback.



A view of the wiring.

VALVE CODING SYSTEMS

(*Continued from page 853*)

the general class to which the valve belongs. The code is as follows :—

C Frequency changer.
CRM Television tube.
D Diode or double diode.
F Voltage amplifier, tetrode or pentode.
K Small gas-filled triode or tetrode.
L Voltage amplifier. triode, tetrode or pentode.
M Tuning indicator.
P Power amplifier.
U Half-wave rectifier.
UU Full-wave rectifier.

The heater voltage of a rectifier is not placed in the coding. The letters are followed by a serial number.

Examples

1C2. Frequency changer with a 1.4V heater. (B7G base).
6C12. Frequency changer with a 6.3V heater. (B9A base).
6F33. 6.3V pentode with the suppressor grid connected to a diode. (B7G base).
30PL1. Triode-beam power tetrode with 0.3A heater. (B9A base).
UU9. Full-wave rectifier. (6.3V heater, B8A base.)

Marconi, Osram, G.E.C., M.O.V. Coding

This system of coding normally employs a letter or group of letters followed by a number. The letters indicate the class of valve and have the following meaning :—

A Valve with special industrial applications.
D Diode or double diode.
GU Gas-filled rectifier.
GT Thyatron.
H High impedance triode.
KT Kinkless tetrode or pentode.
L Low impedance triode.
M Metallised valve (usually placed at the end of the code).
N Output pentode.
U Rectifier.
W Variable-mu pentode.
X Frequency changer.
Y Tuning indicator.
Z Sharp cut-off pentode.

The first number following the letters often indicates the approximate heater voltage or current, but this is not always the case.

Examples

KT66. Beam tetrode with 6.3V heater.
KTW63. Variable-mu pentode with a 6.3V heater.
DL63. Double diode triode with a 6.3V heater. The triode is of the low impedance type.
X17. Frequency changer with a 1.4V heater.
Z77. Sharp cut off pentode with a 6.3V heater.
HN309. High impedance triode-output pentode with a 0.3A heater.
U52. Full-wave rectifier.

G.E.C. germanium diodes are coded GEX followed by a serial number. Current G.E.C. transistors are coded GET plus a serial number.

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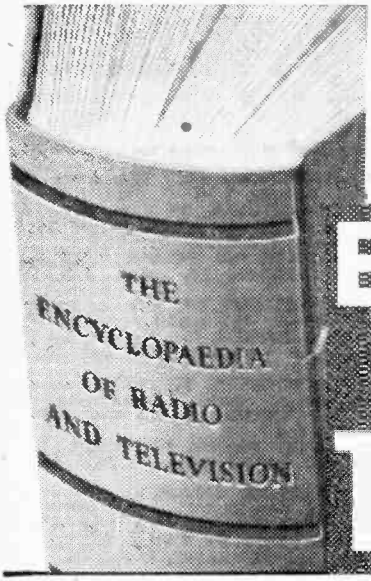

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Becoming an Amateur

No 6.—TWO ONE-VALVE RECEIVER CIRCUITS

By J. D. Pearson, G3KOC

THE reader may already be an experienced constructor, but if this is not the case then he is strongly advised to tackle a simple T.R.F. circuit; many such circuits have been published in past issues of this magazine, complete with detailed component lists and sound constructional advice.

It is a fact that there are still to-day many amateur stations using T.R.F. receivers for reception, particularly in certain European countries where there is no such thing as a "surplus" market. This point is made to illustrate the performance which can be achieved by a well designed T.R.F. set, having a sensitivity figure often well above that of the older-type superhet. Unfortunately the "straight" set cannot compare with the superhet as far as selectivity is concerned. And conditions being as they are on the amateur bands to-day, selectivity is of prime importance.

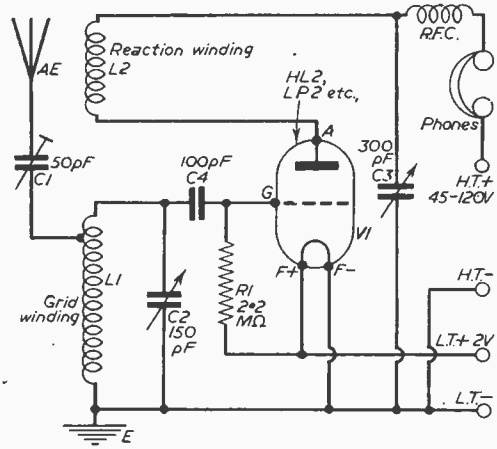

Fig. 1.—Simple one-valve circuit using a triode.

Beginner's Circuit

The circuit in Fig. 1 is intended for the newcomer who has no constructional experience whatever. The coil dimensions given will ensure coverage of the 160-metre amateur band. No apology is offered to the more sophisticated constructor who may be following this series. It must suffice to state that the series is designed to enable the merest tyro to attain the standard required to take the R.A.E.

It will be seen that the circuit is battery-operated: the beginner is strongly advised to gain experience with this type of gear before attempting mains-driven circuits.

Mr. J. W. Wroth of Ramsgate in his den.

Although a type HL2 valve is shown almost any 2V battery triode will function satisfactorily in this circuit; and for those who wish to use the 1.4V type of valve, a DF33 or DL35 in the octal-based range, and a 1T4 in the B7G range may be substituted, not forgetting of course to "strap" the screen-grid to the anode.

The circuit may be built using the "breadboard" method or alternatively, the more orthodox aluminium chassis. The HL2 will operate with an anode voltage anywhere between 60-120V and the 1.4V type with an anode voltage between 45-90V. The potential applied to the anode will determine the "smoothness" with which "reaction" can be applied.

Positive Feedback

If a controlled amount of the output signal at the anode of the detector valve is fed back in the correct phase into the grid circuit of this valve, the result is a high increase in the sensitivity of the stage. This process, if carried too far, causes the valve to provide its own grid-excitation and consequent self-maintained oscillation. The application of positive feedback in

COMPONENTS LIST FOR FIG 1.

C1 —50pF (0.00005μF.) semi-variable trimmer.
C2 —150pF (0.00015μF) tuning, air-spaced.
C3 —300 pF (0.003μF) reaction, air or mica dielectric.
C4 —100pF (0.0001μF) grid condenser, mica or silver mica.
R1 —2.2MΩ (Megohms) grid leak.
RFC —Radio Frequency Choke.
L1 —Grid coil, 45 turns 22 s.w.g. enamelled copper wire close-wound on 1½in. diameter former.
L2 —Reaction coil, 15 turns as above, on same former, spaced ⅛in. from L1. (See Fig. 3.)
Miscellaneous—High resistance headphones, valve-holder to suit V1, connecting wire, terminals, chassis and panel, coil former and holder.
V1 —HL2, LP2, 1T4, DL35, DF33, etc.
The grid leak R1 may be increased in value experimentally to 3.3 or 4.7MΩ, but should not be decreased.

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this manner is known as "reaction" or "regeneration."

In order to obtain maximum performance from a T.R.F. receiver it is essential that the application of reaction should not be too fierce, or "ploppy," thus losing the increase in sensitivity which results when the valve is operated on the threshold of oscillation. Factors which determine the smoothness with which the receiver slides into oscillation are (a) H.T. voltage: (b)

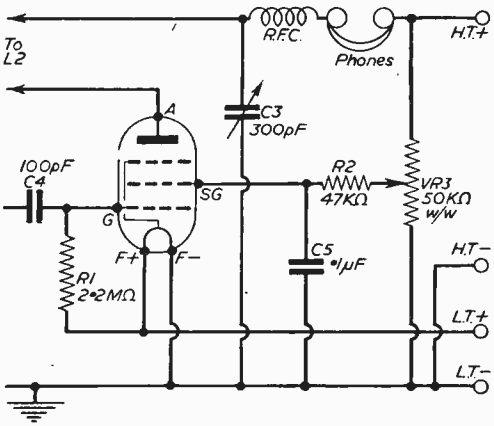

Fig. 2.—A one-valve circuit using a pentode.

amount of coupling between grid and anode coils: (c) proportion of anode turns to grid turns on these coils; (d) the value of the grid leak and condenser, and (e) the fitting of a well-earthed metal panel to the chassis, eliminating hand-capacity effects.

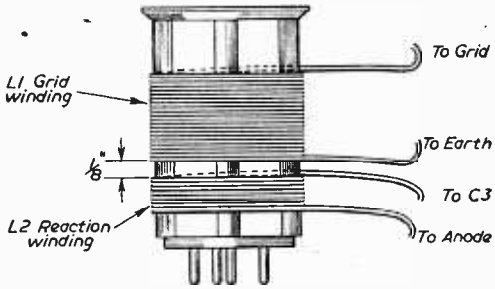

Fig. 3.—Details of the coils.

The beginner should, after building and operating the circuit of Fig. 1, experiment for himself by variation of the factors enumerated. If he has a milliammeter and inserts this *in series* with the H.T. supply to the valve, further lines of investigation will be revealed.

The next step is to supply the screen-grid of the valve with its own separate H.T. voltage through a variable resistor, as shown in Fig. 2. This allows a much finer control of reaction, in addition to that provided by C3. The strap between anode and grid should, of course, be removed. A screen-grid valve of the 2V type can, of course, be used in the circuit of Fig. 1 either with the anode and screen grid strapped, or as shown in Fig. 2.

Beginners should bear in mind that the pin connections to internal electrodes will differ with whichever type of valve is used. A commercial coil may be used in place of L1, L2 if the value of C2 is altered according to coil-manufacturers' directions.

Satellites

BALLOONS with aluminised surfaces will be orbited about 1,000 miles up as relay stations for microwave communications and intercontinental TV transmission in tests by Bell Labs., U.S.A.

Transmitters using 85ft. parabolic dishes will beam 10kW signals at the satellites at about 1,000Mc/s. It is hoped reflection from a satellite will give a usable signal receivable with a parabola 2,300 miles away. The signal will be funnelled into a maser amplifier, in this case a ruby crystal bathed in liquid helium. Bell engineers expect extremely low noise figures with this maser and a special horn collector used with the receiving dish—signal-to-noise ratios up to a hundred times better than presently obtainable.

Where the new transoceanic cables carry up to 160 phone conversations at a time, a single microwave channel of this kind would carry 900 phone circuits, or a full-width TV channel. About 20 satellites would provide communication across the U.S.A. 95 per cent. of the time. This number would be required because such light, large, passive satellites would drift, failing to stay in the regular orbits of heavy, small, active satellites at present in orbit, or the doughnut-shaped satellite proposed by others.

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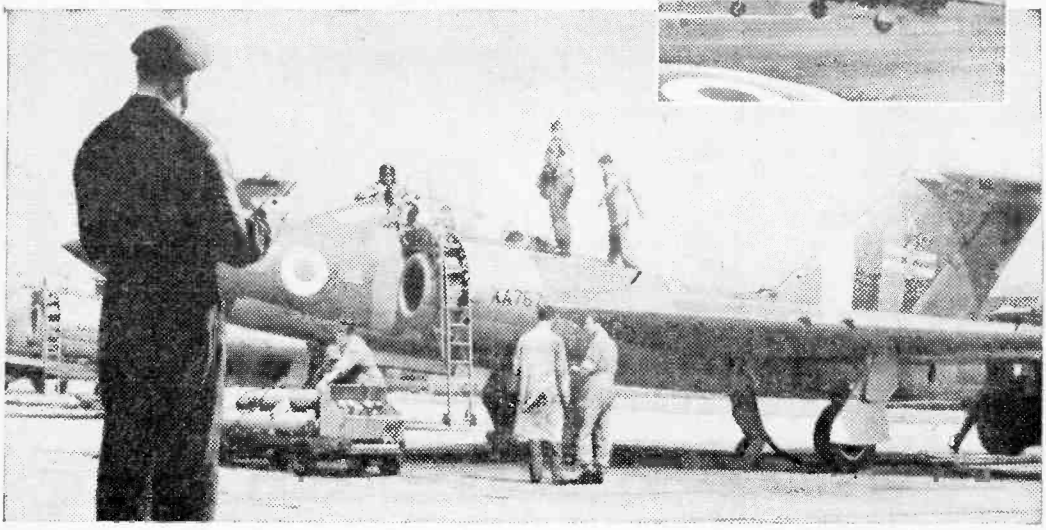

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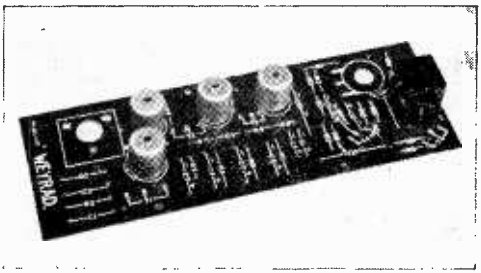

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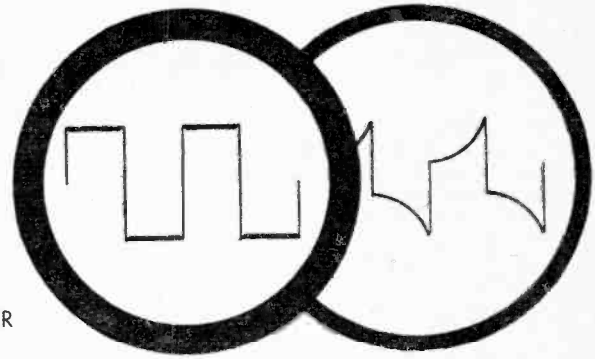

USING PUSH-PULL CIRCUITS FOR BETTER RESULTS

(Continued from page 770 of the January issue)

By C. Stone

SOME old amplifiers of robust type and quite sound design employ a centre-tapped transformer to drive two valves in push-pull in the output stage. Feedback will help correct distortion arising in the transformer, but it is nevertheless worthwhile considering the use of a phase inverter valve instead of the transformer. A circuit for a single triode is shown in Fig. 4. When there is no space for an extra triode, it may be possible to fit a twin triode in the existing position. The 6SN7, for example, would replace an existing 6J5 and at the same time make available a further triode with similar characteristics for use as phase inverter.

