AUGUST
1962

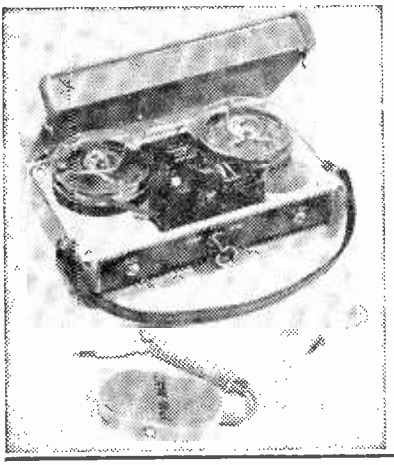
Practical WIRELESS

2/-

The *Atlantic* S.W. Two

The *Consort* T R F Receiver

NEW! Transistorised Tape Recorder



FOR ONLY **£6.19.6** P. & P. 4/-

Consists of three transistor amplifier, record/play, volume control, miniature speaker, forward-stop-rewind-switch, reel of tape and spare reel, motor, attractive coloured case, Mic. and earphone sockets, pick-up coil, mike, earphone and carrying handle supplied. Standard battery operated. Simple to put together in less than one hour. Brand new and guaranteed.

IN ECONOMICAL SEMI-ASSEMBLED KIT FORM

Save at least £4!

Results comparable with similar built-up recorders selling at around 12 gns.

Order Early—delivery in strict rotation. S.A.E. for more details.

RELDA METER SENSATION!!

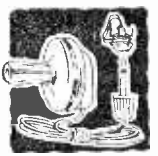
10,000 o.p.v. Multi-Tester in Semi-assembled KIT FORM

Only **69/6**

Ranges: D.C. Voltage: 0-6-30-120-600-1,200 v. (10,000 o.p.v.) A.C. Voltage: 0-6-30-120-600-1,200 (10,000 o.p.v.) D.C. Current: 0-120μA, 0-12-300 mA. Resistance: 0-20K, 0-2 Meg. (150 ohm, 15K at centre scale.) Capacitance: 0.005 to 15μF (at A.C. 6 v.). Decibels:—20 to +63db (600 ohms 1 mW., odbm—0.775 v.). Accuracy: D.C. voltage and current ±2% f.s. A.C. Voltage ±4% f.s. Resistance: ±3% of total scale length. Size: 4¼in. x 3¼in. Complete with test leads, battery and instructions.

Few only available—rush your order now whilst stocks last!

MINIATURE EARPHONE



A really sensitive dynamic earphone of exceptionally fine quality. Provides clear reproduction of music as well as speech. Fully Guaranteed and complete with transparent ear insert. 3 feet cord, subminiature plug and socket.

CR-5 High imp. crystal
MR-4 Low imp. magnetic

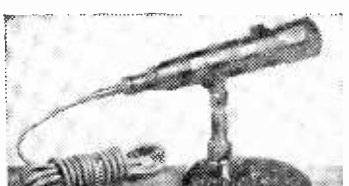
8/- Each Post 1/-

COMPLETE STOCK PURCHASED FROM BANKRUPT DISTRIBUTOR 'ANGEL' ALL-TRANSISTOR RADIO

These sets were originally marketed at £6/19/6, this great saving comes to you because of our bulk purchase. The Set will speak for itself—made in Japan, complete with telescopic antenna for really pulling in those stations, carrying case, dynamic earpiece, battery, beautiful presentation carton.

ONLY **89/6** P & P 2/6

3-WAY SLIM CRYSTAL MICROPHONE



MODEL 100C

May be hand-held, stand mounted (either floor stand or desk stand) or suspended by lavalier cord. Response 60-10,000 cps. Built in on/off switch. Output level—52db. Omni-directional head. Clips on or off standard stand adaptor permitting tilting for multi-angle use. Satin chrome finish. *Supplied complete with 7 ft. of shielded cable, lavalier cord.* Brand new Floor Stand and Base, suitable for above, 35/-. Carriage Paid.

ONLY **39/6**

GREATEST TRANSISTOR SET VALUE YET KNOWN

A 5 stage medium waveband radio which can be built in one hour. No aerial or earth required. This set has the appearance of sets worth 7 to 8 gns. and works as well as sets 4 times the price, remember the saving is not in the parts used but by you making it yourself. Complete in case. Size 5¼ x 3¼ x 1¼in., genuine 2¼in. speaker, tuning condenser, volume control with switch, etc. All parts sold separately.

37/6 P. & P. 2/6

WIRELESS SET No. 19

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, MCW, CW, R/T switch, Het-tone netting, off-on, Quench, aerial—AVC-LT-HT—Drive tests, Supplied complete with valves and instruction book.

SET ONLY 65/-
Carriage 10/-

LIMITED NUMBER ONLY
Don't be disappointed—Order Now

PORTABLE RADIO-PHONES

Consisting of trans-receiver covering 7.4-9 Mc/s. Range up to 6 miles, depending upon obstruction and elevation. On test the receiver astounded us for we heard 65 short wave stations—one as far away as Russia. Complete with 5 valves, headphones, microphone, junction box and 6ft. telescopic aerial. Operates from standard 120 v. and 3 v. dry batteries.

ONLY 60/- EACH
P. & P. 4/-
TWO FOR £6 post free
(Batteries 20/- per set extra.)

MAIL ORDERS TO
(DEPT. P.), 32a COPTIC STREET, LONDON, W.C.1

Relda Radio Ltd

CALLERS WELCOME AT
87 TOTTENHAM COURT ROAD, LONDON, W.1. MUS 9606

★ VALVES ★

by return of post

THE MOST COMPREHENSIVE COMPETITIVE VALVE LIST IN THE COUNTRY

10% DISCOUNT SPECIAL OFFER TO PURCHASERS of any SIX VALVES marked in black type (15% in dozen). Post: 1 valve, 6d., 2-11, 1/-.

NEW LOW PRICES GUARANTEED 3 MONTHS

FREE TRANSIT INSURANCE. All valves are new or of fully guaranteed ex-Government or ex-equipment origin. Satisfaction or Money back Guarantee on Goods if returned unused within 14 days.

OZ4	5/-	6J5GT	4/-	12K8GT	9/6	DF35	9/9	EM80	7/9	SP41	2/6
1A5GT	5/-	6J6	4/-	12Q7GT	5/-	DF91	8/6	EM81	8/6	SP61	2/6
1A7GT	11/-	6J7	8/6	128A7	7/-	DF96..	7/3	EM84	9/-	SU25	16/-
1C5GT	9/-	6J7G	4/9	128G7	5/-	DF97	8/6	EM85	10/-	SU2150	4/6
1D5	8/-	6J7GT	7/6	128H7	3/6	DH63	6/-	EN31	16/-	T41	7/6
1D6	9/9	6J8	9/6	128J7	5/6	DH76	5/-	EY51		TDD4	7/6
1H5GT	9/9	6K6GT	6/6	128K7	4/9	DK32	11/-	Small	7/9	U14	8/-
1L4	3/3	6K7	5/9	128N7GT	7/9	DK91	5/6	EZ35	7/6	U18	8/-
1LD5	3/6	6K7G	2/3	13D3	9/-	DK92	7/-	EZ80	5/6	U22	6/9
1LN5	4/9	6K7GT	4/6	1487	14/9	DK96	7/3	EZ35	6/6	U24	16/-
1N5GT	9/9	6K8GT	8/9	19AQ5	7/6	DL33	8/-	EZ41	7/-	U25	11/6
1R5	5/6	6K25	7/6	19BG6	19/-	DL35	9/-	EZ80	6/-	U26	9/9
1S4	8/-	6L1	12/6	20D1	9/6	DL65	6/-	EZ81	6/6	U31	7/-
1S5	4/6	6L6G	6/6	20F2	9/6	DL75	8/-	FW4/500	8/-	U33	14/-
1T4	3/6	6L18	9/-	20L1	16/-	DL92	9/-	FW4/800	8/-	U35	12/6
2A3	6/6	6L19	11/-	20P1	8/9	DL91	8/-	GT1C	7/-	U37	26/-
2A7	9/6	6LD3	8/-	20P3	12/6	DL92	6/-	GZ32	8/9	U50	5/9
3A4	4/9	6LD12	6/9	20P4	18/-	DL94	6/9	GZ34	12/6	U52	4/9
3A5	9/-	6LD20	7/9	20P5	15/-	DL96	7/3	HL41DD		U76	5/6
3D6	4/6	6N7	7/6	25A6G	8/-	EABC80	6/9		8/3	U78	5/-
3Q4	7/-	6P1	7/6	25L6G	6/9	EAC91	4/6	HN309	19/-	U191	12/6
3Q5GT	8/-	6P25	8/6	25L6GT	7/9	EAF42	8/-	HVR2	10/6	U281	9/6
3S4	6/-	6P28	12/6	25Y5G	8/-	EB41	7/-	IW4/350	7/6	U282	15/-
3V4	6/9	6Q7G	6/-	25Z4G	7/-	EB91	3/-	IW4/500	7/6	U301	15/-
5H4GY	12/6	6Q7GT	8/6	25Z5	8/-	EBC33	4/9	KLL32	8/6	U309	6/9
5T4	8/-	6R7G	8/6	25Z6G	8/-	EBC41	8/-	KT32	6/9	U329	6/9
5U4G	4/9	6SA7	5/6	30C1	7/-	EBC81	7/9	KT33C	4/6	U339	11/-
5V4G	7/9	6SG7	4/9	30C15	11/6	EBF80	7/9	KT36	12/6	U801	19/-
5Y3G	5/9	6SH7	3/-	30P5	6/-	EBF83	9/6	KT44	7/6	UABC80	8/-
5Y3GT	5/9	6SK7	5/-	30PL1	9/6	EBF89	8/6	KT45	8/6	UAF42	7/9
5Y4G	11/-	6SL7GT	5/9	30L1	6/9	EBL21	12/6	KT61	8/6	UB41	7/9
5Z4	11/-	6SN7GT	4/6	30L15	9/6	EBL31	17/6	KT63	5/9	UBC41	7/9
5Z4G	7/6	6SQ7	5/9	30P4	9/6	EC91	4/6	KT76	8/6	UBC81	9/6
5Z4GT	11/-	6S87	3/6	30P12	7/6	EC91	7/6	KTW61	5/9	UBF80	8/-
6/30L2	9/-	6U4GT	10/6	30P16	6/6	ECC32	4/-	KTW62	5/9	UBF89	7/6
6A8	4/9	6V6G	5/-	30P19	17/6	ECC33	4/6	KTW63	5/9	UBL21	14/6
6A7	10/-	6V6GT	6/-	30PL1	9/6	ECC34	9/-	KTZ63	5/6	UCC84	14/6
6A8G	9/6	6X2	7/9	30PL13	13/-	ECC35	6/-	L63	2/9	UCC85	7/-
6A8GT	12/6	6X4	5/-	35L6GT	8/6	ECC40	14/-	LN152	7/-	UCF80	15/-
6AB8	7/-	6X5G	5/-	35T	25/-	ECC81	5/6	MU14	7/6	UCH21	12/-
6AC7	3/3	6X5GT	5/6	35W4	6/9	ECC82	6/-	N37	11/-	UCH42	7/3
6AG5	8/-	6Y6G	7/6	35Z4GT	5/6	ECC83	6/6	N78	13/-	UCH81	8/-
6AG7	7/6	7A7	8/6	35Z5GT	8/-	ECC84	8/-	N108	16/-	UCL82	9/9
6AK5	5/-	7B6	9/-	41	7/6	ECC85	7/9	N152	8/6	UCL83	13/6
6AL5	3/-	7B7	7/9	42	7/6	ECC89	16/-	P41	4/6	UF41	7/6
6AM6	3/-	7C5	7/3	50C5	9/-	ECC91	4/-	P61	2/9	UF42	5/6
6AQ5	6/-	7C6	7/6	50CD6	19/-	ECF80	8/6	PABC80		UF80	7/-
6AT6	5/9	7H7	7/3	50L6GT	8/6	ECF82	8/6		11/6	UF85	7/6
6AU6	7/6	7K7	9/6	52KU	10/6	ECH21	12/6	PC84	6/9	UF86	14/6
6B7	8/6	7Q7	8/6	53KU	10/6	ECH35	7/6	PC85	8/9	UF89	7/-
6B8G	8/-	7R7	1/6	81SPT	11/-	ECH42	8/6	PC88	14/-	UL41	7/-
6BA6	5/9	787	9/-	62BT	13/6	ECH81	7/9	PC92	9/-	UL44	11/-
6BE8	5/9	7V7	7/9	75	6/6	ECH83	8/8	PCC189	13/6	UL84	9/9
6BG6G	15/-	7Y4	6/9	78	6/6	ECL80	6/-	PCF80	7/-	UL84	7/-
6BH6	6/-	7Z4	7/-	80	5/9	ECL82	9/6	PCF82	7/3	UM80	9/6
6BJ6	6/-	8D3	3/-	83	9/6	ECL83	11/7	PCF84	16/-	UR1C	8/-
6BR7	9/6	10C1	11/6	185BT	19/6	ECL86	10/6	PCF86	12/6	U116	12/6
6BW6	7/6	10C2	14/6	803	19/-	EF22	7/-	PCL82	7/3	UU7	9/6
6BW7	5/6	10C14	8/-	807(A)	5/6	EF36	3/3	PCL83	10/6	UU8	17/-
6BX6	4/9	10F1	5/9	808	7/6	EF39	4/6	PCL84	7/6	UY1N	11/-
6C4	3/6	10F9	10/6	813	55/-	EF40	12/-	PCL85	11/6	UY21	11/-
6C5	5/6	10F18	10/-	832	14/-	EF41	8/-	PCL86	12/6	UY41	6/-
6C6	3/9	10LD3	7/-	866A	11/6	EF42	7/6	PEN45	8/6	UY85	6/6
6C9	11/-	10LD13	7/9	954	2/-	EF50-BR	2/-	PEN46	5/-	VP41	5/6
6CD6G	19/6	10LD11	14/6	958	2/6	EF50	3/-	PL33	8/3	VR105	6/9
6CH6	7/6	10LD12	8/-	9001	4/-	EF54	3/3	PL36	9/6	VR150	6/9
6D2	3/-	10P13	11/-	9002	4/9	EF80	4/9	PL38	16/6	W61M	11/-
6D3	9/6	10P14	9/-	ATP4	2/9	EF85	6/6	PL81	8/6	W76	4/9
6D6	4/3	10P18	7/-	AZ31	8/-	EF86	9/-	PL82	6/6	W81	7/3
6F1	4/9	12A6	1/9	AZ41	11/-	EF89	6/9	PL83	6/6	X61M	11/-
6F6G	5/9	12AH8	9/-	B36	7/9	EF91	3/-	PL84	8/-	X63	8/6
6F12	3/-	12AT6	7/6	C1C	9/6	EF92	4/6	PL820	8/6	X65	11/-
6F13	6/9	12AT7	5/6	CBL1	26/6	EF98	3/-	PX4	12/6	X66	11/-
6F14	9/6	12AU6	9/6	CBL31	21/-	EF183	14/-	PX25	9/6	X76M	11/-
6F15	9/6	12AU7	6/-	CCH35	14/-	EF184	12/-	PY31	9/-	X78	21/-
6F16	8/-	12AX6	6/6	CL33	9/6	EL32	4/6	PY32	10/-	X79	16/6
6F19	6/6	12BA6	7/6	CY31	9/-	EL33	7/9	PY80	6/9	X81M	9/-
6F23	6/6	12BE6	7/6	D77	3/6	EL35	7/-	PY81	6/6	Y63	6/3
6F24	12/-	12BH7	9/9	D152	5/9	EL41	8/-	PY82	6/-	Z63	4/9
6F25	13/-	12C8	6/6	DA30	12/6	EL42	8/9	PY83	7/-	Z66	9/6
6F32	6/6	12E1	17/6	DAC32	9/9	EL81	11/-	PY88	9/9	Z152	4/9
6F33	6/6	12J7GT	9/-	DAF91	4/6	EL83	11/-	PZ30	9/6	Z719	4/9
6J5	4/3	12K7GT	4/9	DAF96	7/3	EL84	7/-	R18	11/-	ZD152	7/9
6J5G	3/-	12K8	11/-	DET19	2/9	EL91	4/-	R19	11/-		