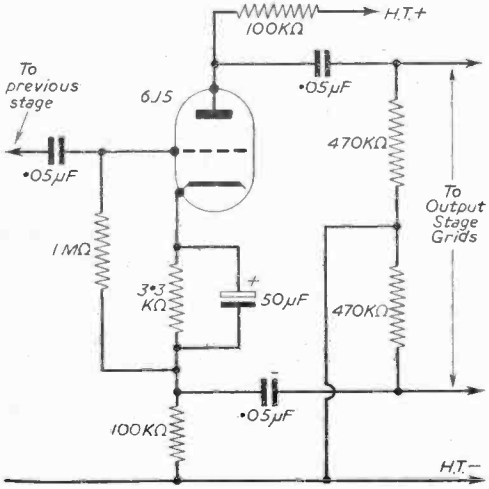

Fig. 4.—A single triode phase inverter.

Component values may be varied somewhat, according to the valve type chosen, and H.T. voltage. The anode and cathode load resistors (100k in Fig. 4) should be of fairly close tolerance—say 5 per cent. of specified value. Similarly, the 470k grid resistors of the output valves should be of 5 per cent. tolerance, otherwise a rather large discrepancy may arise in the working of the two valves. For best results, a "matched" pair of valves should be selected.

A typical output stage is shown in Fig. 5, and may be used with the phase inverter in Fig. 4. With home constructed equipment the extra current can often be provided, when changing from a single output valve to push-pull. As example, two 6V6 valves, with a 285v supply, will require about 105mA. The existing rectifier, mains transformer, and smoothing choke may thus well be of insufficient rating, and need changing. Alternatively, it is sometimes possible to use output valves of smaller type, so that the total H.T. current does not exceed that taken by a single output valve of larger type.

In Fig. 5, the valves are triode connected. For pentode working (screen grids to H.T. positive line) the optimum load is 8,000 ohms. When maximum output is required, with economical current demands, triode working is not recommended. It is also important to note that using valves in push-pull, as in Fig. 5, does not increase the *amplification* of this stage, compared with the use of a single valve.

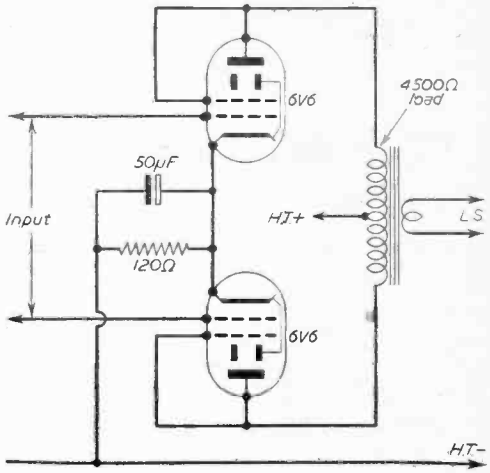

Fig. 5.—Output stage for circuit in Fig. 4.

Complete Amplifier

A complete amplifier circuit, with feedback, and push-pull, is shown in Fig. 6. Feedback can be modified by changing the value of the 220 ohm resistor. A higher value will be needed here if a speaker having a speech coil impedance higher than 3 ohms is used. The amplifier will require a fairly good input such as may be obtained from a radio tuner. A 6SN7 may replace the two 6J5 valves. Other

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valves may be fitted, with values modified to suit if necessary.

For small inputs, such as obtained from some types of pick-up, or from a microphone, a triode or pentode pre-amplifier will be needed, and any tone correction circuits should be incorporated in this stage, not in the main amplifier.

Layout

A circuit such as that shown in Fig. 6 can have a layout similar to that of the circuit diagram: construction is simplified as the circuit has a certain degree of symmetry. A small aluminium chassis can be used and the unit could be built on the same chassis as the radio tuner. The 6V6 valves will develop considerable heat and provision should be made to ensure adequate ventilation. If the amplifier is assembled in a wooden box for instance, expanded metal grilles.

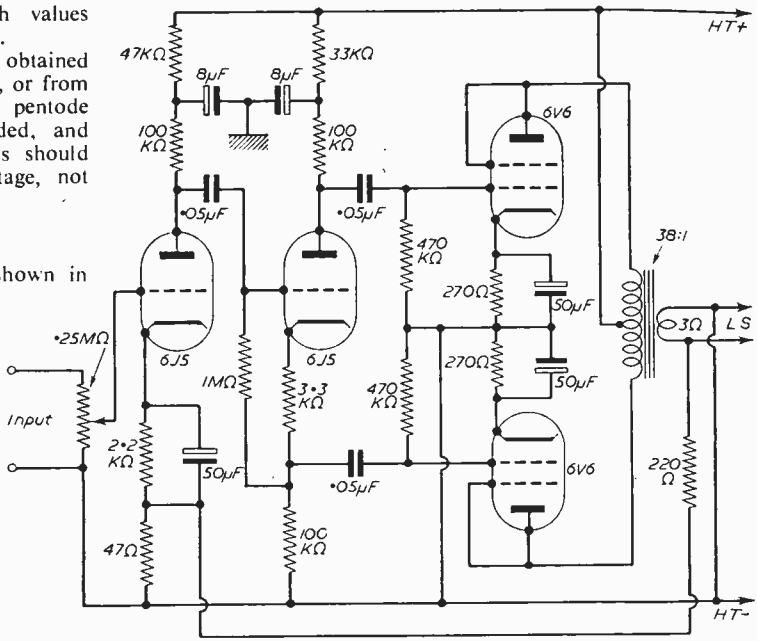

Fig. 6.—A push-pull amplifier for a radio tuner, etc.

GLOWS IN VALVES

By J. B. Dance, M.Sc.

SOMETIMES a blue, violet or pink glow is seen inside a valve whenever it is in use in dim light. This is, of course, nothing to do with the normal, red, glow from the valve heaters. In certain circumstances a perfectly good valve may glow under normal operating conditions but in other cases a glow indicates that the valve is faulty and it may then cause damage to other components in the circuit.

Occurrence

Valves which have an anode voltage of a few hundred volts or more and a fairly high anode current often emit a blue glow when they are operating normally. This glow is due to parts of the electron stream missing the anode and striking the glass envelope or some other solid object within the valve (such as the mica which supports the electrodes). It is almost always possible to distinguish such a glow from the other type of valve glow (which will be discussed below) by merely noting the place from which the glow is emitted. If the glow emanates from the glass envelope of the valve or from any mica supports in the envelope, this does not indicate that the valve is in any way faulty. For example, the glass envelope of 807 valves almost always glows to some extent in normal operation.

If a blue, violet or pink glow is seen coming from the space between two electrodes, there is certainly some gas in the valve. This glow is due to the formation of charged particles or ions in the gas (known as ionisation). The process is very similar to the formation of light in gas discharge lamps such as the yellow (sodium) and blue (mercury) street lamps.

Vacuum

All ordinary radio valves are of the high vacuum type. If a glow is emitted from the space between the electrodes, gas has entered the valve and it is said to be "soft." A valve which has been "on the shelf" for a long time will probably have a very small amount of gas in it and may give a very slight blue glow when used. This disappears, however, when the valve is operated for a short time with a low resistance connected between its grid and cathode. A valve which emits a constant glow from the space between its electrodes should be regarded as a very doubtful component and should be replaced as soon as possible. A soft valve will have a high reverse grid current; that is, electrons pass on to the grid of the valve where they are neutralised by the positive ions in the gas. It is highly probable that the cathode will be damaged by positive ion bombardment.

In extreme cases the glow may extend outside the limits of the electrodes and sparking may occur inside the valve; it should then be discarded immediately. Sometimes a very small crack may be seen in the glass of a valve which is soft; in this case the getter—which should be of a bright metal deposit on the inside surface of the glass—becomes a dull white. Such a valve is invariably useless.

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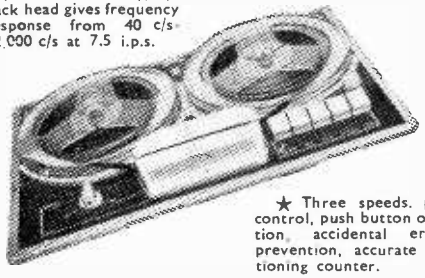

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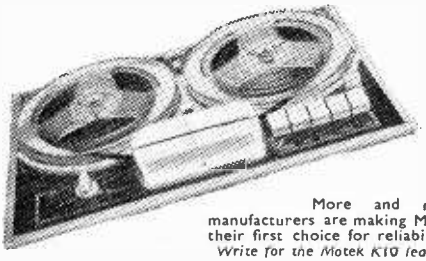

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Learning Morse

By H. J. Long (G5LO)

BEFORE an Amateur Sound Transmitting Licence is granted, the would-be amateur has to satisfy the authorities—in this case the Postmaster-General—that he has passed the City and Guilds Radio Amateurs' Examination and, also, that he is proficient in sending and receiving Morse code at a speed of not less than twelve words per minute.

Interference

The reason why the P.M.G. insists on a proficiency in Morse code is quite simple. If for some reason an amateur were operating his station and causing interference with a government or service station, he could be asked to close down, or even move frequency. How is he to comply with these instructions if he is unable to read Morse?

This being so, the enthusiast, if he wants to obtain his "ticket," should make a determined effort to learn the Morse code. It is not so very difficult, so the following simple instructions are intended as a guide in taking the first steps in learning the Morse code.

Morse code has a reputation of being difficult to learn; naturally, some effort is involved, but provided a suitable system is adopted from the outset, the task is by no means tedious.

Various methods can be used in teaching Morse, some good, others perhaps not so good. Quite often the learner asks a friend to send slow Morse on a buzzer or audio oscillator. This method can be used, provided the friend is a good operator and has what is termed a good "fist." But this can be very boring, even to your best friend! So, if in doubt, my advice is to follow carefully the following simple instructions.

Sound and Rhythm

The Morse code as used in radio is one that has been adopted internationally; most countries of the world use it. It consists of dots and dashes arranged in a given sequence which represent a letter of the alphabet, a figure, or an abbreviation.

Look at the list of the Morse code alphabet and note how each letter has its own character or symbol. For the purpose of timing, which is very important in making up the sound and rhythm from which the Morse symbol can be identified, a dash is equal to three dots in time, while the interval between the dots and dashes in a sequence, i.e., in the same letter, equals a dot in time. Between two letters in a word the interval is equal to three dots and between two words five dots.

Having studied the Morse code alphabet, it is at once apparent, even to a novice, that it is quite impossible to count the dots and dashes as they are being sent. This brings us now to the most important point to understand, in that to read Morse you have to *memorise the sound or rhythm as applied to each letter being sent.* In other words, you associate an individual sound being heard and write it down as the letter it represents, or retain it in your memory until you have a complete word—the latter coming only after some considerable practice. A clear understanding of what the beginner is trying to do in learning Morse is perhaps the most important point of all.

Memorising the Alphabet

The first step is to memorise each letter of the alphabet with its relation to the Morse symbol. Take a slip of paper and write down about four letters of the alphabet and alongside each letter put the Morse symbol. It is perhaps better to choose the letters at random, not in alphabetical order.

So we might now have N—., W.— —, E., G— —., on our slip of paper. At any odd moment look at one letter and its associated Morse symbol and in *dit dah* language repeat the Morse symbol mentally. For instance, if you look at letter N you would instantly say mentally *dah dit*, repeating it over and over again. Letter W *dit dah dah*, E *dit*, and G *dah dah dit*.

The reason why *dit dah* is used instead of dot dash is that the resulting sound you will eventually hear when reading Morse is much nearer the sound *dit*, which can be said in rather clipped terms, whereas *dah* is said in more drawn out terms, which lends itself to the dash which is equal to three dots in terms of time.

With sufficient practice, a few minutes at a time, you should in a short time be able to *dit dah* any of your four letters you have written down. When you know these letters perfectly, you may take another four and repeat the process until you have been right through the alphabet. Numerals and punctuation marks can be memorised in the same way.

Take your time in memorising these symbols, and if there are one or two letters of which you are not sure, go back over them. Time and patience spent on this first stage will be well repaid later on.

Copying Morse

Having now reached this stage, we have to consider in what form the Morse is to be copied down.

To be ably to copy down Morse legibly calls for rather more care than, say, just writing one's signature, so clear, legible copying must be aimed at. Block capitals or script writing should be preferred to long-hand, for with the latter one is apt to scribble. Having decided on what form the copying down is to be, be sure to stick to

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that method, as to change one's style half-way through takes some doing.

We are now ready to have some copying practice—no, not from the receiver yet, but from our own *dit dah* language. So copy down on paper any letter you mentally think of in the Morse symbol. In effect we are reversing the process we previously did, instead of memorising a letter we see printed as a Morse symbol, we think of a Morse symbol and write it down as a letter.

THE INTERNATIONAL MORSE CODE

A—dit-dah.	N—dah-dit.
B—dah-dit-dit-dit.	O—dah-dah-dah.
C—dah-dit-dah-dit.	P—dit-dah-dah-dit.
D—dah-dit-dit.	Q—dah-dah-dit-dah.
E—dit.	R—dit-dah-dit.
F—dit-dit-dah-dit.	S—dit-dit-dit.
G—dah-dah-dit.	T—dah.
H—dit-dit-dit-dit.	U—dit-dit-dah.
I—dit-dit.	V—dit-dit-dit-dah.
J—dit-dah-dah-dah.	W—dit-dah-dah.
K—dah-dit-dah.	X—dah-dit-dit-dah.
L—dit-dah-dit-dit.	Y—dah-dit-dah-dah.
M—dah-dah.	Z—dah-dah-dit-dit.

NUMERALS

1—dit-dah-dah-dah-dah.	6—dah-dit-dit-dit-dit-dit.
2—dit-dit-dah-dah-dah.	7—dah-dah-dit-dit-dit.
3—dit-dit-dit-dah-dah.	8—dah-dah-dah-dit-dit.
4—dit-dit-dit-dit-dah.	9—dah-dah-dah-dah-dit.
5—dit-dit-dit-dit-dit.	0—dah-dah-dah-dah-dah.

Say *dit dah* and write down letter A, say *dah dah dit dah* and write down letter Q, and so on. What to say can be taken from a book or newspaper, but sometimes read from right to left, picking out the letters one by one, as this helps to break the habit of "over reading," which is anticipating a letter before it is sent, a habit that is quite hard to break when reading faster copy at a later stage. Twenty minutes at a time in any one sesssion is ample for this copying practice, but persevere with this until you can legibly transcribe any symbol of the Morse code from the *dit dah* to the written letter.

Listening out for Signals

We are now in a position to commence stage three in our operations. This will require a short-wave receiver with headphones. If your receiver is of the communications type you will have to switch in the B.F.O. to receive C.W. If it is of the simpler, straight, type you will have to use your reaction control so that the set is just oscillating.

Look round the short-wave spectrum and tune in a C.W. signal that is being sent fairly slowly; there are usually plenty of signals to choose from. Having found such a signal, try to recognise, in *dit dah* fashion, the distinct sound or rhythem which you already associate with the letters of the alphabet As an example, say we have tuned in a station that is sending its call sign, such as, VVV de ABC VVV de ABC VVV de ABC, repeated over and over again. It should not be too difficult to identify it in *dit dah* fashion as, *dit dit dit dah, dit dit dit dah, dit dit dit dah*, the de as *dah dit dit, dit*, the de by the way means from, indicating that it is from the station the signal is being sent, and the actual call sign which is *dit dah, dah dit dit dit, dah dit dah dit*, or ABC.

If station ABC was putting out a general call, it would be CQ de ABC, the CQ indicating that it was a general call. Or if as ZYX de ABC, this would indicate that station ZYX was being called by station ABC.

Copy down any letter you may identify, but if you miss one let it go and try again the next time round. With a little practice you will soon reach the stage where you can copy a call sign first go. From now on it is a matter for the individual, practice and still more practice, but do not overdo it, ten minutes at a time is ample.

By trying to copy signals from commercial stations, which send signals automatically, but at hand speed between traffic, you should gain a good knowledge of the correct formation of the Morse symbol, which should serve you in good stead when you start to send Morse on the key, but, as we pointed out earlier, this article was intended as a guide in taking the first steps in learning the Morse code.

IMPORTED ELECTRICAL APPARATUS

Dangers of mis-connection

THE following Press notice has been received from the Institution of Electrical Engineers and it is of particular importance at this time of year.

"The attention of vendors and users of imported domestic electrical apparatus, photographic and projection equipment, tape recorders, etc., is urgently directed to the risks which may ensue if the colour coding of the cores of the flexible cord with which such apparatus is furnished differs from the established British coding set out in The Institution's Regulations for the Electrical Equipment of Buildings, that is to say:

Green—earth connection.
Red—phase (live) connection.
Black—neutral connection.

"The risk is most acute if the flexible cord provided with the apparatus has a core coloured red which serves as its earth connection; because if the user, following established British practice, connects this core to the terminal of a British connecting plug which may itself be marked red, and then inserts the plug into a normal British socket, the result will be that any exposed metal parts of the imported apparatus connected to the red core will be charged at mains voltage, and represent a serious hazard.

"The attention of importers and wholesalers known to be handling foreign apparatus fitted with flexible cords which do not conform with British practice in respect of colour coding has already been drawn by the Home Office Central Advisory Committee on Safety in the Home to this situation: the purpose of this notice is to warn vendors and users of the risk, so that they can enquire as to the nature of the flexible cord provided with apparatus in which they are interested."

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Complete Kit. BARGAIN Only **£6. 8. 6** post free

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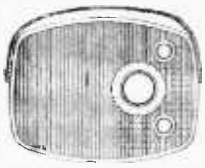
Instruction Booklet, 1/6. (Free with Kit.)



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AUTOCHANGERS. BSR (UA8), £6.19.6. COLLARO, £7.19.6; GARRARD (RC121 4D Mk. II) plug-in head, stereo adapted, 10 gns. Stereo head £2 extra.

RECORD PLAYER CABINETS. Contemporary styled 18in. x 13in. x 8in., 3 gns. Carr. and Ins 3/6.

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6K7	5/6	ECC84	10/6	EY51	10/-	PL83	11/6
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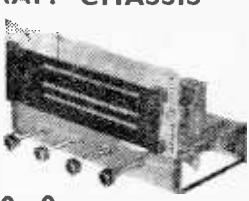

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SCOTCH plastic base, 1,700 ft. (7in spool), **25/-**. All orders for Tape post free.

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E.M.I. 4-speed, wired for STEREO and fitted Acos stereo t.o. cartridge. **£6.19.6.** Post 5/-.

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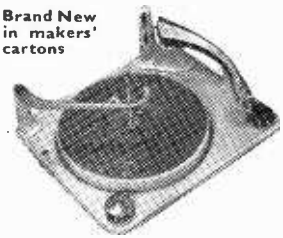

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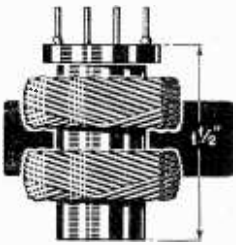

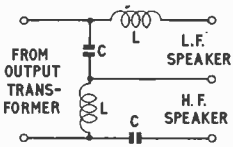

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L = 0·135mH.	C = 30μF.
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L = 0·675mH.	C = 6μF.

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LDN.1 for 3 ohm speakers. Price **7/6** ea. (**15/-** per pr.)
LDN.2 for 15 ohm speakers. Price **10/-** ea. (**20/-** per pr.)
Note: Two coils are required to complete the network shown in the circuit diagram, i.e., for 3 ohm speakers two type LDN.1 are required. (Please add 1/- to cover postage on each pair of coils.)
In both cases the cross-over frequency is 2.5 kc/s and with the constant resistance circuit recommended, the attenuation beyond the cross-over frequency will be 12 dbs per octave.

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Loudspeakers designed to reproduce the whole audio range are usually very expensive and results comparable with much more expensive units can be achieved by the use of two normal loudspeakers. One is used to reproduce the lower frequencies, the other caters for the higher frequencies where the response of the larger unit will have fallen off. It is clearly necessary to include a frequency dividing network between the speakers and output transformer in order to distribute the low and high frequencies to the appropriate speaker.

The frequency at which the cross-over takes place may lie between 800 c.p.s. and 5 kc/s depending upon the relative performance of the two loudspeakers used. A reasonable compromise which will suit most pairs consisting of an 8in. to 12in. unit and a 2½in. to 6in. unit, is 2.5 kc/s.

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Club News

REPORTS OF CURRENT ACTIVITIES

BRITISH INSTITUTION OF RADIO ENGINEERS

9, Bedford Square, London, W.C.1.

MEETINGS for January, 1960.

London.—Meetings are held at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

January 15th at 6.30 p.m.—"A Proposed Space-charge-limited Dielectric Triode"—G. T. Wright, Ph.D.

January 27th at 6.30 p.m.—"Training for Operating and Maintaining Television Broadcasting Equipment"—K. R. Sturley, Ph.D., and A. E. Robertson.

Bristol, South Western Section.—Meetings held at the School of Management Studies, Unity Street.

January 27th at 7 p.m.—"An Equipment for Automatically Processing Time Multiplexed Telemetry Data (Timetape)."—J. H. Russell, N. Purnell and T. T. Walters.

Cardiff, South Wales Section.—Meetings held at the Welsh College of Advanced Technology.

January 13th at 6.30 p.m.—"Television Broadcasting Methods"—H. J. M. Hockley and N. Hughes, B.Sc.

Liverpool, Merseyside Section.—Meetings held at the University Club, 2, Mount Pleasant.

January 11th at 7 p.m.—"High Frequency Propagation—its Present and Future Use for Communication Purposes"—A. F. Wilkins, O.B.E., B.Sc.

Newcastle-upon-Tyne, North Eastern Section.—Meetings are held at the Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Road.

January 11th at 6 p.m.—"Data Processing Machines"—J. Allen and J. Keating.

Wolverhampton, West Midlands Section.—Meetings held at the Wolverhampton and Staffordshire College of Technology, Wulfruna Street.

January 13th at 7.15 p.m.—"Electronics in Medicine"—P. Styles.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: F. C. Ward (G2CVV), 5, Uplands Avenue, Littleover, Derby.

FUTURE events:

January 13th at 7.30 p.m.—Members' exhibition—three sections; juniors; home constructed; kit assembled.

January 20th at 7.30 p.m.—Open evening in sub-basement rooms.

January 27th at 7.30 p.m.—Quiz night.

February 3rd at 7.30 p.m.—Annual General Meeting.

February 7th at 7.30 p.m.—Proposed date for contest for G5YY.

BRADFORD AMATEUR RADIO SOCIETY

Cambridge House, 68, Little Horton Lane, Bradford, 3.

Hon. Sec.: D. M. Pratt (G3KEP), "Glenluce," Lyndale Road, Eldwick, Bingly, Yorkshire.

ON November 10th three junior members gave lectures on "How We Began." On November 18th the Society visited Messrs. Mains Radio Gramophones Ltd., the manufacturing company of the Radio Rentals Group. D. G. Enoch (G3KLZ), President of the Society, gave an interesting lecture on December 1st on "Tape and Disc Recording."

Future events:

January 12th.—"Colour Photography"—Arthur Bailey.

January 26th.—Annual display of members' gear.

February 9th.—"Inexpensive Sound Fidelity"—D. Pratt (G3KEP), Hon. Sec.

February 23rd.—Junk sale.

Meetings are held at 7.30 p.m. Morse classes are held by arrangement before meetings.

SOUTH YORKSHIRE AMATEUR RADIO SOCIETY

THIS club is just being formed and meetings were held at the home of Mr. Albert Field, 3, Coppice Avenue, Hatfield, Doncaster, to collect names of members. All enquiries from those interested in joining the Society should be addressed to Mr. Field at the address given above.

CALCOT RADIO SOCIETY

Hon. Sec.: C. Aldous, 3, Oliver Drive, Calcot, Reading, Berkshire.

ON December 10th Mr. S. Woodward, of the Calcot Radio Society, gave a lecture and practical demonstration on stereophonic sound.

Future event:

January 21st.—A representative of Dynatron Radio will give a lecture and demonstration.

AMATEUR RADIO SOCIETY OF CHESHAM AND DISTRICT

Hon. Sec.: K. R. Spratt, 207, Bois Moor Road, Chesham, Bucks.

THIS recently formed society has not yet obtained premises and classes in morse and theory for R.A.E. are being given by licensed members at their own homes, likewise all meetings are held on a rota basis at members' homes. It is hoped, when premises are available as a Society H.Q., not only to get more local amateurs together, but to take in many of the radio-minded youths of the district and enable them by lectures and morse training to become licensed members.

AMATEUR RADIO MOBILE SOCIETY

Hon. Sec.: G. E. Storey (G3HTC), 10, Avon Road, Sunbury-on-Thames, Middx.

FUTURE events:

January 30th at 3 p.m.—At the Small Hall of the St. Bride Foundation Institute, Bride Lane, Fleet Street, E.C.4.

The programme will include at least one lecture on a radio subject of general interest and the showing of several films.

The Society is planning a rally of an unusual kind to take place possibly in April or May of this year. The site will be somewhere between London and Birmingham. Those interested in attending either of the above meetings should write to the Secretary for further details.

THE READING AMATEUR RADIO CLUB

Hon. Sec.: R. J. Nash (G3EJA), 9, Holybrook Road, Reading.

THE November meeting was well attended and G4HZ and G5TP gave a short talk on aerials which proved most interesting to all concerned. The December meeting was held on the 19th and was also well attended. G3LLK gave an unusual and interesting talk on home-built receivers.

Future events:

January 30th.—Junk sale and discussion on future programme for 1960.

WELLINGBOROUGH AND DISTRICT RADIO AND TELEVISION SOCIETY

Hon. Sec.: D. J. Trusler, 87, Irchester Road, Rushden, Northants.

MEETINGS are held at the club room above the W.I.C.S. Fruit Shop in Silver Street, except where otherwise stated. (Every Thursday.)

Future events:

January 7th.—Annual general meeting.

January 21st.—"Transistors", a talk by F. Manning.