Post: 2 lbs. 2/-, 4 lbs. 2/6, 7 lbs. 3/6, 15 lbs. 5/- etc. No C.O.D. ALL ITEMS LESS 5% AND POST FREE IN DOZENS. LIST OF 1000 SNIPS, 6d

Tubes

Carr. & Ins. 12/6.

HIGHEST QUALITY— COMPARE OUR PRICES

MOST MULLARD, MAZDA, COSSOR, EMITRON, EMISCOPE, BRIMAR, FERRANTI TYPES. PROCESSED IN OUR OWN FACTORY

	GUARANTEED 6 Months	GUARANTEED 12 Months	NEW TYPES
12in.	£2. 0.0	£3. 5.0	MW 31/74 £4-0-0
14in.	£2.10.0	£3.15.0	MW 36/24 £5-0-0
15/17in.	£3. 5.0	£4.10.0	CRM 172 MW 43/64 £6-0-0
21in.	£3.15.0	£5.15.0	

SPECIAL TEMPORARY OFFER. Due to huge Bulk Special Purchase we are offering MW 31/74 Tubes at the unrepeatable price of 29/-, MW 36/24 ditto, 30/-. P.P. 12/6. The above are guaranteed for 6 months.

RECORDERS. "Verdik" 4 Track Collaro 3 Speed Transcription Deck. Superior reproduction, Streamlined Portable Case. Complete with Mike. Market value approx. £45. OUR SPECIAL PRICE 29 gns.

CO-AX. standard and low loss, 25 yds., 12/6, 50 yds., 22/6; 100 yds. 42/6, Co-ax Plugs 1/3. Wall outlet boxes 3/6

4-SPEED RECORD PLAYERS. Latest Turntable, together with lightweight Staar Galaxy dual sapphire crystal turnover pick-up head. Amazing value (pick-up only 19/-). £3.10.0. Carr. 3/-.

PORTABLE RECORD PLAYERS. Takes all sizes Records, all speeds, amplifier, auto-changer, Garrard new "Slimline" Gram. In two-tone Case. All absolutely new. 14 gns.

MIRROR GALVANOMETERS. Evershed and Vignoles, 45 second swing, high sensitivity, heavy gunmetal cases, with spares, in transit case, unused. £3.10.0.

P.M. SPEAKERS. 3 ohm, top makes. Performance guaranteed. 6½in., 8in., 8/-, 5in. 7 x 4in., 11/-.

13 CHANNEL T.V.s

Table Models, Famous Makes. Absolutely Complete. These sets are unequalled in value due to huge purchase direct from source. They are untested, and not guaranteed to be in working order. Carr. etc., 15/-.

12in. **£2.19.0** 14in. **£4.19.0**

TRANSISTOR PORTABLES. 6 + diode lightweight, approx. 1lb., slightly larger than pocket set, but much greater volume, better quality, complete battery, amazing sensitivity worth £11. Our price only £7.10.0.

F.M. TUNER KITS. Well-known make. Comprising F.M. Tuning Head, guaranteed none drift. Frequency coverage 88-100 mc/s. OA81 balanced diode output, Magic Eye Tuning, Two I.F. Stages and discriminator, £6.9.6.

P.V.C. CONNECTING WIRE. 100 yds., 30 mil: Special Price 7/6, 200 yds. 30 mil: special price, 12/6. 25ft. Coil, 1/-, 5 Coils different colours, 4/-. Connecting flex. Prices as above.

TRANSISTORS. Red spot 3/6 ea. White Spot 4/6 ea. Yellow spot 2/9 ea. Germanium diodes 9d. ea., 8/- doz. **TAG STRIPS.** From 3 way to 12 way. Mixed parcels of 25—3/9. The best and cheapest way to buy!

4½ watt AMPLIFIERS Further delivery of these excellent units to hand complete with 6F8 amplifier, 20P3 output, and UU9 rectifier. Easily converted into high gain unit, complete with good quality, 8in. speaker in attractive two tone bakelite case easily converted for guitars, record players, baby alarms, mic. amplifiers. 19/- Carr. Packing, etc. 7/6.

ASSAULT CABLE. 1,000 yds. Covered Steel Telephone Wire. Ideal for gardening. 9/-. P.P. 4/-.

AVO MODEL 40. Universal Standard test meter, limited quantity. £8.10.0.

12 VOLT Blowers, ex-Gov., 19/6.

VOLUME CONTROLS. 5K to 2 Meg: from 3/3 to 5/9 each.

TRANSISTOR INTERCOM, High sensitivity, complete with batteries, usually £9. DISCOUNT PRICE £7.15.0.

B.B.C./I.T.A. TUNERS

Famous makes complete with PCF80, PCC84 valves. 38 M/c I.F.

Fantastic value **19/-**

CONDENSERS. 25 Mixed, Electrolytic. Many popular sizes. List Value £5. Our Price 10/-.

GET 15, G.E.C. High Power, Contact cooled, manufacture matched pr Transistor with Push-Pull Input & Output Transformers. Knock out price 29/-.

NEW SPEAKER CABINETS, covered in attractive Rexine, Gold Metal front 11/-. Or complete with 7 x 4 Speaker, 19/-. P.P. 1/6.

UA20 Autochangers. Latest B.S.R. 10 mixed records. Brand New. Unrepeatable, £6.19.0. Also UA14. A Proven Choice £7.19.0 P.P. 4/-.

"GARRARD" Slimline. Very latest Compact Autochanger. Just released. Amazing value, £6.19.0. Also available, Garrard Model 209, £9.17.6. P.P. 4/-.

100 RESISTORS 6/6

100 CONDENSERS 10/- Miniature Ceramic and Silver Mica Condensers 3 pF to 5,000 pF. LIST VALUE OVER £5.

IVORY/GOLD KNOBS 1" Diameter, half price 1/2, 5 for 4/6: 1½" 1/3. 5 for 5/-.

VALVE HOLDERS. B7G, 6d. ea., with Screen 8d. ea. B9A, 6d. ea. with Screen 8d. ea.

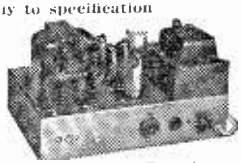
TECHNICAL TRADING CO.

RETAIL SHOP
350-352 FRATTON ROAD, PORTSMOUTH
MAIL ORDER ONLY **DEVONIAN COURT, PARK CRESCENT PLACE, BRIGHTON 7, SUSSEX**

STERN'S MULLARD DESIGNS

Designed by MULLARD—presented by STERN'S strictly to specification

MULLARD "5-10" MAIN AMPLIFIER



For use with the MULLARD 5-valve pre-amplifier with which undistorted power output of up to 10 watts is obtained. We supply **SPECIFIED COMPONENTS AND NEW MULLARD VALVES**, including **PARMEKO MAINS TRANSFORMER** and choice of the latest Ultra-Linear **PARMEKO** or the **PARTRIDGE** Output Transformer.

COMPLETE KIT OF PARTS (**PARMEKO** Output Trans.). **£10.0.0**

Alternatively we supply **ASSEMBLED and TESTED.** **£11.10.0** Incorporating Partridge Output Transformer £1.6.0 extra.

MULLARD'S PREAMPLIFIER TONE CONTROL UNIT

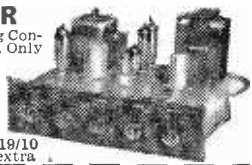
Employing two EF86 valves, and designed to operate with the MULLARD **MAIN AMPLIFIERS**, but also perfectly suitable for other makes.

PRICE COMPLETE KIT OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£8.0.0**

Supplied strictly to **MULLARD'S SPECIFICATION** and incorporating:

- 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.

THE MULLARD "510/RC" AMPLIFIER

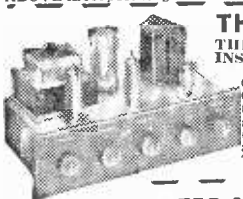


The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Only Specified Components and new **MULLARD VALVES** are supplied including **PARMEKO MAINS TRANSFORMERS** and choice of the latest **PARMEKO** or **PARTRIDGE** ULTRA-Linear Output Transformers.

KIT OF PARTS **£11.10.0** OR ASSEMBLED and TESTED **£13.10.0**

H.P. Dep. £2.6.0, 12 months at 17/0. Dep. £2.14.0 12 months at 19/10 ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra

THE MULLARD "33/RC"

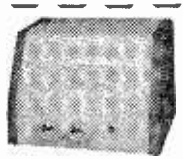


THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION PROVIDING EXCELLENT REPRODUCTION OF UP TO 3 WATTS OUTPUT

COMPLETE KIT OF PARTS **£7.10.0** OR ASSEMBLED and TESTED **£8.19.6**

(plus 6/6 carriage and insurance) H.P. Terms: Deposit £2.0.0 and 8 months at £1.0.0. Complete to MULLARD'S SPECIFICATION including Mullard valves and a **PARMEKO OUTPUT TRANSFORMER.**

STERN'S INTER-COMM BABY ALARM



A small versatile Unit employing the new MULLARD ECL86 valve and designed to provide two (or three) way conversation up to extreme distances. Operates from A.C. mains 200 to 250 Volts.

PRICES . . . MASTER UNIT and ONE EXTENSION

KIT OF PARTS **£6.17.6** ASSEMBLED AND TESTED **£8.0.0**

Consists of a MASTER UNIT, size only 8¼ x 5¼ x 6in. and ONE EXTENSION (a second extension may be added to any time). The Master Unit incorporates switching and power supply and with the chassis completely isolated from the mains is operated in absolute safety. Cases covered in quality leatherette.

A BULK PURCHASE OF MARCONIPHONE TAPE RECORDING EQUIPMENT ENABLES US TO OFFER THE MODEL MTR/1 PORTABLE TAPE RECORDER

FOR ONLY **£26.0.0** (Carr. & Ins. 10/- extra)

Deposit £5.4.0, 12 months of £1.18.2. The list price of the MTR/1 is £44.2.0. It is a 3-Speed Twin Track Recorder incorporating the latest Collaro "Studio" Tape Deck and operates at 1⅞, 3¾ and 7½in./sec. Speeds. It incorporates a "Pause" Control, a safety interlock device which ensures that a recorded tape cannot be accidentally erased and a low level output socket so that the output may be fed into an external high fidelity amplifier for monitoring purposes or for high quality reproduction on playback.

PRICE REDUCTIONS

(a) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-valve PRE-AMP CONTROL UNIT H.P. Dep. £3.7.0 and 12 months at £1.2.9..... **£15.15.0**

(b) The "5-10" and the 2-stage PRE-AMP both ASSEMBLED and TESTED H.P. Dep. £3.16.0 and 12 months of £1.7.8..... **£18.18.0**

With Partridge O/put Transformer £1.6.0 extra.

RECORD PLAYERS

The Latest Models are in stock many at reduced prices. Send S.A.E. For Illustrated Leaflet.