February 4th.—A stereophonic sound demonstration by D. Clarke and P. Butler in the Lecture Theatre of the Wellingborough Technical College.

February 11th.—Some aspects of photography. A talk by T. Judge, President of the Local Camera Club.

February 18th.—Film night in the club room.

March 3rd.—"Electronics and Radiation," talk by R. Mitchell, B.Sc.

THE ELECTRONICS CLUB, TRIVANDRUM, S. INDIA

THIS is a newly formed club, being only four months old and having 23 members in all. As in other radio clubs the membership consists of hams, SWL's, Hi-Fi enthusiasts and experimenters. Lectures and discussions are arranged and the Club maintains a technical library. Films on scientific subjects are screened occasionally and it is hoped to bring out a quarterly club journal.

On September 13th an inaugural lecture was held and Dr. Hariharan, of the University College, Trivandrum, spoke on "Some Aspects of Microwave." The Club would like to receive copies of PRACTICAL WIRELESS and other magazines.

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Indoor Aerials

FACTORS INVOLVED IN USING SMALL AERIALS

By W. Cleland

THE average domestic receiver usually gives sufficient loudness on a short length of aerial wire, and very often the "E" socket, which is either a direct connection to the chassis, or connected to it by a capacitor, is left unused.

Metal Plate

The return capacitance from this short length of wire to the "E" terminal and chassis of the set is very small, even when an earth is used, and a considerable increase in volume can be obtained by adding a metal plate to the end of the aerial wire. A sheet of aluminium placed out

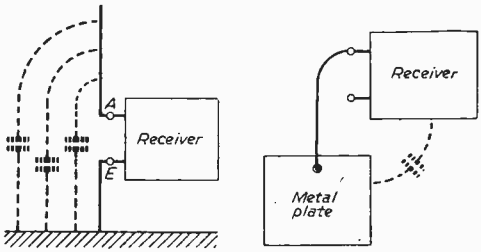

Fig. 1 (Left).—Aerial earth system, showing stray capacitance to earth. Fig. 2 (Right).—Increasing the end capacitance of a very short aerial by adding a metal plate.

of sight against a wall, behind some item of furniture, could be used for the purpose. The effect is similar to that of the horizontal section of an inverted "L" aerial, which adds top-capacitance.

With a mains radio, the addition of this metal plate will also assist in using the radio signals present in the mains. These reach the chassis of the set either directly, in the case of a live chassis, or through the interwinding capacitance of a mains transformer. Earthing the set, for example, to the third pin of a three-pin plug, is, therefore, unlikely to increase the volume, and a long wire to a clip on a water-pipe may cancel out some of the signal from the aerial, if the two run in the same direction.

The impedance of the mains to earth will be low, particularly if the cable has a metal covering, or a third wire connected to a water-pipe. Neither side of the mains is earthed on the premises, but one conductor is earthed at the power station.

Battery Sets

Earthing is, therefore, more important with a battery receiver, and will increase the volume. The signal input from the aerial can be increased by adding a metal plate, but the chassis of the

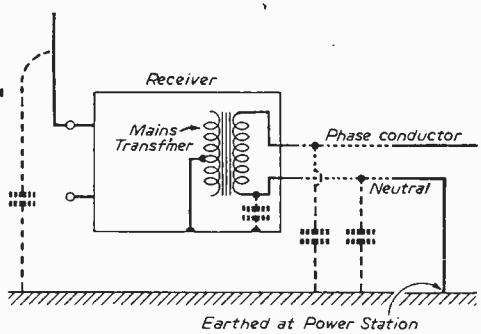

Fig. 3.—Earthing effect of mains connection.

receiver can be made to serve the same purpose by leaving the "E" socket unused and earthing the end of the aerial wire instead.

To do this with a mains receiver takes advantage of the mains as an aerial, but also increases the intake of mains-borne interference. An isolating capacitor included in the connection from the aerial socket to a water-pipe is sometimes misleadingly called a "capacity" aerial, suggesting that the effect depends in some way on the capacitor.

When the receiver is of a miniature type, a short wire aerial will be found to produce enormous changes in volume according to the position of the set in relation to surrounding objects. If the aerial wire is swung backwards and forwards near any large metal object, a corresponding fluctuation in the sound output will be noticed. In some parts of a room, reception may be almost unobtainable, although a ferrite aerial will still be able to receive the signal.

Internal Aerials

Unless the receiver is to be used in a fixed situation where a satisfactory aerial system can be provided, it is better to use a small frame aerial, or a more compact ferrite aerial. Although directional, these are the best types for portable radios as they are self-contained and little affected by capacitance to external objects. The listener himself has an appreciable capacitance, and can usually increase the volume by gripping the aerial; so his proximity to a midget receiver with an open aerial arrangement is likely to affect reception.

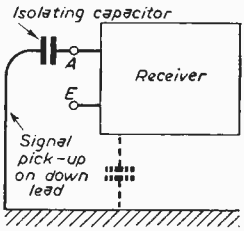

Fig. 4.—Reversed arrangement, sometimes called a "capacity" aerial when an isolating capacitor is included.

Much greater volume can, nevertheless, be obtained with an open aerial system under suitable conditions, and although a ferrite aerial can be recommended for a portable set, it is worthwhile providing a socket for an external aerial as an optional extra, where this is possible without upsetting the tuning.

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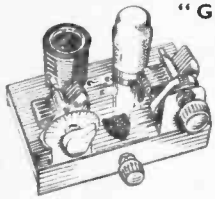

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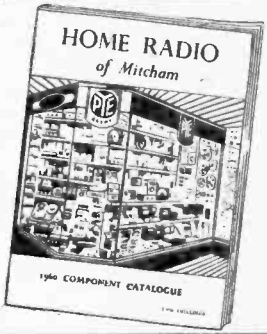

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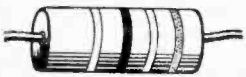

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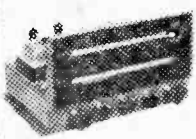

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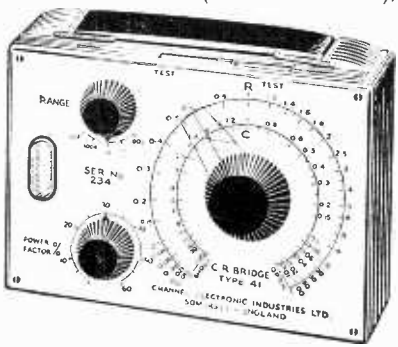

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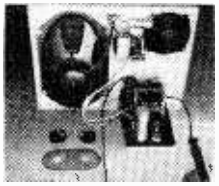

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Increasing Signal-to-Noise Ratio

LIMITERS CAN IMPROVE RESULTS

By J. Ball

IF a constructor is troubled by noise in the output of a receiver, his immediate reaction may be to add a noise limiter. Whilst this sounds perfectly logical, he will almost certainly be disappointed because a noise limiter will reduce only one particular type of noise and this is not necessarily the type which usually causes most trouble.

Broadly speaking, noise can be considered to be any unwanted sounds emitted from a speaker. The important thing is not the actual noise voltage at any point in the receiver, but the signal-to-noise ratio. Extra amplification alone will not improve the signal-to-noise ratio or the intelligibility because both the signal and noise are amplified by the same amount. A given amount of noise will, of course, cause most trouble when the signal voltage is very low, i.e., when receiving weak signals or using a high gain audio amplifier.

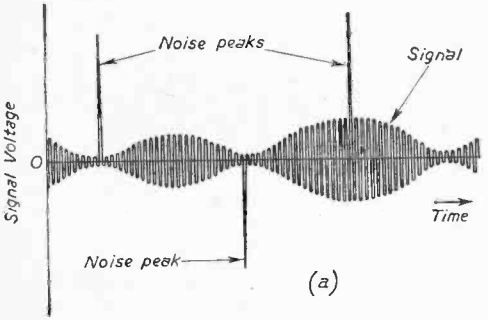

Fig. 1(a).—Typical impulse noise.

"Sharsh"

One type of noise is variously known as "hiss", "hash", "mush" or "sharsh" because, when one speaks these words, the sound resembles that of the noise. Sharsh noise is a mixture of all frequencies and is, therefore, by analogy, sometimes called "white noise" because white light is a mixture of light of all frequencies.

Some sharsh is present at the aerial. The receiver noise (also sharsh) is added to this during the passage of the signal through the receiver. No matter how the sharsh originates, the signal-to-noise ratio of a receiver can be improved by increasing the selectivity. Excessive selectivity should not be used, however, or side band cutting will take place with consequent loss of high frequencies and of intelligibility. The signal covers a narrow band of frequencies but sharsh is present on all frequencies. An increase of selectivity may therefore remove much of the sharsh which is not actually in the signal frequency band. Noise owing to signals on near-by frequencies will, of course, also be reduced by increasing the selectivity. One of the simplest methods of obtaining excellent selectivity and, therefore, comparatively little sharsh is the use of a double superheterodyne receiver. A circuit which can be added on to a receiver to convert it into a double superhet was described on page 388 of the July, 1959, issue of PRACTICAL WIRELESS.

The high frequency components of sharsh cause most of the trouble. A low pass filter ("top cut" or tone control) may therefore help considerably, but there is little point in using such a filter in a high selectivity receiver. A steep cut low pass filter is useful for reducing sharsh on recordings. Sharsh noise from F.M. receivers is reduced by amplifying the high frequencies more than the low frequencies at the transmitter (pre-emphasis) and amplifying the low frequencies more than the high frequencies at the receiver (de-emphasis).

Aerial

It is essential to use a good, well designed outdoor aerial if low noise is to be obtained when weak signals are being received. The noise picked up by a good aerial may not be any less than that from a poor aerial but the signal voltage—and hence the signal to noise ratio—is greater.

Some sharsh is always generated in the receiver but at signal frequencies below about 20Mc/s it should be much less than the sharsh noise from the aerial in any well designed receiver. The only noise which is important is that generated in the R.F. stages or mixer because noise generated later in the receiver is completely masked by the amplifier noise from the early stages. Mixer valves are always very noisy and it is important to keep this noise as low as possible if it is desired to receive weak signals on high frequencies. A good R.F. stage should be used so that the signal is amplified as much as possible before passing through the noisy mixer stage. Special R.F. stages which generate very low noise have been designed, but these lie outside the scope of

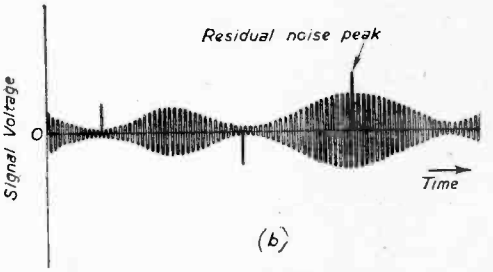

Fig. 1(b).—After passing through a limiting circuit the noise peaks are reduced.

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this article. It is also important to use the optimum aerial coupling and to ensure that the receiver is correctly aligned. Any noise which remains when the receiver aerial terminal is earthed is receiver sharsh noise.

Impulse Noise

Impulse noise—also known as pistol shot or machine gun noise—consists of short isolated signals of duration about one thousandth of a second (much less than this at the aerial). It can originate in a number of ways including internal

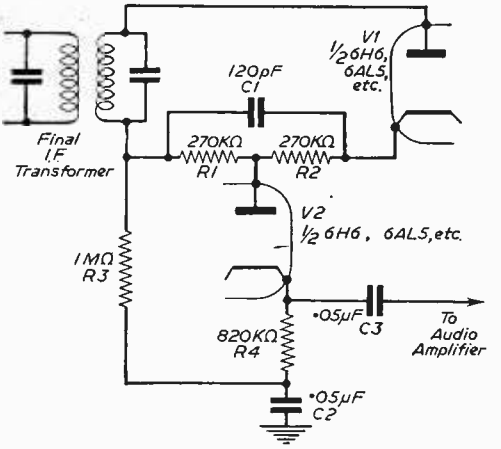


Fig. 2.—A series audio noise limiter and detector. (The cathode of V1 should be earthed.)

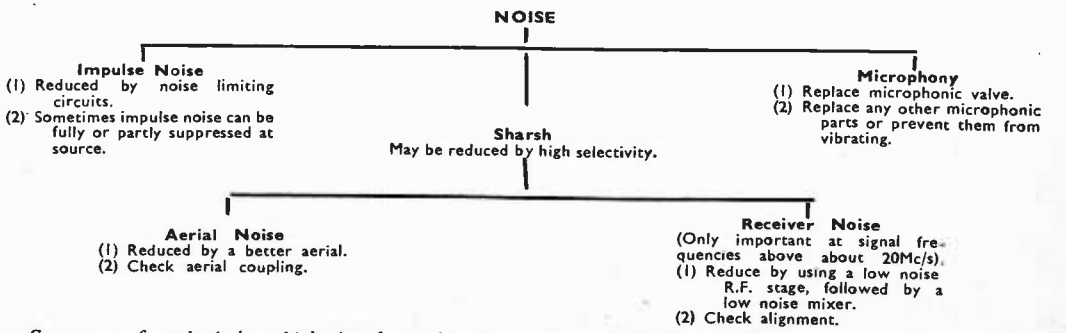
combustion ignition systems, clicks from electric switches, flashing signs, factory equipment and natural "static" lightning discharges. The noise from electric motors is a combination of sharsh and impulse noise.

Fig. 1(a) shows a typical example of impulse noise together with the wanted signal. Owing to the extremely short duration of impulse noise, the amplitude must be very much greater than that of the signal if it is to cause appreciable interference. Much of the noise can be eliminated by means of a simple audio noise limiter; the signal and the remaining noise then appear as shown in Fig. 1(b). The noise limiter merely "chops off the tops" of the noise peaks leaving the remainder of the noise just above the maximum signal level. A noise limiter will only reduce impulse noise and cannot affect sharsh.

A simple series noise limiter is shown in Fig. 2. V1 is the audio detector and V2 is the additional noise diode. The circuit requires only three more resistors and one more condenser than a conventional diode detector circuit. A negative voltage, which is proportional to the carrier level is developed across C2, but this voltage cannot change rapidly because C2 and R3 are both large. Noise peaks which exceed a certain level will drive the anode of V2 negative with respect to its cathode. During this instant of time the diode will not conduct and the audio signal will therefore be cut off or limited. The noise level at which this occurs is controlled by the bias on V2 which in turn depends on the carrier level at the time. The biasing, therefore, automatically adjusts itself whatever the input voltage from the last I.F. transformer in the receiver. If at any time it is desired to stop the limiter from working, it is only necessary to connect a wire from the anode of V2 to the cathode of the same valve. This could be done with a switch if desired so that the limiting circuit could be switched in and out. This particular noise limiter is of no use for Morse reception because the bias automatically adjusts itself to the carrier level. A noise limiting circuit of this type can be added to an existing receiver without any further drilling of the chassis if a suitable germanium diode (e.g., type IN34) is used for V2. Alternatively, a small diode of the normal type such as the VR92 or the EA76 may be mounted under the chassis to avoid the need for drilling it. Many variations of the circuit are possible.

Microphony

Microphony is very different from the forms of noise mentioned previously. The component which is microphonic must first be found by careful tapping of components in the low level stages whilst the unit is working. If a valve is found to be microphonic it should be replaced, but it should not be discarded, as it will probably work quite well in a stage operating at a higher voltage level. Very occasionally, tuning condensers are found to be microphonic, and steps must then be taken to prevent the plates of the condenser from vibrating.



Summary of methods by which signal-to-noise ratio may be increased when various types of noise are causing trouble.

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A REVOLUTIONARY NEW BRITISH INVENTION!

★ Uses standard tapes
★ Plays at 7½" per. sec. or 3 other speeds
★ Records direct from radio or microphone
★ Erase and fast rewind

£13.12s

Special moving-coil microphone and tape extra.

EASY TERMS

Instantly turns any gramophone into a first-class Tape-Recorder

and back into a record-player in a moment!

Gramdeck is completely *new* . . . a revolutionary and ingenious invention that instantly turns your gramophone into a tape-recorder and back into a gramophone at will! Slip the Gramdeck on to your turntable and you have the finest tape-recorder you've ever heard! Lift it off . . . your gramophone is ready to play records again. There are no motors or valves to go wrong—and *you get a quality that has to be heard to be believed!* Everyone is praising the Gramdeck.

"*The quality is at least equal to that obtained from a good microgroove disc,*" says a leading professional journal.

"Ingenious—simple . . . why on earth did no one think of it before!"—THE TAPE RECORDER.
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"Quality of reproduction excellent . . . real hi-fi results . . potential is tremendous . . . both designer and manufacturer should be congratulated."—BRITISH RADIO & T/V RETAILERS REVIEW.
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Gramdeck records and reproduces with a wonderful depth and breadth of tone. Because it uses equipment that is already in your gramophone it only costs a fraction of the high-quality tape-recorder you would normally require. Full details, specifications, photographs, easy terms, etc., are given in the Gramdeck Book. Send for your FREE copy, today.

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This new Mullard publication is a practical manual for every audio enthusiast. In addition to describing twelve of the most popular Mullard circuits, it has introductory chapters on many of the theoretical and practical aspects of high quality sound reproduction.
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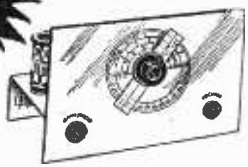
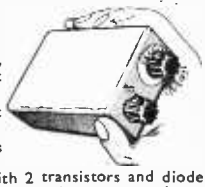


Construction price includes valve and one coil covering 40-100 m.
- Can be converted to 2v. or 3v.
- Receives speech and music clearly from all over the world.

Send 2/- for diagram and price list.

SENSATIONAL RESULTS WITH 2 TRANSISTORS



★ No aerial or earth.
★ Dial tuning with mini .000S.
★ Drilled chassis, colour coded, components, simple layout for beginners.
★ Special small case fits shirt pocket.
★ Soldering iron and pliers are only tools needed.

Finest results ever obtained with 2 transistors and diode layout. The ideal radio to carry with you everywhere.
PARTS PRICE LIST & EASY LAYOUT PLANS, 2/-.
Total building cost, including transistors, wire, etc., **62/6**

TRANSISTOR POCKET RADIO

Two-stage circuit using variloopstick coil.
- Ideal for the beginner.
- Can be built in 30 minutes.
- Works for months off 7d. battery.
- Fits into palm of your hand.

The ideal low-cost transistor pocket radio for the beginner.
Send 2/- for data and list of components.
ONLY **30/-**

CRYSTAL RECEIVER
Covers M/W Band
All components including case for Ideal for the beginner.
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BUILD THIS AMAZING RADIO
POWERFUL! PERSONAL! PORTABLE!

★ Sturdy metal case.
★ No holes to drill.
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★ Can be built in 1 hour.
★ Covers medium waves.
★ Loud clear tone.
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FOR ONLY **35/-**

This delightful set is designed to give you a completely personal portable radio.
Bronze-finished case. Ideal for the beach, the bedroom, the office—in fact, anywhere.
Send 2/- for wiring diagram and component price list.

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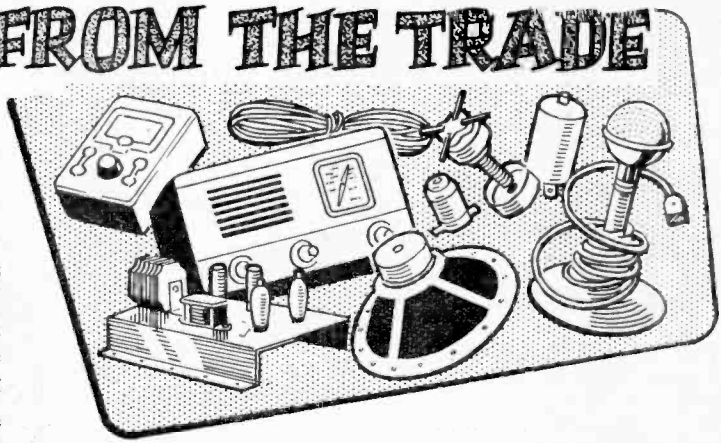
NEWS FROM THE TRADE



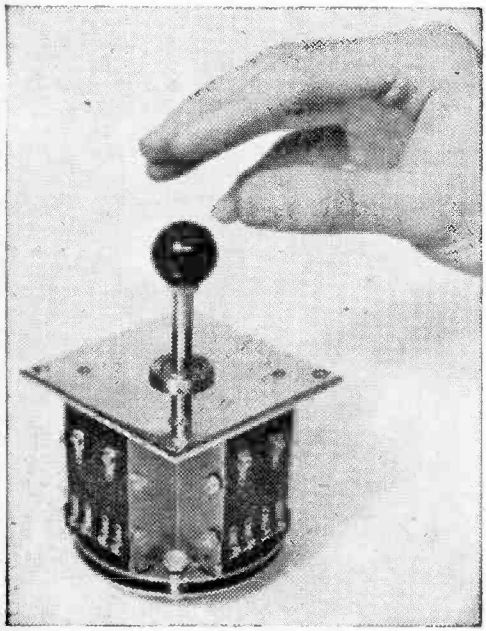
LATEST DEVELOPMENTS IN RECEIVERS AND COMPONENTS

TAPE RECORDERS

IT is announced by Philips Electrical Ltd. that they have added two new models to their range of portable tape recorders. They are the EL.3515 and the EL.3538, selling at 32 guineas and 57 guineas respectively. The EL.3515 is described as the "family" tape recorder and weighs only 18lb. Suitable for twin-track recording at 3¾in./s. it gives a total of four hours' playing time when double-play tape is used. It will take all sizes of reel up to 7in., and has easy push-button controls and a 4in. speaker. A recording level indicator is incorporated and separate inputs with mixing facilities are provided. The amplifier can be used separately with microphone or gram and recordings can be monitored by headphones. There is generous storage space for cables and microphone. The carrying case of impact-proof "Polystyrene" is finished in two shades of grey. The EL.3515 is supplied complete with crystal microphone, 5in. reel of standard tape and spare take-up spool.

The EL.3538 is a three-speed (1⅞, 3¾ and 7½in./s.) tape recorder housed in a carrying case finished in blue-grey. Push-button controls, grouped at the front of the machine, ensure fully automatic operation. Using double-play tape, the machine will provide up to eight hours' recording and easy maintenance is facilitated by a plastic hood which can be detached for cleaning of the mechanism. The EL.3538 weighs 30lb. and is equipped with a compact-type moving coil microphone, a 7in. reel of long-playing tape, a spare take-up spool and a 5in. loudspeaker.

Further information may be obtained from *Philips Electrical Ltd., Century House, Shaftesbury Avenue, London, W.C.2.*



One of the Pye "joystick" switches.

"JOYSTICK" SWITCHES

A RANGE of new joystick control switches which are safer and more easily operated than conventional push-button systems has been developed by the Switch Division of Pye Ltd. With manual or automatic return from two to eight positions, this new controller has many basic variations. The joystick has all the advantages of visual directional movement, plus the inclusion of an isolator for additional safety. This advance in sequence control technique allows a wide range of applications—all of which require considerably less space and are less expensive than an equivalent number of push-button units. Basically, the controller consists of a varied number of robust switches mounted under a 3½in. square chromium top plate. The switches are grouped evenly each side of the square and are operated by a control lever which passes through an oil-filled spherical bearing. The operator moves the lever almost unconsciously in the direction in which a traverse or operation should take place—a movement similar to changing gear in a car. Directions in which the lever can be moved are controlled by a gate plate mounted below the switches. Controllers can be supplied with stepped switching for multi-speed control and latest types include built-in potentiometers for infinitely variable control. (*Pye Ltd., Cambridge*).

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PLAYING TIME CALCULATOR

REQUESTS for the "Scotch" Brand Playing Time Calculator, which has been offered free of charge to recording enthusiasts, have been so overwhelming that two printings have now been completely exhausted. Further supplies are being prepared and efforts are being made to obtain further supplies to enable all requests to be fulfilled without delay. The calculator is obtainable from the *Minnesota Mining & Manufacturing Co., of 3M House, Wigmore Street, London, W.1.*

The "Scotch" magnetic tape playing time calculator.

NEW BRANCH

IN addition to their branch at 42, Tottenham Court Road, Lasky's Radio Ltd. have now opened new and larger premises in Edgware Road, London, W.2, and have a complete stock of all high fidelity equipment, tape recorders and accessories, together with a full range of components.

NEW MINIATURE MICROPHONES

EXTREMELY small coil formers injection moulded in Styron Polystyrene are an essential feature of miniature microphones now being manufactured by *A. P. Besson and Partner Ltd. St. Joseph's Close, Hove 4, Sussex.*

These microphones are of the self-energising balanced armature type, designed to operate with transistor amplifier, and function within a temperature range of 20-115 deg. F. They can, however, be specially processed to enable them to function satisfactorily at much higher temperatures if required.

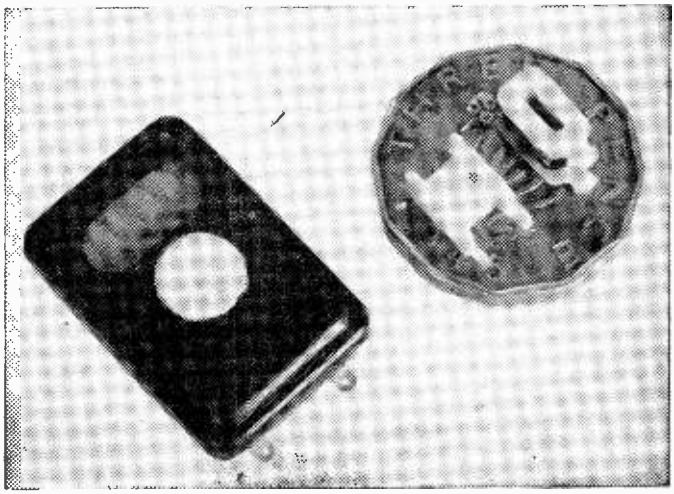
They are ideal for use in hearing aids, dictating machines, tape recorders, lapel microphones, walkie-talkie sets, pocket transmitters and other miniature equipment in which their light weight and compactness can be used to advantage.

Styron Polystyrene, which can be moulded to close tolerance and possesses the requisite electrical properties, is marketed by British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1.

OSCILLOSCOPE DISPLAYS OF HYSTERESIS LOOPS

THE production of hysteresis loops is a very lengthy procedure when using ballistic or magnetometer instruments, involving the plotting of many co-ordinates. For this reason many schools have, in the past, found it impossible to include the experiment in their programmes, although the subject of hysteresis appears in the G.C.E. physics syllabus at "S" level.