THE NEW GARRARD "AUTOSLIM" 4-speed Autochanger with Crystal Pick-up **£8.10.0**

COLLARO "JUNIOR" 4 SPEED SINGLE RECORD PLAYER with separate Crystal Pick-up Carriage and Insurance 5/-. Above Pick-up separately for £1.6.6. **£3.15.0**

The **NEW COLLARO C60** 4-speed Autochanger unit with Studio "O" Pick-up..... **£7.19.6**

The **E.M.I.** 4-speed Single Record Player with Crystal Pick-up **£6.9.6**

B.S.R. MODEL UA14. A 4-speed mixer Autochanger with Crystal Pick-up **£7.19.6**

Available incorporating the **B.S.R. STEREO Pick-up**, plays L.P. and 78 Records..... **£8.13.10**

GARRARD MODEL TA/MK.II 4-speed Player fitted high output Crystal Pick-up.. **£8.10.0**

GARRARD MODEL RC210. Autochanger 4-speeds. High output. Crystal Pick-up... **£9.19.6**

Carriage and Insurance on each above 5/- extra.

SPECIAL CASH 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.

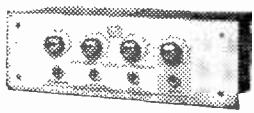
WE ALSO SUPPLY SEPARATELY

(a) The 2-stage (plus Rectifier) **AMPLIFIER** **£4.2.6**

(b) The **PORTABLE CARRYING CASE** **£3.17.6**

(c) 6in. **P.M. SPEAKER** 18/6. Carriage and Insurance 4/- extra.

MULLARD FOUR CHANNEL MIXER UNIT



Self powered with Cathode follower output. Incorporates Two inputs for MICROPHONES One for CRYSTAL PICK UP and a fourth for RADIO or TAPE

Complete Kit of Parts **£8.8.0**

Assembled and Tested **£10.0.0**

TERMS: Deposit £2 and 12 months at 15/-.

Alternatively Model L.L. provides for one microphone Input matched for moving coil or Ribbon Mike. **£1.17.0** extra.

The TOHPHONIC

TRANSISTOR BATTERY OPERATED INTERCOM

89/6 P. & P. 4/-.

Including PP3 battery and 25 yards lead with plugs. A completely Portable Intercom with 101 uses being ideally suitable for the office or even as a Baby Alarm, since being battery operated, it is completely safe. Two-way calling system and volume on/off switch, the units are housed in attractive plastic cabinets (black/white) with chrome stands. It is extremely economical operating on one 9-volt battery, replacement price being 2/6"

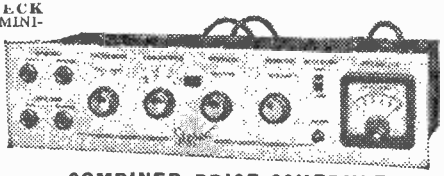
STERN RADIO 109, FLEET ST., TELEPHONE FLEET ST. 5812-3 LONDON, E.C.4. **PREMIER RADIO** 23, TOTTENHAM COURT RD., LONDON W.1. TELEPHONE MUSEUM 3451

MAIL ORDERS and all POSTAL ENQUIRIES to 7-9 TUDOR PLACE, TOTTENHAM COURT RD., LONDON, W.1. MUSEUM 4128/9

Stereophonic Sound by Stern's

THE "STP-1" STEREO TAPE PREAMPLIFIER

- BRENELL Mk. V TAPE DECK incorporating similar ¼-TRACK MINI-FLUX TAPE HEADS.
- PUSH PULL OSCILLATOR CIRCUIT
- 4-SPEED EQUALISATION
- FERROXCUBE OSCILLATOR TRANSFORMER
- SENSITIVE METER FOR SIGNAL LEVEL
- SEPARATE GAIN CONTROLS IN EACH CHANNEL
- MULLARD VALVES INCORPORATED



COMBINED PRICE SCHEDULE

DESIGNED TO OPERATE WITH

COLLARO "STUDIO" TAPE DECK incorporating the latest ¼-TRACK REUTER TAPE HEADS.
OVERALL SIZE CASE 13¼ x 8in. FRONT PANEL (Choice of Black or White) 14 x 3¼in.

PRICE

28.0.0

Including separate Power Supply Unit.
Deposit £5.12.0, 12 months at £2.1.0.

THE "STP-1" PREAMPLIFIER is offered

WITH TAPE DECKS AS FOLLOWS:

- BRENELL Mk. V ¼-TRACK MODEL..... **£67.0.0**
  Deposit £13.8.0, 12 months at £4.18.5.
- COLLARO "STUDIO" ¼-TRACK MODEL..... **£45.0.0**
  Deposit £9.0.0, 12 months at £3.6.3.

STEREOPHONIC RECORD PLAYER UNITS ARE AVAILABLE FROM STOCK

THE MULLARD "10+10" STEREO AMPLIFIER

(described below) with the "STP-1" PREAMPLIFIER and one of the TAPE DECKS provide a COMPLETE STEREOPHONIC INSTALLATION. *WE OFFER*.. The "10+10", the "STT-1" and the

- (a) BRENELL Mk.V ¼-TRACK DECK **£87.0.0**
  Deposit £17.8.0, 12 months at £6.7.8.
- (b) COLLARO "STUDIO" ¼-TRACK DECK..... **£65.0.0**
  Deposit £12.12.0, 12 months at £4.16.0.

Please enclose S.A.E. with all enquiries.

MULLARDS "10 PLUS 10" STEREO AMPLIFIER

A high fidelity design based on the famous Mullard "5-10". Provides up to 10 watts (per channel) Superb reproduction. Frequency response flat to within 3 db from c/s. to 60 Kc/s at 50 Mw. Total Harmonic Distortion at 10 watts 0.1%.

(a) ASSEMBLED COMPLETE AMPLIFIER, including CONTROL UNIT (as Illustrated)..... **£21.0.0**
Deposit £4.4.0, 12 months at £1.10.10.

(b) A complete KIT of PARTS..... **£18.10.0**
Deposit £3.14.0, 12 months at £1.7.2.

We also supply the assembled MAIN AMPLIFIER only (excludes control unit) for operation with our DUAL CHANNEL PREAMPLIFIER, this provides for a more versatile or elaborate installation and would be essential if a low output Magnetic Pick-Up, such as the Decca, is to be used.

(a) THE ASSEMBLED MAIN AMPLIFIER with the ASSEMBLED DUAL CHANNEL PREAMPLIFIER **£30.0.0**
Deposit £6.0.0. 12 months at £2.4.0.

(b) A complete KIT of PARTS for both Units **£26.0.0**
Deposit £5.4.0. 12 months at £1.13.6.

Illustrated and Descriptive Brochure available. Please enclose S.A.E.

DUAL CHANNEL PREAMPLIFIER

Incorporates two Mullard 2-valve Preamplifiers 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**
H.P. £3.10.0 & 12 mths. at 18/4.

ASSEMBLED AND TESTED **£15.0.0**
H.P. £3.0.0 & 12 mths. at £1.2.0

STEREO "TWIN THREE" AMPLIFIER with specially designed PORTABLE CASE

A most compact portable design consisting of TWIN CHANNEL AMPLIFIER based on the latest design by MULLARD LTD., incorporating top grade Output Transformers, and the new audio Triode-Pentode Valves Mullard E.C.L.86. Separate Bass and Treble controls. Suitable for use with Crystal Pick Ups, and capable of genuine high quality reproduction up to 3 watts per channel. An attractive and contemporary portable case in two tone colours. The unique feature of the design is the loudspeaker mounting. Two 8 x 5in. p.m. elliptical loudspeakers are separately baffled and mounted in the lid, which is detachable, allowing for each speaker to be individually positioned.

PRICE for the ASSEMBLED AMPLIFIER, Two 8 x 5in. ROLA SPEAKERS and PORTABLE CASE **£14.0.0**
Deposit £2.16.0, 12 months at £1.0.6.

"TWIN-THREE" Assembled and Tested..... **£7.15.0**

8 x 5in. ROLA LOUDSPEAKERS (3 ohms) each. **£1.1.0**

PORTABLE CASE..... **£5.0.0**

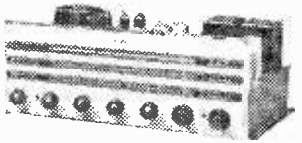
A CHOICE OF SINGLE RECORD PLAYERS and AUTOCHANGERS is available from Stock (Send S.A.E. for details)

ARMSTRONG RADIOGRAM CHASSIS

FULL RANGE IN STOCK, please enclose S.A.E. for leaflets.

STEREO 12 Mk. 2 £43.10.0

(ILLUSTRATED)



Deposit £3.14.0, 12 months at £3.3.10.

The most complete chassis ever produced, combines AM and FM Tuners, a Stereo Control Unit and two High Fidelity Amplifiers in one compact unit, provide a total of 16 watts for both mono and stereo. Other features include: inputs for tape recording, play back, pick-ups and stereo radio (s. could this come about); separate wide range bass and treble controls and balance control.

STEREO 55 £32.15.0

Deposit £6.15.0
12 months at £2.7.8

A junior version of the Stereo 12 Mk. 2 providing ten watts output, five watts from each amplifier and covering the VHF and Medium wavebands.

JUBILEE Mk.2 £30.12.0

Deposit £6.4.0
12 months at £2.4.9

A Hi-Fi mono chassis giving eight watts push-pull output and covering VHF, medium and long bands. Tape recording and play back inputs.

AF208 £22.18.0

Deposit £4.18.0
12 months at £1.13.0

An AM/FM chassis providing 5 watts output and covering the full VHF and medium wavebands. Tape recording and playback inputs.

TVB VHF TUNER £21.18.0

Deposit £4.14.0
12 months at £1.11.7

A self-powered high-fidelity tuner of outstanding design, incorporating features which are normally found only in the most expensive tuners. The full VHF band (87–100 M/cs) is covered and a matching output control enables the output to be varied between 0 and 500 mV.

BRAND NEW!—ROLA CELESTION

6in. x 4in. P.M. Loudspeaker, 3 ohm. V/Coil.....18/6
7in. x 5in. P.M. Loudspeaker, 3 ohm. V/Coil.....£1.1.0
10in. x 6in. P.M. Loudspeaker, 3 ohm. V/Coil.....£1.10.0
6½in. dia. P.M. Loudspeaker, 3 ohm. V/Coil.....18/6
10in. dia. P.M. Loudspeaker, 3 ohm. V/Coil.....£1.7.6

Please enclose extra 1/- to cover postage.

AN ATTRACTIVE **CORNER FITTING CASE** for the 6in. x 4in. and 10in. x 6in. LOUDSPEAKER is AVAILABLE for.....£2.10.0
(Size 20in. high × 10in. × 7in. deep).

Please enclose S.A.E. with all Enquiries.

STERN RADIO
PREMIER RADIO
MAIL ORDERS and all POSTAL ENQUIRIES to

BUILD A HIGH QUALITY TAPE RECORDER LIKE THIS FOR £35.0.0

FOR THIS WE SUPPLY

★ Complete Kit of Parts to Build the HF/TR3 Tape Amplifier.
★ Rola/Celestion 10 x 6in. p.m. Loudspeaker.
★ The New Collaro "Studio" Tape Deck.
★ ACOS Crystal Microphone and 1,200ft. Spool Tape.
★ Portable Carrying Case (as illustrated).

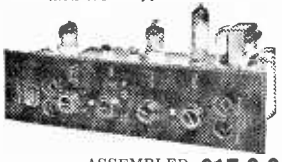
Deposit £7.0.0 and 12 months at £2.11.4

ALTERNATIVELY WE SUPPLY THE COMPLETELY ASSEMBLED and GUARANTEED TAPE RECORDER FOR £39.10.0

H.P. Terms: Deposit £7.18.0 and 12 months of £2.17.11.

HF/TR3 MKII TAPE AMPLIFIER

(Mullard Type "A" design)



A very high quality Amplifier incorporating 3-speed treble equalisation, by the latest FEROXCUBE POT CORE INDUCTOR. FOR COLLARO-TRUVOX-BRENELL WEARITE Tape Decks, has GILSEN Output Transformer. Includes separate Power Supply Unit.

KIT OF PARTS **£13.13.0** Deposit £2.15.0 12 months at £1.0.0.

ASSEMBLED and TESTED **£17.0.0** Deposit £3.8.0. 12 months at £1.4.11.

SPECIAL "COMBINED ORDER" PRICES

For Constructors with their own cabinet—WE OFFER—

(a) COMPLETE KIT to build the HF/TR3 Amplifier together with the COLLARO "STUDIO" DECK **£26.0.0**
Deposit £5.4.0. 12 monthly payments of £1.18.2

(b) As above but with the HF/TR3 supplied ASSEMBLED and TESTED **£29.10.0**
Deposit £5.18.0. 12 monthly payments of £2.3.4

(c) COMPLETE KIT to build the HF/TR3 AMPLIFIER with the BRENELL Mk. V TAPE DECK.... **£42.0.0**
Deposit £8.8.0. 12 monthly payments of £3.1.7.

(d) As above but with HF/TR3 supplied ASSEMBLED and TESTED **£45.10.0**
Deposit £9.2.0. 12 monthly payments of £3.6.9

(e) THE ASSEMBLED AND TESTED HF/TR3 AMPLIFIER with the WEARITE MODEL 4A DECK, incorporates Wearite Head Lift Transformer etc. **£60.10.0**
Deposit £12.12.0. 12 monthly payments of £4.8.9.

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

The MODEL HFG/2R PORTABLE TAPE RECORDER

(Original Price £33.0.0)

FOR ONLY 22 gns.