However, with an oscilloscope a direct display of a hysteresis loop may be obtained simply and with a minimum of preparation time, and since many school laboratories are equipped with such an instrument the Mullard Educational Service has produced a leaflet describing the experiment and giving full theoretical and constructional details of the circuitry required. It is the latest in the series, "Demonstrations & Experiments in Electronics" published by the Mullard Educational Service and may be obtained from *Mullard Ltd., Mullard House, Torrington Place, London, W.C.1.*



A miniature microphone and two polystyrene coil formers.

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121K, 141K, AW36-21, C14FM CRM123, CRM141, CRM142, MW31-16, MW31-74, MW36-24, MW36-44	£3/10/-	£5/15/-	£7/19/-
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NEW 108K TV TUBES SPECIAL OFFER : £2/19/-

Many other types not listed available. S.A.E. enquiries.

THAT SECOND SET?

13 CHANNEL T.V.'s

COMPLETE, UNTESTED

12" — £3.19.

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CARRIAGE FREE BUT AT CUSTOMER'S RISK

ALSO 12" 5 CHANNEL T.V.'s UNTESTED 55/- CARRIAGE

100 CONDENSERS 10/-

A must for your spares box. A well-balanced assortment of miniature silver mica and ceramic condensers. 3-10,000 PF. List value over £5.

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Standard 3 ohms, ex-equipment, top makes, performance guaranteed.

6½ in. 8/- 5in. 7×4 11/- 10in. 10×6 13/-

100 RESISTORS : 7/6

A magnificent assortment. ¼—2 watt.

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Transmitter receivers. U.S.A. standard aircraft type. 100-140 Mc/s., less valves. **25/-** Carr. 5/-.

COLLARO "CONQUEST"

Hi-Fi 4 spd. 10 record Auto. Limited Quantity. **£6/19/-**

G73 :

SIGNAL GENERATOR and wave-meter. 100 kc/s, 25 Mc/s., crystal calibrator, precision attenuator. Top make. 200/250 V.A.C. **79/-**

6 v. VIBRATOR PACKS

Output 220 v. 60 m.a., complete **12/6** p. & p. 3/-.

TRANSISTORS :

RED SPOT. Transistors for I.F., L.F. and Output up to 800 kc/s, 4/9 ea. (4/3 each in dozens). WHITE SPOT. R.F. and I.F. (2.5 Mc/s, 7/- (6/6 each in dozens). XA103, 15/- ; XA104 17/6 ; XB104 10/- ; GET15 25/-.

DIODES

General purpose famous make. 9d. 8/- doz.

DIODES. Equivalent to GEX44 3/9.

RECTIFIERS :

Iron selenium, full wave bridge, 12 volt 3-4 amps. 9/6. (Carr. 1/-). 25 per doz. 250 v. 80 ma., 5/- ; 250 v. 250 ma., 9/6; 500 v. 50 ma., 6/6 ; 500 v. 150 ma., 9/6 ; 1,000 v. 40 ma., 8/6; contact cooled 250 v. 50 ma., 7/- ; 250 v. 250 ma., 19/6; 250 v. 300 ma., 23/6.

VALVES ALL GUARANTEED 3 MONTHS

PL81 SOILED AMAZING VALUE AT ONLY **7/-**

EY51 SHORT ENDS **5/-** **U25** SHORT ENDS **8/-**

4-SPEED RECORD PLAYERS

Latest Turntable, together with lightweight Staar Galaxy dual sapphire crystal turnover pick-up head. Truly amazing value. Pick-up only 19/-. **£3/10/-** Carr. 3/-.

FREE TRANSFORMERS

with each manufacturer matched pair of GET15 POWER 1 watt output. Transistors, price 50/-, we give free the correct Push Pull INPUT AND OUTPUT TRANSFORMERS of High Grade construction and 4 Transistor Amplifier circuit. Will transform your existing receiver or amplifier into a truly "Mains Volume" outfit.

INFRA RED HEATERS

At half price. Unrepeatable.

800w., 2ft. 9in., £3 ; 1,200 w., 2 ft. 9 in., £3/5/- ; 2,000 w. 2 ft. 9 in., **£3/10/-** Carr. 3/-.

PICK-UP CARTRIDGES

ACOS 22/6. POWER POINT 18/6. STEIG AND REUTER 15/-. SONOTONE 17/6.

B.S.R. TAPE DECKS £9/10/-

PORTABLE RECORD PLAYERS

Collaro 4 speed auto-changer, 2½ watt high gain amplifier. Super two-tone case. **13 Gns.**

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10% DISCOUNT SPECIAL OFFER TO PURCHASERS of any SIX VALVES marked in black type (15% in dozens). Post : 1 valve, 6d. ; 2-11, 1/-.

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1A7GT	12/6	6BE6	6/6	6K7G	2/3	7B8	12/-	19AQ5	7/6	90AV	4/6	DL94	7/9	EF39	4/6	EZ41	8/-	PCL84	12/6	U26	12/-	UL44	12/6
1C5GT	10/6	6BG6G	12/6	6K7GT	5/3	7C5	7/6	19BG6G	16/-	185BT	16/-	DL96	8/3	EF40	13/6	EZ80	6/9	PEN25	5/-	U33	11/-	UL46	9/6
1D5	9/6	6BH6	7/9	6K8G	6/-	7C6	7/6	20D1	9/6	323A	15/-	EA50	9d.	EF41	8/9	EZ81	7/6	PEN45	7/6	U35	8/6	UL84	8/3
1H5GT	9/6	6BJ6	9/6	6K8GT	9/6	7H7	7/6	20F2	9/6	723A	35/-	EABC80	7/6	EF42	7/6	GT1C	7/-	PEN46	5/-	U37	26/6	UM80	9/6
1L4	3/9	6BW6	7/9	6K25	7/6	7K7	8/-	20L1	12/6	807	15/-	EAF42	8/6	EF50	RED	GZ32	8/6	PEN383	9/-	U43	9/6	UU6	9/6
1N5GT	9/9	6BW7	6/6	6L1	13/6	7S7	9/6	20P1	11/6	808	15/-	EAF42	8/6	EF50	RED	GZ34	12/6	PL33	9/-	U50	6/6	UU7	9/6
1R5	7/-	6BX6	5/9	6L6	9/9	7Y4	7/6	20P3	12/6	813	55/-	EB34	1/6		2/-	GZ37	10/6	PL36	13/6	U52	6/3	UU8	16/6
1S4	9/-	6C4	3/6	6L6G	7/6	7Z4	7/6	20P5	16/-	2050	3/6	EB41	7/-	EF50	USA	HABC80	9/6	PL38	14/6	U76	6/-	UU9	7/-
1S5	6/6	6C5	5/6	6L7M	6/-	10C1	9/-	25A6G	8/-	5763	10/-	EB91	4/-		2/6	HL41DD	9/6	PL81	10/6	U78	6/-	UY1	7/-
1T4	5/-	6C6	4/3	6L18	9/6	10C2	12/6	25L6G	8/-	7193	2/-	EBC3	9/-	EF54	3/6	HVR2	6/6	PL82	7/9	U191	9/6	UY41	6/6
2D21	4/6	6C9	9/6	6L19	11/6	10C14	9/3	25L6GT	9/-	AZ31	9/-	EBC33	5/-	EF30	5/6	KT32	6/-	PL83	8/-	U281	8/6	UY85	7/3
3A4	6/-	6C10	8/9	6LD3	8/9	10F1	10/-	25Y5G	9/-	B36	8/6	EBC41	8/9	EF85	7/-	KT33C	6/-	PX25	9/6	U282	22/7	VR150/30	
3A5	9/6	6CD6G	18/6	6LD12	7/9	10F9	10/6	25Z4G	7/6	B65	4/9	EBC81	11/-	EF86	11/-	KT36	9/-	PY31	8/6	U301	9/6		
3Q5GT	8/9	6CH6	9/3	6LD20	8/6	10L14	9/-	27SU	16/-	CBL31	24/4	EBF80	8/6	EF89	8/6	KT44	9/6	PY32	12/6	U329	12/6	W17	5/3
3S4	7/-	6D1	9d.	6P15	8/3	10LD3	8/3	30C1	7/9	CCH35	7/-	EBF89	8/6	EF91	3/9	KT45	8/6	PY80	7/-	U403	9/6	W61	9/9
3V4	7/9	6D2	4/-	6P25	9/-	10LD12	9/-	30F5	7/6	CL33	13/-	EBL31	16/-	EF92	4/9	KT61	9/-	PY81	7/-	U404	9/6	W76	6/6
5R4G	9/6	6D3	9/6	6P28	9/-	10P13	12/-	30FL1	9/6	CY31	11/-	EC52	3/9	EF95	6/6	KT66	15/-	UABC80				W77	4/9
5U4G	5/9	6D6	4/6	6Q7G	7/6	10P14	12/-	30L1	7/9	D63	1/6	ED90	3/6	EL32	4/-	KTW61	5/6	PY82	7/6		9/-	W81	5/6
5V4G	10/6	6F1	5/9	6Q7GT	9/3	10P18	8/3	30P4	12/6	D77	4/-	EC91	4/6	EL33	9/-	KTW63	5/6	PY83	8/6	UAF42	9/-	X61M	12/6	
5Y3G	6/-	6F6G	6/6	6SA7	6/-	12A6	5/6	30P12	11/6	D152	6/6	ECC31	9/6	EL38	12/6	KTZ63	5/-	PZ30	8/6	UB41	8/-	X63	8/6
5Y3GT	7/-	6F6M	7/-	6SD7	9/-	12AT6	8/-	30P16	7/9	DA30	12/6	ECC32	3/9	EL41	9/3	L63	2/9	R18	12/6	UBC41	8/-	X65	11/-
5Z4G	9/-	6F12	4/-	6SG7	5/-	12AT7	6/-	30PL1	13/6	D100	25/-	ECC33	7/6	EL42	9/6	LN152	8/6	R19	12/6	UBC81	12/-	X66	11/-
5Z4GT	11/-	6F13	5/9	6SH7	4/6	12AU7	6/9	35L6GT	9/6	DAC32	9/9	ECC34	9/-	EL84	8/3	LZ319	7/9	R52	11/-	UBF80	8/6	X76M	9/6
6A7	9/6	6F14	9/6	6SJ7	5/6	12AX7	7/6	35W4	6/9	DAF91	6/6	ECC35	6/9	EL85	11/-	MU14	8/-	SP6	4/-	UBF89	9/3	X78	14/6
6A8G	8/6	6F15	8/6	6SK7	5/-	12BA6	8/-	35Z4GT	6/-	DAF96	8/3	ECC81	6/9	EL91	4/9	N37	11/-	SP61	2/6	UCC85	8/9	X79	14/6
6A8GT	9/-	6F16	8/9	6SL7GT	6/9	12BE6	9/-	35Z5GT	8/6	DF33	9/9	ECC82	6/6	EL95	9/6	N78	15/-	SP41	2/6	UCF80		Y63	6/-
6AB8	8/6	6F19	7/6	6SN7GT	4/9	12BH7	9/6	42	7/6	DF91	5/3	ECC83	7/-	EM34	8/6	N108	11/-	SP61	2/6	UCH42	8/-	Y65	11/-
6AC7	4/6	6F33	5/-	6SS7	6/6	12C8	6/6	50C5	10/6	DF96	8/3	ECC84	8/9	EM80	9/3	N152	10/6	SU25	12/6	UCH81	9/-	Y76M	9/6
6AG5	4/6	6H6	2/-	6U4GT	10/6	12E1	12/6	50CD6G	16/-	DH63	7/6	ECC85	8/3	EM81	9/3	P41	4/5	SU2150A	4/6	UCL82	12/-	X78	14/6
6AK5	6/6	6J5	4/3	6V6G	5/9	12J5GT	3/6	50L6GT	9/6	DH77	7/6	ECC91	3/6	EM84	10/6	P61	2/3	T41	7/6	UCL83	13/6	Z14	9/9
6AL5	4/-	6J6	2/6	6V6GT	6/6	12K7GT	6/-	53KU	10/6	DK91	7/6	ECF80	10/6	EM85	10/6	PABC80	9/6	TH30C	12/6	UF41	8/9	Z63	5/-
6AM5	4/9	6J5G	2/6	6X4	6/-	12K8GT	12/-	54KU	8/6	DK92	8/6	ECF82	10/6	EN31	16/-	PCC84	7/9	U14	8/-	UF42	8/6	Z66	7/6
6AM6	3/9	6J5GT	3/6	6X5G	5/-	12Q7GT	6/-	61BT	11/-	DK96	8/6	ECH42	8/9	EY51	8/3	PCC85	9/6	U18	9/-	UF80	9/6	Z77	4/-
6AT6	7/6	6J6	5/-	6X5GT	6/6	12SG7	6/-	61SPT	11/-	DL35	10/6	ECH81	8/3	EY86	8/9	PCC89	14/-	U22	6/6	UF85	9/6	Z152	5/6
6AU6	9/6	6J7	7/6	7A7	11/6	12SJ7	5/6	77	4/6			ECL80	8/6	SMALL	9/-	PCF80	7/9			UF86	16/-	Z719	5/6
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1.5 v.	75 v.	150 ma.	750 ma.
3 v.	150 v.	300 ma.	1.5 amp.
15 v.	300 v.	1.5 amp.	7.5 amps.
30 v.	600 v.	3 amps.	15 amps.
150 v.	750 v.	15 amps.	
300 v.	1,500 v.	30 amps.	Resistance
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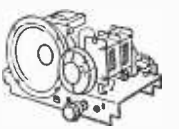

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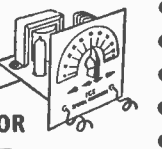

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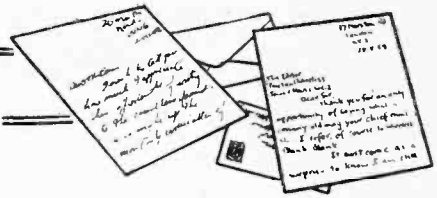


The Editor does not necessarily agree with opinions expressed by his correspondents.

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.

Admiralty W/T Station

SIR,—My attention has been drawn to a report in PRACTICAL WIRELESS for November, 1959, on the recently inaugurated Admiralty Wireless station at Inskip, near Preston.

The report in your section "Round the World of Wireless" on page 345 is not quite factual. The paragraph states that "the supply and installation of the transmitting equipment for the new Admiralty W/T station at Inskip, near Preston, Lancs, has recently been completed by Marconi's Wireless Telegraph Co. Ltd." Whilst it is true that Marconi was the major contractor and co-ordinated the efforts of the various sub-contractors, it is of interest to note that Standard Telephones and Cables Limited supplied and installed eight short-wave transmitters rated at 40kW peak envelope power and two long wave transmitters rated at 10kW and 5kW respectively. In addition, we supplied several drive units.—J. READ (Publicity Manager, Standard Telephones and Cables Limited).

Variometers

SIR,—Mr. Barringer's letter from Glasgow re variometers is interesting and no doubt he wonders at the small parts now used in radio. I started in 1910 and still potter with radio, though with wavelengths of a few centimetres. The variometer was very efficient and required no tuning condenser across it.

The reason for miniature parts today is the cost of materials and the great drive to make things small and not so bulky. Before the First World War, our tuning coils were wound on cardboard tubes, four and five inches in diameter, dipped in hot candle wax for insulation. One of mine was six feet long.

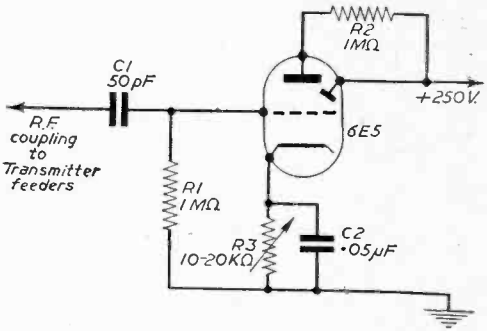
Wavelengths in those days were two thousand meters, and the stations were Cleethorpes, Nauen in Germany, and the Eiffel Tower, if I remember rightly.

Only spark transmissions were on the air. We made condensers from 2lb. jam jars, lined with tinfoil, inside and out, and we used a moving iron band, like the wire recorder for rectifying signals. Old ignition coils made fine sparks for sending and could be heard all over the world. Crystals with cat's whiskers came in later. Mostly silicon set in Wood's metal. When valves came in, about 1924, we used to buy variable condensers in parts and build them up to the capacity we wanted. They were large affairs with big dials and even light bulbs to show the readings at night. The only valves at first were Dutch, just a filament, grid and plate, four pin. They cost 5s. each and you had to try out several to find the one best suited to your circuit. Some valves were "soft" and some "hard."

Strict attention was paid to wiring-up sets. Leads were of stiff tinned copper wire. No attention was paid to their length as wavelengths in 1924 were long. Mr. Barringer should try his hand at making a variometer, they are good, cheap to make, require no condenser for tuning. —R. K. LLOYD (Karubue, Central Africa).

Modulation Indicator

SIR,—Below is a circuit for a simple modulation indicator which I have used at my station for several years, and which may be of interest to readers. I have no idea of the origin of this circuit; it was suggested by a friend of mine



Circuit of the indicator.

some years ago, when I contemplated building such a unit. It could be built into the existing rig, or as a separate unit.

The circuit incorporates a 6E5 magic eye, or any other similar tube as the indicator. High tension and heater supplies are obtained from any convenient source.

R.F. coupling is effected by wrapping a length of "hook up" wire several times around the feeders from the transmitter, and connecting to the grid of the 6E5 indicator tube through a 50pF mica condenser. It may be found that enough coupling is obtained by placing this wire near the final tank coil.

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The method of adjustment is as follows: apply heater and H.T. voltage to the tube. Adjust R3 until the eye just closes. Now, line up transmitter without modulation applied, and adjust R.F. coupling from transmitter, until eye opens to 45 deg.

If the transmitter is now modulated, the "eye" will close at 80 per cent. modulation. It should be noted that readjustment of the R.F. coupling to the unit will be necessary when changing bands. —D. W. SMITH (Greenock).

Radio Club

SIR,—I am almost seventeen and have just started a Radio Club in the school which I attend. We have a small room at our disposal and £10 in the "kitty." I should like to know how to spend the money and what equipment to buy. I should like also to hear how other small clubs are run.

We have two experienced radio operators running the club and the members' knowledge of radio is not very great. Can anyone tender any advice?—J. M. REES (New House, The School, (Monmouth).

Electronic Organ Data Wanted

SIR,—There are one or two electronic organs on the market with 2ft stops, but which, in fact, do not generate higher than 4ft. I believe this effect is obtained by some form of filter or network, included between the generators and the amplifier. I have been unable to find any circuit or other data on this point, either in any of the many books on the subject, or at the Patent Office, and I wonder whether any readers who are interested in this subject may be able to offer any assistance in obtaining this 2ft effect. I believe in America that there is one instrument which has a 1ft. stop, obtained from a generated 8ft.—R. PENNANT (N.W.).

Transistors v. Valves

SIR,—To those who have experimented with both there can be no doubt as to the advantages of transistors. The real reason why transistors are not becoming popular is because the components required to go with them are not available.

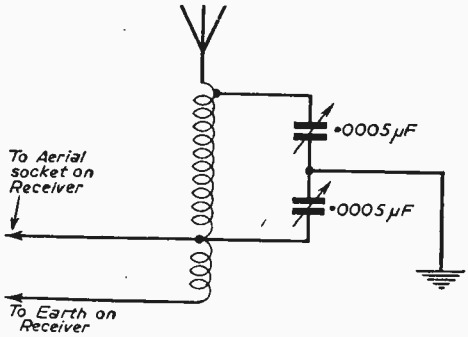
Over 80 per cent. of transistor components available are made to go on the printed circuit board, thus dictating to the constructor what he shall build. Let us have some components with decent terminations and not short spills and then transistors will come into their own.—P. E. ADDIS (Minehead).

SIR,—I agree most heartily with Mr. B. Wallace. My interest in transistors has nothing whatever to do with matchbox, or portable, radios and lies in quality of reception with the absence of background noise. I disagree entirely with your November editorial. I have no knowledge of radio other than that picked up in relation to transistors during the last four years. I've put together almost as many circuits as those you have published and have damaged possibly six transistors in that time. I have never yet damaged an OC70 or an OC71 though on one occasion I damaged a pair of OC72's in "push-pull," cost to buy OC70—8s. 6d.; OC72—12s. 6d.—hardly expensive.—B. A. (Birmingham, 13).

[*We think that B. A. has been lucky in not damaging more transistors and would remind him that the sum of* 8s. 6d. *is much more than a great many constructors can afford to pay for a careless mistake.*—ED.]

Selectivity

SIR,—In the past issues of PRACTICAL WIRELESS there has been a circuit of a M.W. Signal Booster, notes on medium wave aerials, and notes on improving selectivity by coupling the aerial to the receiver. The best improvement I have found is an aerial tuning unit (see diagram). The main coil is about 25 turns of 26 s.w.g. on 2in.



Circuit of the aerial tuning unit.

former with a link winding of five turns. The condensers are 0.0005μF as used in crystal sets, etc. The coil will cover 180-300m but by adding turns in the link winding and the main coil, by switching; there is no reason why stations up to 2,000m could not be covered and by changing condensers and coil again short waves could be covered.—M. REYNOLDS (Nailsea).

Information Required

SIR,—Can any reader supply information on the Bendix receiver BC624 (SCR522). There are a large number of the units available for sale and I should like some help as V.H.F. is rather tricky for a novice.—J. R. HARVEY (108, Fern Lane, Ileston, Middlesex).

Correspondents Wanted

SIR,—I am 14 years old and I am interested in radio construction. I would like to correspond with others of around my age. I have been reading PRACTICAL WIRELESS for over a year now.—J. WILKINSON (12 Church Road, Walkden, Near Manchester, Lancashire).

SIR,—I am 14 years old, and very interested in radio. I would like correspondents of my own age.—J. C. PLUNKETT-COLE (Kennicott House, Ashburton Road, Totnes, S. Devon).

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ARP12	2/9	ECC91	4/-	KT44	9/-	PY82	8/-		4/3	6AG5	4/6	6SN7GT	4/6
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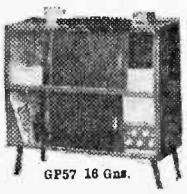
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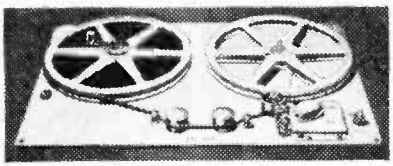

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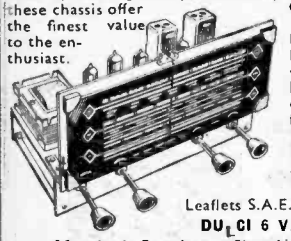

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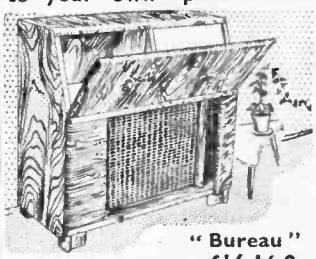

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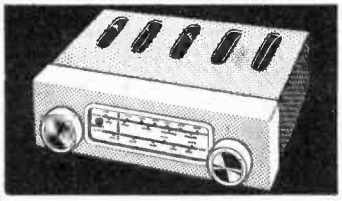

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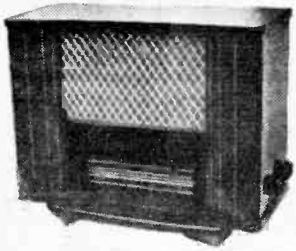

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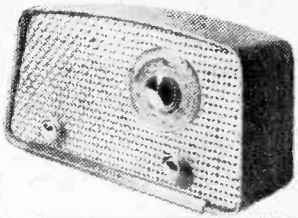

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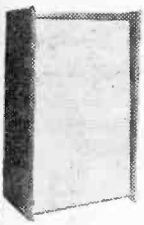

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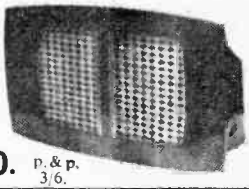

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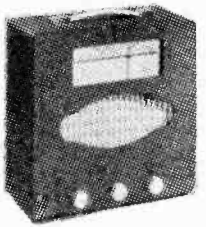
3A4	7/-	7A7	9/-	EBC33	6/6
3A5	9/-	7D5	10/-	EF50	4/-
3D6	4/6	7D6	10/-	EL32	5/-
3Q4	7/6	7S7	9/-	EL33	12/6
3Q5	9/-	7Y4	7/-	EM34	7/6
3S4	7/-	9D6	5/-	EM80	10/-
3V4	7/6	12AH7	6/-	EM81	10/-
5R4G	8/6	12AU6	9/-	EM85	11/-
5V4	10/-	12BE6	10/-	FC4	10/-
5X4G	10/-	12J7	10/-	FW4/800	
5Y3GT	6/-	12K8	10/-		10/-
5Y4G	10/-	12SC7	6/-	GZ32	11/-
5Z3	10/-	12SG7	6/-	GZ34	11/-
5Z4G	8/6	12SH7	6/-	HL23/DD	
5Z4M	10/-	12SJ7	6/-		6/6
6A7	9/-	12SK7	6/-	KT33C	8/6
6A8	9/-	12SQ7	8/6	KT66	12/6
6AB8	10/-	14S7	14/-	KTW61	6/6
6AC7	5/-	25A6	10/-	KTW63	5/-
6AG5	5/-	25L6	10/-	MVS PEN	
6AK5	6/-	25Z4	9/-		10/-
6AL5	5/-	25Z5	9/-	MS PEN	10/-
6AM5	5/-	25Z6GT	10/-	MU14	7/6
6AM6	5/-	28D7	4/-	MX40	10/-
6B8G	4/6	35Z5	8/6	N14	10/-
6BR7	12/6	42	7/6	PEN4VA	
6BW6	8/6	43	10/-		10/-
6C4	5/-	50B5	10/-	PEN25	5/-
6C5	5/-	50C5	10/-	PEN46	5/-
6F6	7/6	75	10/-	PP36	10/-
6F8	7/6	80	8/6	PX25	12/6
6F12	5/-	83V	10/-	QP21	5/-
6F32	7/6	83	10/-	QP25	6/6
6F33	5/-	807	5/-	SP4	10/-
6J5M	5/-	807USA	7/6	TDD4	10/-
6J7M	7/6	AC/SG	10/-	U50	6/-
6K7G	5/-	AC2PENDD		U52	6/-
6K7M	7/6		12/6	URIC	10/-
6K8M	10/-	AC/PEN	10/-	VMS4	10/-
6L6M	10/-	AC/VP1	10/-	VP23	5/-
6Q7G	7/6	AC/VP2	10/-	VS70	6/-
6R7	6/-	AR8	5/-	XH	4/-
6SA7	6/-				
6SC7GT	7/6	AZ31	10/-	Y63	7/6

REDUCTIONS FOR SETS OF VALVES:

X66, KTW61, DH63, KT63, U50, **30/-**. 1R5, 1S5, 1T4, 1S4 (or 3S4 or 3V4), **25/-**. 1C5, 1A7, 1N5, 1Q5 (or 3Q5), **35/-**. DK96, DL96, DF96, DAF96, **35/-**. TP25, VP23, HL23/DD, PEN25 (or QP25), **25/-**. 12K8, 12K7, 12Q7, 35Z4, 35L6 (or 50L6), **40/-**.

p.p. 6d. per valve. Orders above £3 post free.