H.P.Dep.£4.14.0.12months£1.13.9

Crystal Microphone £1.0.0 extra. *(Carr. and Ins. 10/- extra).* Incorporates THE LATEST GARRARD "MAGAZINE" TAPE DECK and a HIGH QUALITY AMPLIFIER which is entirely based on the very successful MULLARD TYPE "A" DESIGN and specifically developed to operate the CARRARD DECK. Price INCLUDES SUPPLY OF THE GARRARD TAPE MAGAZINE and 4in. SPOOL OF DOUBLE PLAY TAPE. Comprises a Twin Track Recorder operating at 3¾in/sec. speed and providing up to 1 hour 10 mins. playing time. Truly "Portable", weighs only 22 lbs. Outstanding features are excellent performance and simplicity of operation

THE TRUVOX "SERIES 80" TAPE EQUIPMENT

MODEL D82 TAPE DECK — Incorporating **Twin Track Heads.** Deposit £5.5, 12 months of £1.18.7 **£26.5.0**

MODEL D84 TAPE DECK — With **Four Track Heads** and Track Switch for **Mono/Stereo** operation. Deposit £6, 12 months of £2.2.11. **£29.8.0**

MODEL PD82 — Complete **Twin Track** Mono Recorder-Preamplifier Unit. Deposit £8.8, 12 months of £3.1.7. **£42.0.0**

MODEL PD84 — Complete **Four Track** Mono Recorder-Preamplifier Unit incorporating outlets for **Stereo** reproduction. Deposit £9.4, 12 months of £3.7.6. **£46.0.0**

The PD82 and 84 comprise two self-contained units to add full tape facilities to existing sound reproducing installations (Hi-Fi equipment, radiograms, record reproducers, or good radio receivers)

DESCRIPTIVE LEAFLETS READILY AVAILABLE

109, FLEET ST., LONDON, E.C.4.
TELEPHONE FLEET ST., 5812-3

23, TOTTENHAM COURT RD., LONDON W.1.
TELEPHONE MUSEUM 3451

7-9 TUDOR PLACE, TOTTENHAM COURT RD., LONDON, W.1. TELEPHONE MUSEUM 6120/9

ADD "HI-FI" TAPE RECORDING TO YOUR EXISTING AUDIO INSTALLATION WITH

MULLARD TYPE "C" TAPE PRE-AMPLIFIER—ERASE UNIT

The "Hi-Fi" link to add full tape recording facilities to High Fidelity home installations. Incorporates FEROXCUBE POT CORE PUSH PULL OSCILLATOR and 3-speed treble equalisation by FEROXCUBE POT CORE INDUCTOR FOR WEARITE-COLLARO-TRUVOX OR BRENELL TAPE DECKS. Includes separate power Supply Unit.

KIT OF PARTS **£14.0.0** Deposit £2.16.0, 12 mths. at £1.0.6

OR ASSEMBLED **£17.0.0** Deposit £3.8.0 12 months at £1.4.11

(Excluding power unit £11.15.0 and £14.10.0 respectively.)

(a) The COLLARO "Studio" Deck with the Model "C" Preamplifier and POWER SUPPLY UNIT ASSEMBLED AND TESTED..... **£29.10.0**
Deposit £5.18.0. 12 monthly payments of £2.3.3

(b) As above but the TYPE "C" Unit and POWER UNIT supplied as COMPLETE KIT OF PARTS **£26.10.0**
Deposit £5.6.0. 12 monthly payments of £1.18.10

(c) The BRENELL Mk. V Deck with the Model "C" PREAMPLIFIER and POWER UNIT. ASSEMBLED and TESTED **£46.0.0**
Deposit £9.4.0 and 12 months at £3.7.6

(d) As above but the Model "C" PREAMPLIFIER and POWER UNIT supplied as a COMPLETE KIT OF PARTS **£43.0.0**
Deposit £8.12.0. 12 monthly payments of £3.3.1

(e) The WEARITE MODEL "4" DECK with ASSEMBLED and TESTED Model "C" PREAMPLIFIER and POWER UNIT incorporating WEARITE HEAD LIFT TRANSFORMER, Etc. **£60.10.0**
Deposit £12.2.0 and 12 months at £4.8.9

(Carriage and Insurance on above is 10/- extra.)

THE 'ADD-A-DECK'

Incorporating

GARRARD TAPE DECK and MODEL HF/G2P PRE-AMPLIFIER

Supplied on ONE CHASSIS (as illustrated) READY FOR USE **18 Gns.**

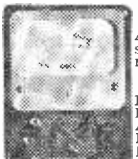
(Carr. & Ins. 10/- extra.)

Price includes Garrard Magazine and a 4 in. Spool Double Play Tape

H.P. Deposit £3.16.0. and 12 months of £1.7.8.

Provides complete tape recording facilities and designed to operate through the pick-up sockets of the standard type of RADIO RECEIVER, or an AMPLIFIER, from which really first class reproduction is obtained. It consists of a Twin Track Deck connected up to the Pre-amplifier and operates at 3¾in/sec. speed providing up to 1hr. 10 mins. playing time.

THE JEMCO MODEL MT-955 MULTIMETER



50,000 ohms per volt — D.C.
5,000 ohms .. .. A.C.

A truly efficient Meter for the amateur or professional man, having features found normally in more expensive Meters. Ranges:

D.C. volts 2.5–10–50–250–1.K
A.C. .. 2.5–10–50–250–1.K

D.C. Current 100μA–10mA–100mA–500mA 10 amps
Resistance 4 Ranges up to 20 meg.
Add D.B. 0–46 Size 7 x 5¼ x 3in.

PRICE, including Full Test Lead Kit ..... **£12.19.6** p. & p. 4/-

! SPECIAL OFFER !

WE HAVE A LIMITED QUANTITY of HMV Model 544 STEREO AMPLIFIERS and OFFER THEM FOR

£18.18.0 Deposit £3.16.0. 12 mths. £1.7.8.

LIST PRICE £27.6.0.

Size 11½ x 10 x 4in. high.

A complete Stereo Amplifier incorporating All Controls. Suitable for Crystal or Ceramic Stereo Pick Ups producing 4 watts peak output per channel from input of 200 m/Volts. Operates with 15 ohm Loudspeakers and has power available for Radio Tuner.

AUDIOTRINE HI-FI TAPE RECORDER KIT

REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN AN HOUR

The Recorder incorporates the latest Collaro Studio Tape Transcriptor. The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best quality Tape and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 14½ x 15 x 8½in. high, and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflet.

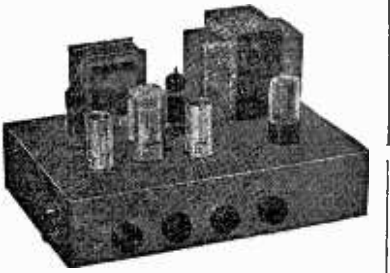
25½ GNS. Carr. 17/6

ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

H.P. TERMS. Deposit £2.13.9 and 12 monthly payments of **44/-**. Cash price if settled in 3 months.

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP STAGES



Two input sockets with associated controls allow mixing of "mike" and gram, as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, 5Y3. 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 D.B. 30-30,000 c/s. Six negative feedback loops. Hum level 60 D.B. down. ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For **STANDARD** or **LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS,** etc. **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/- (Or factory built 51/- extra).

If required louvred metal cover with 2 carrying handles can be supplied for 18/9. **TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9, and 9 monthly payments of 24/9.** Send S.A.E. for illustrated leaflet detailing Ready-to-assemble Cabinets. Speakers. Microphones, etc., with cash and credit terms.

R.S.C. STEREO/TEN HIGH QUALITY AMPLIFIER

A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts, suitable for all crystal stereo heads. Ganged Bass and Treble Control give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83 ECC83, EL84, EL84, EZ81. Outputs for 2-3 ohm speakers. Point-to-Point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. **8 Gns.** Full constructional details and price list 2/6. Carr. 10/-. Kit can be assembled, ready for use, 59/6 extra.

BRADMATIC RECORDING HEADS. High Impedance Record/Playback 22/-. Low Impedance Erase. **12/6.**

PICK-UP ARMS. Complete with latest Acos/hi-fi Turnover head and rest. Only **29/11.**

CRYSTAL MICROPHONES. Hand type NP110 **14/9,** R.T.C. **19/9,** Acos Mic 40 **25/9.** Acos Mic 45 **29/9,** Stick type Acos 39-1 **39/9,** BM3 with neck band and heavy table stand **59/9.** Lapel type **35/9.**

COLLARO JUNIOR 4-speed Single Player Unit and Crystal Pick-up with hi-fi Turnover head. Only **£3.19.6.**

COLLARO CONQUEST 4-SPEED AUTO-CHANGER, with high fidelity Studio pick-up. Latest model. For 200-250 v. 50 c.p.s. A.C. mains. Our price **£6.19.6.** Carr. 5/6.

COLLARO RC 457 4-SPEED MIXER AUTO-CHANGERS. Turnover Studio Pick-up head, for 200-250 v. A.C. **£7.19.6.** Carr. 4/6.

B.S.R. UA8 4-speed AUTO-CHANGERS with hi-fi turnover head. **£6.19.9.** Carr. 4/6.

GL3A 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. A.C. mains. Size 11¼ x 2½ x 2¼in. Controls: Vol. and Tone with switch. Only **59/9.**

R.S.C. BATTERY CHARGING EQUIPMENT

All for A.C. Mains 200-250v., 50ccs Guaranteed 12 months.

HEAVY DUTY CHARGER KIT 6/12 v. 6 amps. variable output. Consisting of Mains Transformer 0-200-230-250 v.: F.W. (Bridge) Selenium Rectifier: Ammeter. Variable Charge Rate Selector Panels. Plugs, Fuses, Fuseholder and circuit, **59/9.** Carr. 4/6.

PARMEKO POTTED CHOKES

200 mA. 12 H 100 ohms	16/9
120 mA. 30 H 200 ohms	16/9
120 mA. 8 H 10 ohms	13/9

SOLDERING IRONS. 230-250 v. 30 watts. First quality. For Radio work, **19/9.** Spare elements and bits available.

Assembled 6/12v. 4-5 amps. Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finished. Fused and ready for **69/9** use with Carr. 5/- mains and output leads. Terms: Deposit 13/3 and 5 monthly payments 13/3. 6/12 v. 3a., all facilities as above. Only 59/9, carr. 3/9.

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.

Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case finished attractive hammer blue. Ready for use with mains and output leads.

Double Fused. Carr. 3/9 **49/9**

BATTERY CHARGER KITS Consisting of Mains Transformer. F.W. Bridge. Metal Rectifier, well ventilated steel case. Fuses. Fuse-holders, Grommets, panels and circuit. Carr. 3/6 extra.

6v. or 12v. 1 amp.....	24/9
As above, with Ammeters	32/9
6 v. 2 amps	25/9
6v. or 12v. 2 amps.....	31/6
6 v. or 12 v. 2 amps. Inclusive of Ammeter.....	42/9
6 v. or 12 v. 4 amps.....	49/9
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector	59/9

CHARGER AMMETERS. 0-1.5 a., 0-3 a., 0-4 a., 0-7 a., 0-25 a., 0-60 a. **8/9.**

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

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

TOP SHROUDED DROP THROUGH

250-0-250v. 70mA, 6.3v. 2a, 0-5-6.3v. 2a 17/9
350-0-350v. 80mA, 6.3v. 2a, 5v. 2a .. 18/9
250-0-250v. 100mA, 6.3v. 2a, 6.3v, 1a .. 21/9
250-0-250v. 100mA, 6.3v. 3.5a, C.T. .. 19/9
250-0-250v. 100mA, 6.3v. 4a, 5v. 3a .. 25/9
300-0-300v. 130mA, 6.3v. 4a, 6.3v. 1a, for Mullard 510 Amplifier 29/9
300-0-300v. 100mA, 6.3v. 4a, 5v. 3a .. 26/9
350-0-350v. 100mA, 6.3v. 4a, 5v. 3a .. 26/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a 29/9

FULLY SHROUDED UPRIGHT

250-0-250v. 60mA, 6.3v. 2a, 0-5-6.3v. 2a, Midget type 2½-3-3in. 17/11
250-0-250v. 100mA, 6.3v. 4a, 5v. 3a .. 27/9
300-0-300v. 100mA, 6.3v. 4a, 5v. 3a 27/11
300-0-300v. 130mA, 6.3v. 4a, C.T. 6.3v. 1a, for Mullard Amplifier .. 33/9
350-0-350v. 100mA, 6.3v. 4a, 5v. 3a 27/11
350-0-350v. 150mA, 6.3v. 4a, 5v. 3a .. 35/9
425-0-425v. 200mA, 6.3v. 4a, C.T. 5v. 3a 55/-

FULLY SHROUDED (continued)—

425-0-425v. 200mA, 6.3v. 4a, C.T., 6.3v. 4a C.T., 5v. 3a 59/9
450-0-450v. 250mA, 6.3v. 4a C.T. 5v. 3a.. 69/9

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4, etc. 4/6
Small Pentode, 5,000Ω to 3Ω 4/6
Small Pentode 7/8,000Ω to 3Ω .. 4/6
Standard Pentode 5,000Ω to 3Ω .. 5/9
Standard Pentode 7,000 to 3Ω .. 5/9
10,000Ω to 3Ω 5/9
Push-Pull 8 watts, EL84, or 6V6 to 3Ω or matched to 15Ω 9/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 or 15Ω 19/9

Following types for 3 and 15Ω speakers:

Push-Pull 10-12 watts 6V6 or EL84 .. 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, EL34, etc. .. 49/9

MIDGET MAINS Primaries 200-250 v. 50 c/s. 250 v. 60 mA, 6.3 v. 2a 11/9
250-0-250 v. 60 mA, 6.3 v. 2 a. 12/11
Both above size 2½ x 2½ x 2¼ins.

FILAMENT TRANSFORMERS

All with 200-250 v. 50 c/s. primaries 6·3 v. 1.5 a, **5/9**; 6.3 v. 2 a. **7/9**; 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. 1.5 a twice, **17/6.**

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

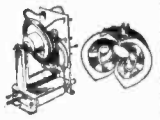
All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ a, **12/9**; 0-9-15 v. 2 a, **14/9**; 0-9-15 v. 3 a, **16/9**; 0-9-15 v. 5 a, **19/9**; 0-9-15 v. 6 a, **23/9**; 0-9-15 v. 8 a, **28/9.**

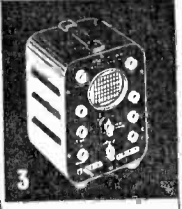
AUTO (Step up/Step down) TRANS. 0-110/120-230/250 v. 50-80 watts. **13/9**; 250 watts, **39/9**; 150 watts, **27/9.**

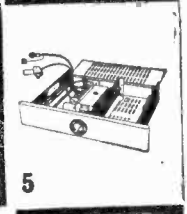
MICROPHONE TRANSFORMERS

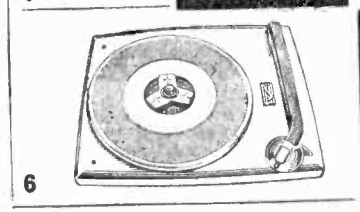
120:1 high grade, clamped, **6/9**; 120:1 Potted. Mu-metal screened, **9/9.**

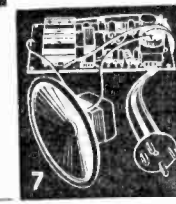
CHECK with these BARGAINS



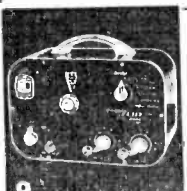


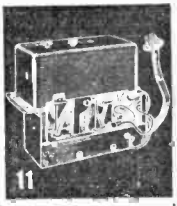




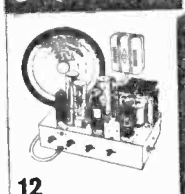


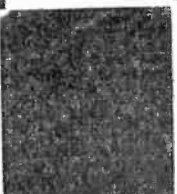
1. **TRANSISTORISED POCKET RADIO** with PRINTED CIRCUIT, MINI-EARPIECE, HIGH GAIN FERROX SLAB AERIAL—NO AERIAL OR EARTH REQUIRED. This wonderful little set to build yourself gives you completely personal listening. Luxembourg obtainable in favourable areas! Twin coloured case 4¼ x 3¼ x 1¼in. 21/-. P. & P. 2/6. (All parts sold separately).
2. **LINE E.H.T. TRANSFORMERS.** Built-in line width control. 14kV. Scan coil 90in. deflection on ferrite yokes. Frame O.P. transformer pi. 18kV smoothing condenser, suitable for 14in., 17in. or 21in. tubes. With circuit diagram, 29/6 plus 4/6 P. & P. Suitable Focus Magnet (state tube), 10/- plus 3/- P. & P.
3. **OSCILLOSCOPE for D.C. and A.C. APPLICATIONS.** Push-pull X amplifier; Fly-back suppression; Internal Time-base Scan Wave form available for external use: pulse output available for checking TV line O/P Transformers, etc. Provision for external—I/P and C.R.T. Brightness Modulation. A.C. mains 200/250 v., £18.18.0. P. & P. 8/- or £4.13.0 deposit, plus P & P. 8/- and 12 monthly payments of 26/8. FULL 12 MONTHS' GUARANTEE INCLUDING VALVES and TUBE.
4. **A.C./D.C. POCKET MULTI-METER KIT.** 2in. moving coil meter, scale, calibrated in A.C./D.C. volts, ohms and milliamps. Voltage range A.C./D.C. 0-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms ranges 0-10,000, 0-100,000 **24/6**, P. & P. 2/-. Wiring diagram 1/-, free with parts.
5. **CHANNEL TUNER.** Will tune to all Band I and Band III stations. Complete with P.C.C.84 and P.C.F.80 valves (in series) I.F. 16-19 or 33-38. Can be modified as an aerial converter (instructions supplied), 32/6, plus 4/- P. & P. **HEATER TRANSFORMER** to suit above, 200-250 v., 6/-, plus 2/- P. & P.
6. **STAAR 45, 9 VOLT BATTERY RECORD PLAYER.** Complete with pick-up and deck. A completely portable record player. Head is protected by a plastic dome, with a brush which cleans the stylus as it rises into playing position. 45 r.p.m. Automatic on-off switch, governed 9 v. motor, attractive 2 tone grey finish, £2.14.6, P. & P. 2/6.
7. **TRANSISTORISED AMPLIFIER** can be used with the STAAR 45, output 1 watt. Size 4½ x 2¾in., printed circuit, tone and volume controls, 4 transistors. By altering 2 resistors, 2 watt output can be obtained. Push-pull output, complete with 3in. moving coil speaker. Built and tested. 49/6, P. & P. 2/-.
9. **SIGNAL GENERATORS.** Cash £7.5.0 or 30/- deposit and 6 monthly payments of 21/6, P. & P. 5/6. Coverage 100 kc/s to 100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Case 10 x 6½ x 5½in. Three miniature valves and Metal Rectifier. A.C. mains 200/250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent. Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Magic eye as output indicator. Accuracy ± 2 per cent.



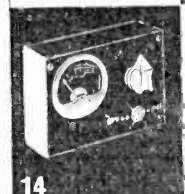


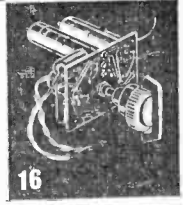
10. **SIGNAL GENERATORS.** Cash £5.5.0. P. & P. 5/6. Coverage 120 kc/s to 84 Mc/s. Case 10 x 6½ x 4½in. Size of Scale 6½ x 3½in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent, modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch variable A.F. output and moving coil output meter. Accuracy ± 2 per cent.
11. **CHANNEL TUNER I.F.** 16-19 Mc/s. Continuously tunable from 174-216 Mc/s. Valves required—PCF80 and PCC84 (in series). Cover BBC and ITA ranges. Also Police, Fire and Taxis, etc. Brand new by famous maker, 10/-. P. & P. 3/-.
12. **8-watt PUSH-PULL 5 VALVE AMPLIFIER.** A.C. mains 200-250 v. Size 10½ x 6½ x 2¾in. 5 valves. For use with all makes and types 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 kc/s. ± 2 db down to 20 kc/s. Output 8 watts at 5 per cent total distortion. Noise level 40 db down all hum. Output transformer tapped for 3 and 15 ohms speech coils. For use with 8in. or 10in. records musical instruments such as guitars, etc. Suitable for small halls. £3.19.6. P. & P. 6/-. Crystal mike to suit 15/-. P. & P. 2/-. 8in. P.M. Speaker to suit 12/6, P. & P. 2/-.
13. **B.S.R. MONARCH UA8 WITH FUL-FI HEAD.** 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: 12½ x 10¾in. Space required above baseboard 4¾in. below baseboard 2¾in. Fitted with Ful-Fi turnover crystal head **£6.19.6**, P. & P. 5/6. **With Stereo Head £7.19.6.** P. & P. 5/6.





14. **TRANSISTOR TESTER.** For both P.N.P. and N.P.N. transistors incorporating moving coil meter. In metal case, size 4½ x 3¼ x 1¼in. Scale marked in gain and leakage. 19/6. P. & P. 3/-.
15. **PUSH-PULL OUTPUT STAGE** inclusive of transistors with input and output transformers to match 3 ohms speech coil, suitable for use with the POCKET RADIO. Kit of parts, including transistors. 19/6, P. & P. 2/-. Wiring diagram 1/6, free with parts.
16. **PORTABLE AMPLIFIER.** On printed circuit for A.C. Mains 200/250 v. Size 4 x 3in. with tone and volume control. Complete with Valves: ECL82 and EZ80. Output 2 watts, 39/6, P. & P. 3/-.





RADIO & T.V. COMPONENTS (Acton) LTD.

21B HIGH STREET, ACTON LONDON, W.3.

ALL ENQUIRIES S.A.E.
GOODS NOT DISPATCHED OUTSIDE U.K.

What! A TV in a Caravan?

To operate your razor from car battery or suitable for many other uses, we offer Motor Generator 12v. input, 200 v. output, which must have cost at least £10 to make, for only 17/6, plus 4/6 post and insurance.

The J.B. Tangential Air Conditioner

The displacement caused by the new Tangential fan is quite amazing, but what is more amazing is the almost complete absence of noise.

Stand the J.B. Air-Conditioner on a window ledge near an open window, and you can have either extraction of bad air, or input of clean, new air, depending upon which way you turn it.

In addition to a fan for moving the air, the unit also contains a heater and control switch, wired such that 500, 1,000 or 2,000 watts of heating may be used.

The total building cost of this air-conditioner is £7.10.0, but is offered at a specially low price during the summer months, this price namely **£6.10.0**, plus 5/- carriage and insurance. The case is very nicely finished in hammered enamel, and when assembled, the unit is indistinguishable from those selling at £12 and more.

Don't miss this special summer offer.

Adjustable Thermostat

Suitable for industrial or domestic purposes, such as controlling furnace oven, immersion heater etc. Can also be used as a flamestat or fire alarm. Made by Sunvic these are approximately 17" long and adjustable over a range 0 to 550 F. The contacts are rated at 15 amps., 230 volts, and the adjustment spindle, which comes to the top, can be fitted with a flexible drive for remote control or just a pointer knob for local control. Listed at £3 or £4 each, these are offered at only 12/6 plus 2/6 postage and insurance.

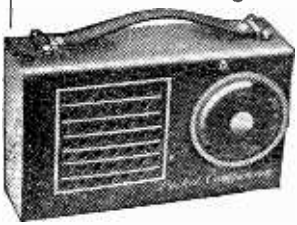
Introducing the J.B. Range of Transistors

Try these, you will be very pleased——

JB1. All wave mixer (replaces OC45 etc.) .. 6/6
JB3. I.F. Amplifier (replaces OC44 etc.) .. 4/6
JB4. A.F. Driver (replaces OC81D etc.) .. 5/-
JB6. Output matched pair (replaces OC81 etc.) ..13/-
Special offer set of six matched for superhet 25/-
Special offer set of four matched for Amplifier (1 watt) ..17/-

Transistor Components
Send S.A.E. for our new price list, just printed.

"A jolly fine set but deserving a better case."



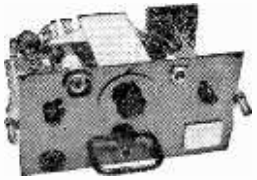
This is a comment which many constructors have voiced and therefore we now offer a De Luxe version of the Pocket Companion. This uses a solid hide case of very pleasant red with gold lettering and our Pocket Companion now has the 15 guinea look.

The most up to date Superhet portable of it's type, it uses a transfilter in conjunction with Philco R.F. transistors and Mullard output transistors. Complete building costs with plastic case **£6.15s.** or with solid hide case, **£7.15s.**

If you have already built and want to change your case, then return the plastic case with a postal order for **£1** or if you wish to retain the plastic case then send **26/-**, plus 1/6 Post and Ins. for the hide case only.

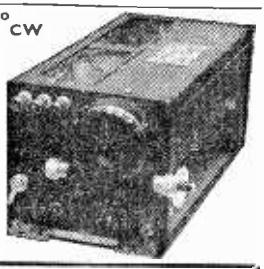
AGENTS WANTED TO BUILD OUR COMPANION PORTABLES. SEND S.A.E. FOR FULL DETAILS.

Oscillating Unit 12A



This is a precision instrument covering the range 30 to 41 MC/SEC with tone switching for 700, 1150 and 1700 cycles per set and magic eye tuning indicator. Unused in original transit cases with attenuator box. Limited quantity only, **£15** each.

Aircraft Radio Receiver. Type CW 0460 48 D



This is part of the equipment RU19, American made equipment for the Navy. It is a 5 valve receiver with a really beautiful precision tuning mechanism. Brand new in original packing but less coil units. Limited quantity only, **£5** each.

CLOSED CIRCUIT TV

If you feel like taking a day out we invite you to our studio here at Eastbourne and will demonstrate 405 and 625 systems, as well as under water and other types of installations. We have equipment for sale or loan, and will be glad to discuss any proposals which you may have. You will be interested to note that a transistorised camera for working direct into a domestic TV receiver can now be purchased for little more than the cost of a good photo camera.

The 'Good Companion' Mk.II using Transfilters

In the "de-luxe" cabinet as illustrated it costs **£10.19.6** to build—but what a set!

Scan these page you will find nothing to compare with its specification. It uses transfilters instead of I.F. transformers, has variable feedback as well as all the usual features. A.V.C., Push-pull output, Ferrite Aerial, Slow Motion Tuning, etc. etc., and is a very powerful Medium & Long Wave set, conservatively rated at 750 mW. Every component used is by a famous maker, such as American Philco MADT R.F. transistors—Mullard A.F. transistors—Jackson Brother's tuning condensers—Rola-Celestion loudspeaker—Dubilier—T.C.C.—Morganite resistors and controls. Also full after sales service available.

You will definitely be doing the right thing if you buy a Good Companion.