Chassis Size 10 x 10 x 4 in.

SHORT-WAVE RADIO

★ **3 Wavebands (10 to 550 metres)—550 kc/s to 2 Mc/s, 2 to 11 Mc/s, 11 to 30 Mc/s.**
★ **5-valve Marconi Superhet.**
★ **A.C./D.C. 200 to 250 v. mains.**
★ **7 x 4 in. Speaker; Gram. input.**
★ **Slow-motion Drive.**

NOW £6.15.6 P.P. 3/6.

OR COMPLETE IN PORTABLE CABINET, **£7.12.6.** P.P. 4/-.

★ ALTERNATIVE MODEL MEDIUM, LONG AND SHORT

—— **THE WORLD IN YOUR HOME** ——

A.C., D.C., R.F. METERS

0-15 v.	2½"	M.I.	(AC) F.R.	8/6
0-20 v.	2"	M.C.	(DC) F.S.	7/6
0-40 v.	2"	M.C.	(DC) F.S.	7/6
0-150 v.	2½"	M.C.	(DC) F.R.	12/6
0-200 v.	2½"	M.C.	(DC) F.R.	12/6
0-1½ kv.	2½"	M.C.	(DC) P.	15/–
0-2½ kv.	2½"	M.C.	(DC) P.	15/–
0-500 UA	2½"	M.C.	(DC) F.R.	15/–
0-500 UA	3½"	C.	(DC) F.R.	59/6
0-400 UA	3½"	M.C.	(DC) F.R.	59/6
0-1 mA	2½"	M.C.	(DC) F.R.	22/6
2½-0-2½ mA	2½"	M.C.	(DC) F.R.	12/6
0-30 mA	2"	M.C.	(DC) P.	7/6
0-50 mA	2"	M.C.	(DC) F.S.	7/6
0-10 mA	2½"	M.C.	(DC) F.S.	10/–
0-100 mA	2"	M.C.	(DC) F.S.	10/–
0-150 mA	2"	M.C.	(DC) F.S.	7/6
0-500 mA	2½"	M.C.	(DC) F.R.	12/6
0-750 mA	2"	T.C.	(RF) P.	6/–
0-500 mA	2"	T.C.	(RF) P.	6/–
0-1 amp.	2"	T.C.	(RF) P.	6/–
0-3 amp.	2"	T.C.	(RF) F.S.	6/–
0-12 amp.	2½"	T.C.	(RF) P.	10/–
0-30 amp.	2"	M.C.	(DC) F.S.	7/6
5-0-5 amp.	2½"	M.C.	(DC) P.	10/–
20-0-20 amp.	2"	M.C.	(DC) F.S.	12/6

FREE COMPLETE LIST ON REQUEST. (INCLUDES MULTIMETERS, AVO & CABY, TRIPLET, ETC., AT EASY PRICES.)

TRANSISTORS

FROM **5/-** EACH

SHORT-WAVE, R.F., AUDIO AND POWER

SB078	20 Mc/s	6mW	H.F. ...	10/–
SB305	25 Mc/s	10mW	H.F. ...	15/–
SB231	30 Mc/s	10mW	H.F. ...	22/6
SB231R	50 Mc/s	10mW	H.F. ...	30/–
XB104	1 Mc/s	120mW	Audio	10/–
XA104	6 Mc/s	90mW	Osc/Mixer	18/–
XA103	4 Mc/s	90mW	RF, IF	15/–
XC121	—	200mW	Power	17/–
XC131	Matched pairs only 500mW pr.			34/–
OC44	15 Mc/s	60mW	Osc/Mixer	26/–
OC45	6 Mc/s	60mW	RF, IF	23/–
OC71	600 kc/s	100mW	Audio	14/–
Red Spot	800 kc/s	125mW	Audio	5/–
White Spot	5 Mc/s	125mW	RF, IF	7/6
Photo Transistor		100mW	...	10/–
V15/10P 10-watt Power		...	...	17/6

FREE DATA AND COMPLETE LIST ON REQUEST. ALL TYPES ARE FULLY GUARANTEED.

CRYSTAL MICROPHONES AND INSERTS

Acos 23-4 1in. Square	7/6
" 19-4 1¾in. Round	14/–
" 14 1½in. Round	7/6
" 6-9 2in. Round	12/6

P.P. 6d. any type.

ACOS 39-1
Stick Mic. with Stand **39/6**, P.P. 1/6
ACOS 40 Desk Mic. ... **25/–**, P.P. 1/6

TRANSMITTER/RECEIVER

Army Type 17 Mk. II. Complete with Valves, High Resistance Headphones, Hand Mike, Instruction Book and Circuit. Frequency Range 44.0 to 61 Mc/s. Range approximately 3 to 8 miles. Power requirements: Standard 120 v. H.T. and 2 v. L.T. Ideal for Civil Defence and communications.

BRAND NEW **45/-** P.P. 5/-.

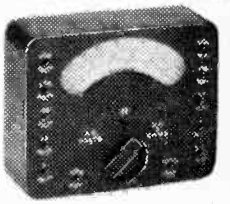
44-61 Mc/s calibrated wavemeter for same, 10/- extra.

TYPE 38 TRANSMITTER/RECEIVER

Complete with 5 valves. In new condition. These sets are sold without guarantee, but are serviceable.

7 to 9 Mc/s **22/6** P.P. 2/6.

Headphones **7/6** pair. Junction Box **2/6**. Throat Mike **4/6**. Canvas Bag **4/-**. Aerial Rod **2/6**.



AVO-MINOR

1,000 ohms/volt.
0-500 mA.
0-500 volts (A.C./D.C.).
0-20 K. Resistance.
Complete with leads, instructions and leather case.
Full Guarantee, **79/6**, p.p. 2/-.

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Opposite Edgware Road Tube Station. *PADdington* 1008/9.

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OPEN MONDAY to SAT. 9-6. THURS. 1 o'clock

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Practical Wireless

BLUEPRINT SERVICE

ALL OF these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, an asterisk in the list below 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 appeared. Thus PW refers to PRACTICAL WIRELESS; AW to *Amateur Wireless* and WM 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.

Title	*Number*	*Price*
CRYSTAL SETS		
Junior Crystal Set	PW94*	2/–
Dual-wave Crystal Diode ...	PW95*	2/6
STRAIGHT SETS		
Battery Operated		
Modern One-valver	PW96*	2/6
All-dry Three	PW97*	3/6
Modern Two-valver	PW98*	3/6
SUPERHETS		
Mains Operated		
A.C. Band-pass Three	PW99*	4/–
A.C. Coronet-4	PW100*	4/–
A.C./D.C. Coronet	PW101*	4/–
MISCELLANEOUS		
The PW 3-speed Autogram ...	—*	8/–
The PW Monophonic Electronic Organ	—	8/–
TELEVISION		
The PT Band III Convertor ...	—*	1/6

SPECIAL NOTE

THE following blueprints include some pre-war designs and are kept in circulation for those constructors who wish to make use of old components which they may have in their spares box. *The majority of the components for these receivers are no longer stocked by retailers.*

Title	*Number*	*Price*
A.C. Fury Four	PW20*	2/6
Experimenter's Short Wave ...	PW30a*	2/6
Midget Short Wave Two	PW38a*	2/6
Band-Spread Three (Battery) ...	PW68*	2/6
Crystal Receiver	PW71*	2/–
Signet Two (Battery)	PW76*	2/6
Simple S.W. One-valver	PW88*	2/6
Pyramid One-valver	PW93*	2/6
BBC Special One-valver	AW387*	2/6
Short-Wave Two	AW429*	2/6
Short-Wave World Beater ...	AW436*	3/6
Standard Four Valve S.W. ...	WM383*	3/6
Enthusiast's Power Amplifier ...	WM387*	3/6
Standard Four Valve	WM391*	3/6
Listener's 5-Watt Amplifier ...	WM392*	3/6
TELEVISION		
Argus Television Receiver ...	—*	3/–
Simplex Television Receiver ...	—*	3/6

QUERY COUPON

This coupon is available until 6th February, 1960 and must accompany all queries in accordance with the notice on our "Open to Discussion" page.

PRACTICAL WIRELESS, FEBRUARY, 1960

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 and Rhodesia: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage for one year: Inland £1.3.0. Abroad £1.1.6 (Canada 19s.). Registered at the General Post Office for the Canadian Magazine Post.

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NEW! The "CONTINENTAL—6" (SUPERSEDING THE TRANSISTOR—8)

COMBINED SIX TRANSISTOR PORTABLE/CAR RADIO

- ★ 400 mW Push-Pull Output.
- ★ Full Medium and Long Wave Tuning.
- ★ Slow-motion Drive.
- ★ XA102, 2-XA101, XB103, 2-Diodes, 2-XC101 Transistors.
- ★ Full A.V.C. and Car Radio.
- ★ Printed Circuit with all components marked.
- ★ Attractive Portable Cabinet.

(ALL COMPONENTS FOR THE TRANSISTOR-8 ARE STILL AVAILABLE.)

TOTAL COST OF ALL COMPONENTS INCLUDING CABINET, CAR RADIO, A.V.C., BATTERY, ETC.
£11.10.0 P.P. 3/6

ALL PARTS SOLD SEPARATELY. SEND FOR FREE DESCRIPTIVE LEAFLET AND PRICES.

Size 9½ x 7 x 3½in.
Weight 4 lbs.

A SIX TRANSISTOR PORTABLE/CAR RADIO OF THE LATEST DESIGN HAVING FANTASTIC SELECTIVITY AND SENSITIVITY ON MEDIUM AND LONG WAVEBANDS. HI-FI TYPE SPEAKER GIVING 400 mW OUTPUT. THE SET OPERATES EQUALLY WELL AS A CAR RADIO—IS EASY TO BUILD—HAS GOOD LOOKS—LOW RUNNING COSTS—EQUALS ANY COMMERCIAL RECEIVER IN THE 20-GN. CLASS.

MAJOR—2

(Two-transistor Pocket Radio)

- ★ 4-stage reflex!
- ★ Medium wave: tunable!
- ★ Very sensitive!
- ★ No aerial or earth!
- ★ Complete layout!
- ★ Over 6 months on one battery.
- ★ 4½ x 3 x 1¾in.
- ★ Weight only 4 ozs.
- ★ Personal 'phone.

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NEW EASY BOOKLET FREE: All components sold separately.

GOOD RECEPTION ANYWHERE!

RED-SPOT TRANSISTORS 5/- EACH

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MAJOR—3

(THREE TRANSISTOR POCKET RADIO)

(As Described in "R.C." Sept. '59)

- ★ 5-stage Reflex Circuit.
- ★ No Aerial or Earth.
- ★ Min. Volume Control.
- ★ 3 Ediswan Transistors.
- ★ Medium Wave Tuning.
- ★ Size 4½ x 3 x 1¾in.
- ★ Personal 'phone.

TOTAL COST **87/6** P.P. 1/6 NEW EASY BOOKLET FREE

FANTASTIC OUTPUT, TERRIFIC RECEPTION. GUARANTEED ANYWHERE

SUPER 6

SIX TRANSISTOR MEDIUM AND LONG WAVES

- ★ Plessey Printed Circuit.
- ★ Mullard Transistors.
- ★ 3-inch Sensitive Speaker.
- ★ Full Medium & Long Waves.
- ★ Size 7 x 4½ x 2in.

Recommended by us as being one of the easiest to build 6-Transistor printed circuit superhet receivers ever offered.

LIMITED QUANTITY ONLY. FREE LIST ON REQUEST

TOTAL COST OF ALL COMPONENTS, INCLUDING CABINET AND BATTERY.
£9.10.0 P.P. 2/6
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THE MINOR

★ 3 x 2 x ¾in. ★ Medium wave. ★ 3-stage reflex. ★ Internal aerial ★ Smallest yet.

TOTAL COST WITH CASE AND MINIATURE EAR-PIECE
All parts sold separately. Diagram and List Free. **49/6** P.P. 1/6

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1	RADIO CONTROL RECEIVER	50/-	1/-
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3	LIGHT OPERATED SWITCH	25/-	1/-
4	SQUARE WAVE GENERATOR	20/-	1/-
5	SIGNAL TRACER	37/6	1/6
6	HEARING AID AMPLIFIER	90/-	1/-
7	3-CHANNEL AUDIO MIXER...	42/6	1/-
8	AUDIO GENERATOR	25/-	1/-
9	ADDON AMPLIFIER	59/6	1/6
10	2 WATT POWER STAGE	52/6	2/-
11	BABY ALARM—100% SAFE	92/6	2/-
12	TOP BAND TRANSMITTER	57/6	1/6
13	3 TO 12 MC/S XTAL OSC.	22/6	1/-
14	35 METRE C.W. TRANSMITTER	27/6	1/-
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