Yaxley Switches

All new and unused and in first class condition

1 pole, 2 way	1/6;	1 pole, 3 way	1/6
1 pole, 4 way	1/9;	1 pole, 5 way	2/6
1 pole, 7 way	3/-;	1 pole, 9 way	3/-
1 pole, 11 way	3/-;	1 pole, 12 way	3/3
2 pole, 2 way	2/-;	2 pole, 4 way	2/6
2 pole, 5 way	3/6;	2 pole, 6 way	3/6
2 pole, 12 way	5/6;	3 pole, 3 way	2/-
3 pole, 6 way	3/6;	3 pole, 12 way	8/6
4 pole, 2 way	2/-;	4 pole, 3 way	3/-
4 pole, 4 way	3/6;	4 pole, 5 way	4/6
4 pole, 6 way	5/6;	4 pole, 11 way	10/6
4 pole, 12 way	11/6;	5 pole, 3 way	3/6
5 pole, 6 way	7/-;	5 pole, 12 way	14/6
6 pole, 2 way	2/6;	6 pole, 3 way	3/6
6 pole, 6 way	8/6;	6 pole, 11 way	16/6
6 pole, 12 way	17/6;	8 pole, 2 way	3/6
6 pole, 4 way	4/6;	8 pole, 6 way	11/6
8 pole, 12 way	23/6;	12 pole, 2 way	3/6
12 pole, 5 way	16/6;	12 way fader	3/6
6 pole, 6 way, shorting			3/6

Big stocks of most types

Special prices for quantities.

Philco Record Player Cabinet

Two tone, covered with high grade rexine, fitted with rubber feet. The front is particularly nice being made of tygan with a horizontal gold bar. Size approximately 14½in. wide, 8½in. deep, 16½in. long. Will take BSR or similar record player or tape deck and ampliner. Must have cost at least £3 each. our special snip price 35/- each, carriage and insurance 6/6.

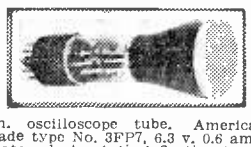
"Coolerstat"

Works in reverse to normal—for switching fans, freezers, air conditioning etc. By famous Pullin Company. One of the best available. For controlling room temperature between 30°-90°F. Switch 15 amps. Regular price over £3, we offer standard model at 22s. 6d. or with Neon on/off indicator at 27s. 6d. Do not miss this unrepeatable bargain.

Power Unit

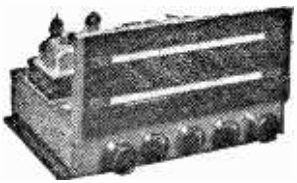
A useful source of D.C. for experimenting energising instruments, electro plating, reactivating batteries etc. This power unit can be made in a few hours and due to the availability of the rectifier valve at a very low price, we can supply the complete kit of parts with ABC instructions, fits into any box for 9s. 6d. plus 1s. post and insurance.

Building A 'Scope ?



3in. oscilloscope tube. American made type No. 3FP7, 6.3 v. 0.6 amp. heater, electrostatic deflection, brand new and guaranteed with circuit diagram of scope. 15/- each, plus 2/6 post and insurance.

ARMSTRONG AF208 AM/FM RADIOGRAM CHASSIS



★ Full VHF Band (87-108 Mc/s and Medium Band, 187-570M) ★ 7 Valves ★ 5 Watts Output ★ 15db Negative Feedback ★ Separate wide range Bass and Treble Controls ★ 2 Compensated Pick-up Inputs ★ Frequency Response 30-22,000 c.p.s. ±2db ★ Tape Record and Playback Facilities ★ Continental Reception of Good Programme Value ★ For 3, 7½ and 15 ohm speakers. Send S.A.E. for leaflet.

PRICE £22.18.0 Carr. Free

LATEST "EMI" 4 SPEED SINGLE RECORD PLAYER

Acos Hi-Fi Pick-up for L.P. and/or 78, 7, 10 and 12in. records. Silent motor, heavy turntable, auto stop. Complete on Baseplate.

Special offer **£6.5.0.** post free.

SINGLE-PLAYER BARGAIN

Ready-built, complete with BSR TU9 4-speed gram pick-up unit. Handsome portable case. 3-watt amplifier with 2 valves and speaker. List price £12.12.0 OUR PRICE £8.19.6. Fully guaranteed in manufacturer's sealed cartons.

SUMMER SALE PRICES

New Boxed VALVES 90-day Guarantee

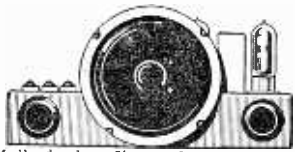
0Z4	5/-	6K7G	5/-	EABC80	8/-	PCL82	10/-
1R5	6/-	6K8G	5/-	EB91	4/-	PCL84	10/-
185	6/-	6L6G	8/-	EBC41	8/-	PL81	10/-
1T4	3/-	6N7M	5/-	EBC81	8/-	PL83	8/-
2X2	2/-	6Q7G	6/-	EBF80	9/-	PY80	7/-
3S4	7/-	6S7	5/-	ECH42	9/-	PY81	8/-
3V4	7/-	6V6G	5/-	ECH81	9/-	PY82	7/-
3Q5	7/-	6X4	5/-	EF85	6/-	PY83	8/-
5U4	6/-	6X5	8/-	EF89	8/-	QP25	7/-
5Y3	6/-	12AT7	6/-	EL32	5/-	SP41	3/-
5Z4	9/-	12AU7	6/-	EL84	7/-	SP61	3/-
6AC7	4/-	12AX7	7/-	EY51	9/-	U22	7/-
6AM6	4/-	12BH7	7/-	EY86	9/-	UBC41	8/-
6AT6	6/-	12K7	5/-	EZ40	7/-	UBC81	9/-
6BA6	7/-	12K8	14/-	EZ80	7/-	UBF89	9/-
6BE6	5/-	12Q7	5/-	EZ81	7/-	UCH81	9/-
6BW6	7/-	25Y5G	9/-	E1148	1/-	UCL82	10/-
6C4	5/-	35L6	9/-	HABC80	10/-	UCL83	12/-
6D6	5/-	35Z4	5/-	HVR2A	5/-	UF89	9/-
6G6	4/-	807	5/-	KT33C	8/-	UL41	9/-
6H6	3/-	954	2/-	KT76	8/-	UY41	7/-
6J5	5/-	DAF96	8/-	MU14	7/-	UY85	7/-
6J6	5/-	DF96	8/-	PC86	8/-	UU9	7/-
6J7G	6/-	DK96	8/-	PCF80	8/-	VR150	7/-
6K6	5/-	DL96	8/-	PCF82	8/-	W81	6/-

SETS OF VALVES

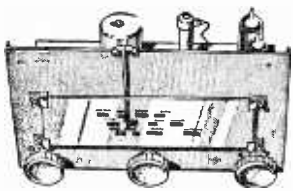
DK96, DF96, DAF96, DL96, 8/- each or 29/6 set.
1R5, 1T4, 1S5, 3S4 or 3V4 19/6

NEW ELECTROLYTICS TUBULAR		TUBULAR		FAMOUS MAKES CAN TYPES	
1/350V	2/-	50/350V	5/6	16/450V	5/-
2/350V	2/3	100/25V	3/-	32/350V	4/-
4/450V	2/3			100/270V	5/6
8/450V	2/3	250/25V	3/-	2,000/6V	4/-
16/450V	3/-	500/12V	3/-	5,000/6V	5/-
32/450V	3/9	8+8/450V	3/6	32+32/350V	5/-
25/25V	1/9	8+16/450V	3/9	32+32+32/350V	6/-
50/25V	2/-	16+16/450V	4/3	32+32/450V	7/-
50/50V	2/-	32+32/350V	4/6	50+50/350V	7/-
				64+120/350V	11/6
				100+200/275V	12/6

COMPLETE RADIO £4.19.6 post free



4 Mullard valves, 5in. speaker, frame aerial. 4 pre-set stations. 1 long, 3 med. wave. **Superhet Circuit. BRAND NEW.** Size 9 x 6 x 5¼in. high. Tested by us ready for use. 200/250 v. A.C.-D.C. Mains.



DE LUXE MODEL as above but with illuminated dial. Fully tunable over Medium and Long Wave. 5 inch speaker. Bargain **£5.19.6,** post free. Tested by us before despatch.

MAINS TRANSFORMERS 200/250 v. A.C.
Postage 2/- each transformer.

STANDARD, 250-0-250, 80 mA, 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a. 5 v. 2 a. or 4 v. 2 a. 22/6, ditto, 350-0-350 ..	29/6
MINIATURE 200 v. 20 mA, 6.3 v. 1 a.	10/6
MIDGET, 220 v. 45 mA, 6.3 v. 2 a. ..	15/6
SMALL, 220-0-220, 50 mA, 6.3 v. 2 a.	17/6
STD., 250-0-250, 65 mA, 6.3 v. 3.5 a. ..	17/6
HEATER TRANS, 6.3 v. 1½ amp. ..	7/6
Ditto, tapped sec. 2, 4, 6.3 v., 1½ amp. ..	8/6
Ditto, sec. 6.3 v. 3 amp ..	10/6
GENERAL PURPOSE LOW VOLTAGE, 2 amp. 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v.	22/6
AUTO TRANSFORMERS, 150 w. ..	22/6
0, 120, 200, 230, 250 v., 500 w. ..	82/6
MULLARD "510" Mains transformer ..	30/-

O.P. TRANSFORMERS. Heavy Duty 50 mA. 4/6. Multiratio, push-pull, 7/6. Ditto, 10 w., 15/6. Miniature, 384m etc., 5/9. **L.F. CHOKES** 15/10H. 60/65 mA, 5/-; 10 H. 85 mA, 10/6; 10 H., 150 mA, 14/-.

TELEVISION REPLACEMENT Line Output Transformers from 45/- each, New Stock
and other timebase components
Most makes available
S.A.E. with all enquiries.

FULL WAVE BRIDGE SELENIUM RECTIFIER: 2, 6 or 12 v. 1½ amp., 8/9; 2 a., 11/3; 4 a., 17/6. **CHARGER TRANSFORMERS.** Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amps., 15/6. 2 amps., 17/6; 4 amps., 22/6. Circuit included. **4 AMP CAR BATTERY CHARGER** with amp meter Leads, Fuse Case, etc., for 6 v. or 12 v., 69/9

BOOKS list S.A.E.

40 Circuits for Germanium Diodes 3/-.
"W.W." Radio Valve Data, 6/-.
High Fidelity Speaker Enclosure, 5/-.
Valve and TV Tube Equivalents, 9/6.
TV Fault Finding, 5/-.
Quality Amplifiers, 4/6.
Radio Valve Guide. Books 1, 2, 3 or 4, 5/- each.
Transistor Superhet Receivers, 7/6.
Practical Radio Inside Out, 3/6.
Master Colour Code Chart, 1/6.
Transistor Controlled Models, 7/6.

C.R.T. BOOSTER TRANSFORMERS

For Cathode Ray Tubes having heater cathode short circuit and for C.R. Tubes with falling emission. Full instructions supplied.
Type A. Optional 25% and 50% Boost. 2V or 4V or 6.3V or 10.8V or 13.3V. Mains input. 10/6.

LOUDSPEAKER P.M. 3 OHM. 2½, 3, 4in., 19/6. 5in. Rola, 17/6; 8in. Plessey, 19/6; 7in. x 4in. Rola, 18/-; 6½in. Rola, 18/6; 10 x 6in. 27/6; 10in. Rola/ 30/-; 4in. Tweeter, 25/-; 12in. R.A. 30/-; 13½ x 8in., Double Cone E.M.I. 45/-.

STENTORIAN HF1012. 10in. 3 to 15 ohms, 10 w., 95/-

BAKER SELHURST LOUDSPEAKERS

Details S.A.E.

12in. Baker 15w. Stalwart 3 or 15 ohms, 45-13,000 c.p.s. 90/-
12in. Baker Stalwart, Foam Suspension, 15 ohms, 40-13,500 c.p.s. .. £6
12in. Stereo, Foam Suspension, 12w., 35-16,000 c.p.s. .. £6.17.6
12in. Baker Ultra Twelve, 20 c.p.s. to 25 kc/s. £17.10
15in. Auditorium, 35 w., Bass. 20 c.p.s. to 12 kc/s, £18

TWIN GANG TUNING CONDENSERS. 365 pF miniature 1in. x 1½in. x 1¾in., 10/-. 500pF Standard with trimmers, 9/-; midget, 7/6; with trimmers, 9/-. **SMALL** 3 gang 500 pF, 17/-.
SINGLE 25 pF, 50 pF, 75 pF, 100 pF, 160 pF, 5/6. Solid dielectric 100, 300, 500 pF, 3/6.

CONDENSERS, New stock. 0.001 mfd. 7 kV; T.C.C., 5/6; Ditto, 20 kV, 9/6; 0.1 mfd., 7 kV, 9/6. Tubular 500 v. 0.001 to 0.05 mfd., 9d., 0.1, 1/-; 0.25, 1/6. 0.5/500 v., 1/9. 0.1/350 v., 9d. 0.1/2,000 v. 0.1/1,000 v., 1/9; 0.1 mfd., 2,000 volts, 3/6.

CERAMIC CONDS. 500 v. 0.3 pF to 0.01 mfd., 9d. **SILVER MICA CONDENSERS.** 10% 5 pF to 500 pF, 1/-; 600 pF to 3,000 pF, 1/3. Close tolerance. (± 1 pF) 1.5 pF to 47 pF, 1/6. Ditto 1% 50 pF to 815 pF, 1/9; 1,000 pF to 5,000 pF, 2/-.

465 kc/s SIGNAL GENERATOR Total cost 15/-. Uses B.F.O. Unit, ZA 30038 ready made. **POCKET SIZE** 2½ x 4½ x 1in. Slight modifications required, full instructions supplied. Battery 8/6 extra 69V 1½V. Details S.A.E.

Wavechange Switches.
8 p. 4-way 2 wafer long spindle 6/6
2 p. 2-way, or 2 p. 6-way long spindle or 4 p. 2-way or 4 p. 3-way long spindle 3/6
3 p. 4-way, or 1 p. 12-way long spindle .. 3/6

Wavechange "MAKITS". Wafers available; 1 p. 12 wafer, 2 p. 6 wafer, 3 p. 4 wafer, 4 p. 3 wafer, 6 p. 2 wafer, 1 wafer, 8/6; 2 wafer, 12/6; 3 wafer, 16/-; additional wafers up to 14, 3/6 each extra.

Toggle Switches, s.p., 2/-; d.p., 3/6; d.p.t.d., 4/-. Ex. Govt. s.p.d.t., 1/-.

CRYSTAL MIKE INSERT
6/6
Precision engineered.
Size only 1¼in. dia. x 1in.

ACOS 39-1 DE LUXE STICK MIKE 35/-
TSL QUALITY STICK MIKE..... 25/-

Valveholders, Pax. int. oct., 4d. EA50 6d. B12A, CRT, 1/3. Engl. and Amer. 4, 5, 6 and 7 pin, 1/-. MOULDED Mazda and int. oct., 6d.: B7G, B8A, B8G, B9A, 9d. B7G with can, 1/6. B9A with can, 1/9. Ceramic EF50, B7G, B9A, int. oct., 1/-. B7G, B9A cans, 1/- each.

THE ORIGINAL

RADIO COMPONENT

Our written guarantee with every purchase.

Bus 133 or 68 pass door
S.R. Station Selhurst

Volume Controls

Long spindles. Midget 5 K ohms to 2 Meg. No. 8w. D.P.3w. 3/- 4/6
Linear or Log Tracks.

80 ohm CABLE COAX

Semi-air spaced ¼in. Stranded core. 40 yds. 12/6 60 yds. 25/- Fringe Quality Air spaced. **6d.yd.** **1/-yd.**

TELESCOPIC CHROME AERIALS. 13in. extending to 43in., 8/6 ea. Coax Adaptor Plug, 3/6 extra.
TRIPLEXERS Bands I, II, III 12/6
COAX PLUG .. 1/- **LEAD SOCKET** .. 2/-
PANEL SOCKETS 1/- **OUTLET BOXES** 4/6
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/6. 80 ohms only.
WIRE-WOUND POTS. 3 WATT. Pre-set Min. TV Types. All values 10 ohms to 25 K., 3/- ea. 30 K., 50 K., 4/-. (Carbon 30 K., to 2 meg., 3/-).
WIRE-WOUND 4 WATT Pots. Long spindle. Values, 50 ohms to 50 K., 6/6; 100 K., 7/6.
PHILIPS TRIMMERS, 0-10 pF, 3-30 pF, 1/-.
TRIMMERS, Ceramic. 30, 50, 70 pF, 9d.; 100 pF, 150 pF, 1/3; 250 pF, 1/6; 500 pF, 750 pF, 1/9.
TRIMMER, 1000 pF, with knob, 2/-.
RESISTORS. Preferred values. 10 ohms to 10 meg., ¼ w., 4d.; ½ w., 4d.; 1 w., 6d.; 1½ w., 8d.; 2 w., 1/-.
HIGH STABILITY. ¼ w., 1%, 2/-. Preferred values. 10 Ω to 10 meg. Ditto 5%, 100 Ω to 5 meg., 9d.

WIRE-WOUND RESISTORS (25 ohms—10,000 ohms)
5 watt 1/3
10 watt 1/6
15 watt 2/-
12.5K to 50K 10 w 3/-

AMERICAN "BRAND FIVE" PLASTIC RECORDING TAPE

			Spare Plastic Reels
Double Play	7in. reel, 2,400ft.	60/-	
	5in. reel, 1,200ft.	37/6	
Long Play	7in. reel, 1,800ft.	35/-	3in. 1/6
	5½in. reel, 1,200ft	23/6	4in. 2/-
	5in. reel, 900ft.	18/6	5in. 2/-
Standard	7in. reel, 1,200ft.	25/-	5½in. 2/-
	5in. reel, 600ft.	16/-	7in. 2/6

'Instant" Bulk Tape Eraser and Head Defluxer, 200/250 v. A.C., 27/6.

CRYSTAL SET BOOKLET, 1/-.
CRYSTAL DIODE G.E.C., 2/-. GEX34, 4/-. OA81, 3/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 15/- pr.
SWITCH CLEANER. Fluid squirt spout, 4/6 tin.

HIGH GAIN TV PRE-AMPLIFIERS
BAND I B.B.C.
Tunable channels 1 to 5. Gain 18db. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PCC84 valves if preferred.)
BAND III I.T.A.—Same prices.
Tunable channels 8 to 13. Gain 17 dB.

Paxolin Panels, 10 x 8in., 2/-.
Miniature Contact Cooled Rectifiers, 250V 50mA, 7/6; 250V 60mA, 8/6; 250V 85mA, 9/6; 200mA, 21/-; 300mA, 27/6.
TV etc., Silicon Sub.-Min. Rectifier. 125V. 300mA, 6/8; 250V, 300mA, 14/6.
Selenium Rect., 300V 65mA, 5/-.
Coils Wearite "P" type, 3/- each.
Osmor Midget "Q" type adj. dust core, from 4/- each. All ranges.
Teletron D.W.R. L. and Med. T.R.F. with reactions, 4/-. Med wave D.R.. 3/6.
Ferrite Aerials, M., 8/9; M. and L., 12/6.
Osmor Ferrite Rod Aerials, L. and M. for transistor circuits, 10/- each.
Ferrite Rods, 8 x ¼in., 3/-; 8 x 5/16in., 3/-.
H.F. Chokes, 2/6. **Osmor QC1,** 6/9.
T.R.F. Coils, A/HF, 7/- pair; HAX, 3/-.
Repanco DRR2, 4/-, DRX1, 2/6.
Radio Screwdriver, 5in., 6d.
Neon Mains Tester Screwdriver, 5/-.
Solder Radiograde, 4d. yd., 1lb. 5/-.
Black Crackle Paint. Air drying, 3/- tin.

Aluminium Chassis, 18 s.w.g. Plain undrilled, 4 sides, riveted corners, lattice fixing holes, 2½in. sides. 7 x 4in. 4/6; 9 x 7in., 5/9; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6; 18 x 16 x 3in., 16/6.
Aluminium Panels, 18 s.w.g., 12 x 12in. 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3; 8 x 6in., 2/-.

TRANSISTOR RADIO MED. & LONG WAVE KIT
First class components to make a 6 transistor 2 wave band superhet chassis. Ideal for portable or table radio. All parts including BVA transistors ferrite aerial, printed circuit, 3¼in. x 2¼in., but EXCLUDING speaker and cabinet. Simple instructions 1/6 (Free with kit).
Speakers, 35 ohm, 7 x 4in. 25/- extra or 3½in. round 19/6 extra. **£4.5.0**

TV Plug-in "V" Aerial 16/6
JACKS. English open circuit, 2/6. Closed circuit, 4/3. Grundig type, 3 pin, 1/3.
JACK PLUGS. English, 3/-; Screened, 4/-; Grundig, 3 pin, 3/6.
Wirewound Ext Speaker Control, 10 Ω 8/-.
ALADDIN FORMERS and cores, ¼in., 8d.; ⅜in., 10d. 0.3in. **FORMERS** 5937 or 8 and cans TV1 or 2, ¾in. sq. x 2¼in. or ¾in. sq. x 1¾in., 2/- with cores.
SLOW MOTION DRIVES. 6:1, 2/3.
SOLON IRON, 25W, 200V or 230V, 24/-.

JASON FM TUNER COIL SET. 29/-. H.F. coil, aerial coil, oscillator coil, two i.f. transformers 10.7 Mc/s, detector transformer and heater choke. Circuit and component book using four 6AM6, 2/6. **Complete Jason FMT.1 Kit.** Jason chassis with calibrated dial, components and 4 valves. £6.5.0.

MAINS DROPPERS. Midget adjustable sliders, 0.3A, 1,000 ohms, 5/-; 0.2A, 1,200 ohms, 5/-; 0.1A, 2,000 ohms 5/-.
LINE CORD. 0.3A 60 ohms per foot, 0.2A 100 ohms per foot, 2-way, 1/- per foot; 3-way 1/- per foot.
MIKE TRANS. 50-1, 8/9; 60:1, potted, 10/6.
P.V.C. Conn. Wire, 8 colours, single or stranded, 2d. yd. Sleeving, 1.2mm, 2d.; 4mm, 3d.; 6mm, 5d. yd.
SPEAKER FRET. Gold cloth, 17 x 26in., 5/-; 25 x 35in., 10/-. **Tygan,** various colours, 52in. wide, from 10/- ft.; 26in. wide, from 5/- ft. Samples, S.A.E. Expanded Metal, Gold, 12 x 12in., 6/-.

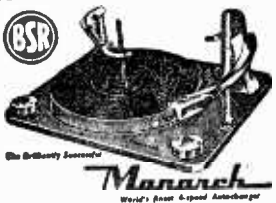
I.F. TRANSFORMERS 7/6 pair
465 kc/s slug tuning miniature can 1¼ x ¾ x ¾in. High Q and good band width. Data sheet supplied.

"REGENT" 4 VALVE "96" RANGE VALVES KIT PRICE £6. 6. 0. carr. 4/-

PRINTED CIRCUIT BATTERY PORTABLE KIT

Medium and long wave. Powerful 7 x 4in. high Flux Speaker. T.C.C. Printed Circuit and condensers. Components of finest quality clearly identified with assembly instructions. Osmor Ferrite Aerial Coils. Rexine covered attache case cabinet. Size 12in. x 8in. x 4in. Batteries used B126 (L5512) and AD35 (L5040). 10/9 extra. Instructions 9d. (free with kit).

MONARCH RECORD PLAYER



BUILD IT YOURSELF using 4-SPEED BSR MONARCH AUTOCHANGER
READY BUILT 3W. AMPLIFIER, HANDSOME PORTABLE CASE. HIGH FLUX LOUDSPEAKER, FULL INSTRUCTIONS SUPPLIED.
Total Price **£12.10.0**
Carr. and ins. 5/-.

RECORD PLAYER BARGAINS
Post 2/- each

4 Speed Autochangers:	
Collaro C60	£7.19.6
BSR, U.A.14	£7.10.0
BSR, U.A.12, Stereo/Mono ..	£8.5.0
Garrard "Autoslim"	£7.19.6
4 Speed Single Players:	
Garrard Mk. II	£8.0.0
Model 4SP	£6.17.6
Garrard 4 HF Transcription	£17.19.6

All Sapphire Stylii available from 6/-.

ARDENTE TRANSISTOR CONTROLS
Type D3035, 7.3 CT; Push Pull to 3 ohms for OC72, etc., 1 x ¾ x ¾in., 9/6.
Type D3034, 1.75 : 1CT. Push Pull Driver for OC72, etc., 1 x ¾ x ¾in., 9/6.
Type D3058, 11.5 : 1 Output to 3 ohms for OC72, etc., 1 x ¾ x ¾in., 9/6.
Type D167, 18.2 : 1 Output to 3 ohms for OC72, etc., ¾ x ¾ x ¾in., 12/-.
Type D239, 4.5 : 1 Driver Transformer, ¾ x ¾ x ¾in., 10/-.
Type D240 8.5 : 1 Driver Transformer, ¾ x ¾ x ¾in., 10/-.

ARDENTE TRANSISTOR VOLUME CONTROLS
Type VC1545, 5K with switch, dia. 0.9in., 8/-.
Type VC1760, 5K with switch, dia. 0.7in., 10/6
Deaf aid ear piece xtal or magnetic, 7/6.

WEYRAD
COILS AND TRANSFORMERS FOR A 2-WAVE TRANSISTOR SUPERHET WITH PRINTED CIRCUIT AND FERRITE ROD AERIAL
Long and Medium Wave Aerial—RA2W. On 6in. rod, 7/16in. diameter, 208pF tuning, 12/6. Car Aerial Coil, 1/-.
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Practical Wireless

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Contents

The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Owing to the rapid progress in the designs of wireless apparatus and to our efforts to keep readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

THE RADIO SHOW

THE Radio Show this year will be held at Earls Court, London, as in previous years. The dates of the show are 22nd August to 1st September and, at the time of writing, it seems that this year's show will be one of the best yet, at least so far as attendances are concerned. However, we are of the opinion that the Radio Show could be made to have much more appeal for the amateur radio constructor, even if such enthusiasts form a minority of the visitors to Earls Court. The home constructor market is usually very poorly represented, and there seems no reason to suppose that the situation will be any different this year. As most exhibitors know, the majority of visitors to the Radio Show are mainly interested in the possibility of seeing various celebrities at the stands of the BBC and ITV companies rather than in viewing the new models in radio and TV sets brought out by manufacturers. It seems to us that there is scope for the inclusion of a small section in the Radio Show for the amateur radio enthusiast since there are many firms which cater particularly for this market.

As usual, there will be a PRACTICAL WIRELESS stand at the Radio Show and the number of this stand will be announced later. We shall be pleased to welcome readers and discuss their problems.

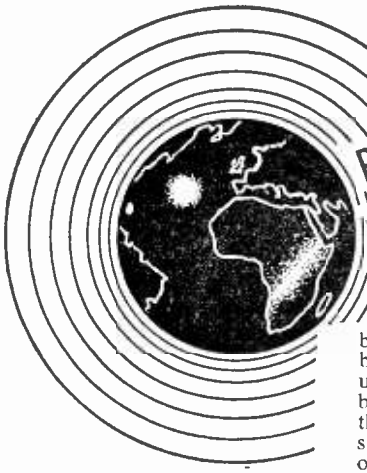
PRE-RECORDED TAPES

The advantages of tape recording are well known to most readers and include long life with little change in the characteristics of the recording during its life, compared with disc records which, even with the most expensive equipment on the general market, wear noticeably with each playing. From the moment when tape recorders first made their appearance, record manufacturers have been interested in the possibilities of selling tape records in the same way as disc records are sold. Naturally, this was not possible at first for several reasons; one was the small number of tape recorders in use outside laboratories and studios and similar establishments. However, the tape recorder is rapidly gaining in popularity, mainly because of the ease with which recordings may be made in the home.

Another reason for the lack of tape records or pre-recorded tapes in the early days of the domestic tape recorder was the public's unfamiliarity with the machines, which it must be admitted were expensive and needed regular professional servicing to maintain their high performance—both disadvantages in the mind of the public.

There are now over one million tape recorders in this country ranging from miniature types for outdoor work to those of professional quality. The market for tape records is thus rapidly expanding and a leading manufacturer of disc records has recently announced a new range of pre-recorded tapes in addition to its present range. No doubt other concerns will follow suit and increase the number of recordings available so that it becomes worthwhile to build up a tape library. We think that in the very near future, pre-recorded tapes will achieve a much greater popularity than they have so far attained.

Our next issue dated September, will be published on August 7th.



ROUND THE WORLD of WIRELESS

NEWS AT HOME AND ABROAD

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of April, 1962, 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	647,503
Home Counties	595,804
Midland	429,979
North Eastern	461,058
North Western	397,425
South Western	351,951
Wales and Border Counties	203,274
Total England and Wales	3,086,994
Scotland	330,698
Northern Ireland	107,118
Grand Total	3,524,810

New Development for Hospital Radio

THE cost of hospital ward radio installations may well be cut substantially as a result of successful experimental work carried out for Dereham Hospital, Norfolk, by Hadley Telephone & Sound Systems Ltd., of Smethwick, Staffs.

In this hospital the development of new techniques has led to the doubling of patients' listening facilities without any increase in the number of bedhead units.

A method of operating two of the stethoscope-type headsets from each bedhead point has been devised. This has been done by employing a single driver unit, mounted in and protected by the control unit, and splitting the acoustic outlet by means of a special bifurcator so that two—or even more—patients' headsets may be served by the same driver unit.

More CENTO aid for Pakistan

PAKISTAN is to have further considerable installations of Marconi high-frequency radio communications equipment as CENTO aid.

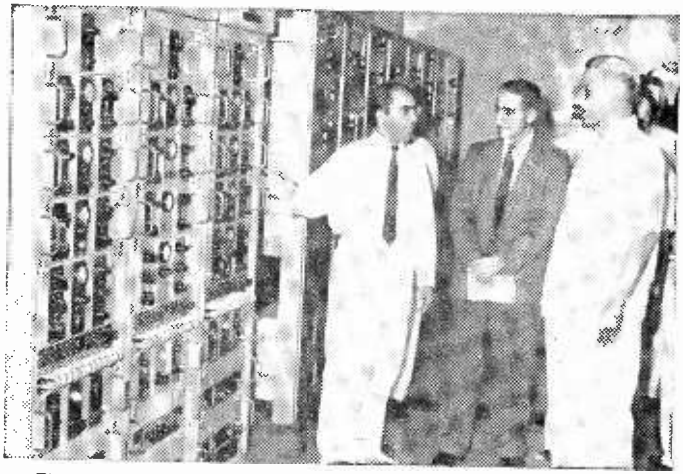
At Pipri, outside Karachi, a 30kW ISB transmitter type HS51 and its associated drives (type HD20 and HD51) are to be supplied.

Ghaggar, the Pakistan Posts and Telegraphs Departments receiving station five miles from Pipri, at which three Marconi dual diversity H.F. receivers have been installed, is to have a two-channel single-path ISB receiver type HR21.

In Karachi, at the overseas radio trunk exchange two 2-channel transistorised radio telephone terminals with 5-band split-privacy facilities, will be added to the present complement of terminals.

Rawalpindi transmitting station, where a 10kW ISB transmitter is already installed, will have a 3½kW ISB transmitter together with an amplifier to raise the output to 30kW; associated drive assemblies and a coaxial feeder switching unit are also included in the order.

Dacca, in East Pakistan, is also to have two 2-channel radio telephone terminals with 5-band split-privacy facilities.



The illustration shows three Marconi HD 51 drive units, part of a previous large CENTO order for Pakistan, being inspected in July 1960 by (right) Mr. F. M. Khan, the present Pakistan Minister of Railways and Communications, (centre) Mr. M. M. Husain, Chief Engineer, Pakistan P. and T. Department, and (left) Mr. M. W. Rizvi, Deputy Chief Engineer (Construction) of the Pakistan P. and T.

VHF R/T System for Sunderland Harbour

EXISTING port services available to shipping using Sunderland Harbour are to be supplemented by a two-channel VHF radio-telephone system which will be supplied and installed by Associated Electrical Industries Ltd. The new equipment will be installed at the Pilot House and will enable ships to obtain pilotage and port information directly. The order has been placed by the River Wear Commissioners with Marine Department of AEI Telecommunications Division, Woolwich, S.E. London.

Orion Computer

THE Swedish telecommunications group, Telefon AB L. M. Ericsson, of Stockholm, have placed an order, valued at about £400,000, with Ferranti Ltd. for an Orion data processing system. It is the third Orion to be ordered by a Swedish company and the sixth Ferranti computer sold in the Swedish market.

The equipment specified makes the Ericsson system the biggest of 15 Orion orders so far announced by Ferranti.

The work to be undertaken by Orion is, among other things, to integrate a production and stock control system. Ericsson's are one of the large companies within the telecommunication field. The highly technical nature of its activities and the physical size of the organisation —it employs more than 16.000 people at its 23 Swedish factories alone and more than 20.000 more in its foreign subsidiaries and associated companies—make the project very complex. To determine a general plan for the integration of the main routines several years' work is required.

Batteries

ARRANGEMENTS have been made by the Ever Ready Co. (G.B.) Ltd. to market the full range of Mallory batteries and cells. Stocks of all types have been delivered to Ever Ready sales areas throughout the U.K.

Mallory batteries now handled by Ever Ready will cover the hearing aid, commercial and industrial fields.

New BBC Beckley Station

THE VHF sound transmitters at the BBC's new transmitting station at Beckley, near Oxford, were brought into service on Monday, 28th May. This station is one of several combined television and VHF sound broadcasting stations which are being built to extend and improve the coverage of the BBC's services. The television transmitter is already in operation.

As the service area of the VHF sound transmitters includes parts of the BBC's Midland and West Regions the Beckley station transmits both the Midland and West of England Home Services in addition to the Light Programme. the Third Programme and Network Three on the following frequencies:

Midland Home Service, 93·9Mc/s.

West of England Home Service, 95·85Mc/s.

Light Programme. 89·5Mc/s.

Third Programme and Network Three, 91·7Mc/s.

Horizontal polarisation is used, which means that receiving aerials should be mounted horizontally.

The Beckley station, which is designed to work unattended, receives its sound programmes by radio, the West of England Home Service from Wenvoe or Rowridge and the other three services from Sutton Coldfield. It will extend the BBC's VHF sound service to a quarter of a million people and provide improved reception for a further quarter of a million people in an area which includes Oxford, Bicester, Witney, Swindon, Wantage and Aylesbury.

Microwave Radio Links for Norway

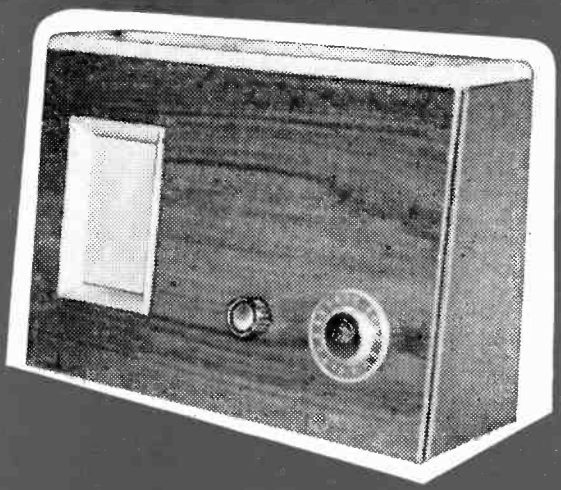
A SUBSTANTIAL contract has been awarded to Marconi's by the Royal Norwegian Air Force for the supply and installation of two microwave radar links for incorporation into Norway's defence system as part of the N.A.T.O. Infrastructure programme.

The contract, which is to the approximate value of £500,000, was obtained in the face of intense competition. No details of the equipments or their intended locations can be given on security grounds but it can be said that they are intended to carry complex search and height-finding radar signals from the radar heads for display and processing at control centres. The radar stations themselves will be operated by remote control over the links.

This follows on the completion of previous important contracts from the Norwegian Ministry of Defence which include a £1,000,000 order in the autumn of 1958 for two high-power, long-range radar control and reporting stations and supplementary equipment.

G8KU is seen here operating one of the stations of the Scarborough Amateur Radio Society during National Field Day, June 2nd/3rd.

THE CONSORT TRF RECEIVER



By B. Lewisham

IN this TRF receiver, a regenerative circuit is used to increase sensitivity and sharpen tuning so that the detector valve can be brought to its most sensitive operating point (the edge of oscillation) if required.

Considerable thought has been given to beginners' requirements and they will find this set an easy and inexpensive way of tackling mains equipment—perhaps for the first time. Chassis work has been kept small deliberately and a "baffle-mounting" plan adopted partly to simplify construction and partly to obtain the desired slimness.

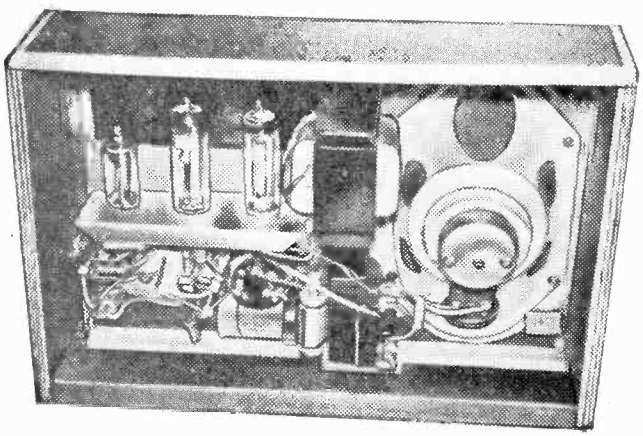
Valves

The valves used are: ECF80 (triode-pentode), EL84 (output valve), EZ80 (valve rectifier). Shock hazards are removed by fitting a mains isolating transformer and thus no danger to life results from handling metal parts when the receiver is switched on. Complete safety is also provided when the set is switched off due to the use of a double-pole mains switch that breaks both mains connections.

The Circuit

Referring to Fig. 1, it will be seen that a simple grid leak detector is used, signals being conveyed to L1 via TC1 and selected as required by VC1.

Provision for tuning over the medium waveband only is given in the original but other ranges can be covered by fitting extra coils and a miniature rotary wave-change switch. The extra circuitry required for incorporating a long waveband range, for example, is given in Fig. 2. Space can be obtained by repositioning, or fitting a miniature type of output transformer, etc.



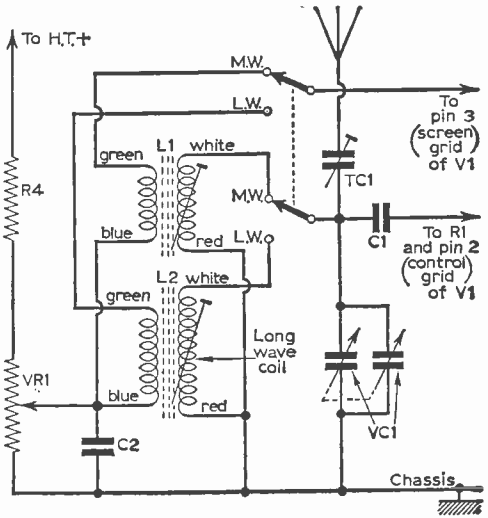
A view of the interior of the completed set.

Detection

The cathode and grid of V1A perform the demodulating process, R1 acting as the diode load—the two electrodes perform effectively as a diode valve. The resultant audio signal, together with unfiltered R.F., pass to the anode via the screen and suppressor grids, the latter being connected internally to the cathode of V1A.

The positive potential required for the screen grid is obtained from a potential divider connected across the power supply

Fig. 2 (right)—A modification to the circuit of Fig. 1 to include long waves.



and reaches the grid via a winding on L1. The R.F. accompanying the audio signal thereby circulates in this winding which if correctly phased can cause positive feedback and oscillation. By making the screen feed voltage variable, the feedback can be controlled and made to increase sensitivity. Potentiometer VR1 performs this service and allows the detector to be brought to the threshold of oscillation without seriously affecting the setting of VC1.

R.F. also appears at the anode of V1A where it is not wanted, but a filter comprising capacitors C3 and C4 in association with an R.F. choke prevents it from reaching the grid of V1B where only audio signals are required. Omission of this choke would seriously affect operation.

The pentode section of V1 also amplifies the audio signals and thus performs two operations simultaneously. The triode section of V1 operates as a conventional A.F. voltage amplifier before presenting the signals to the output valve, V2.

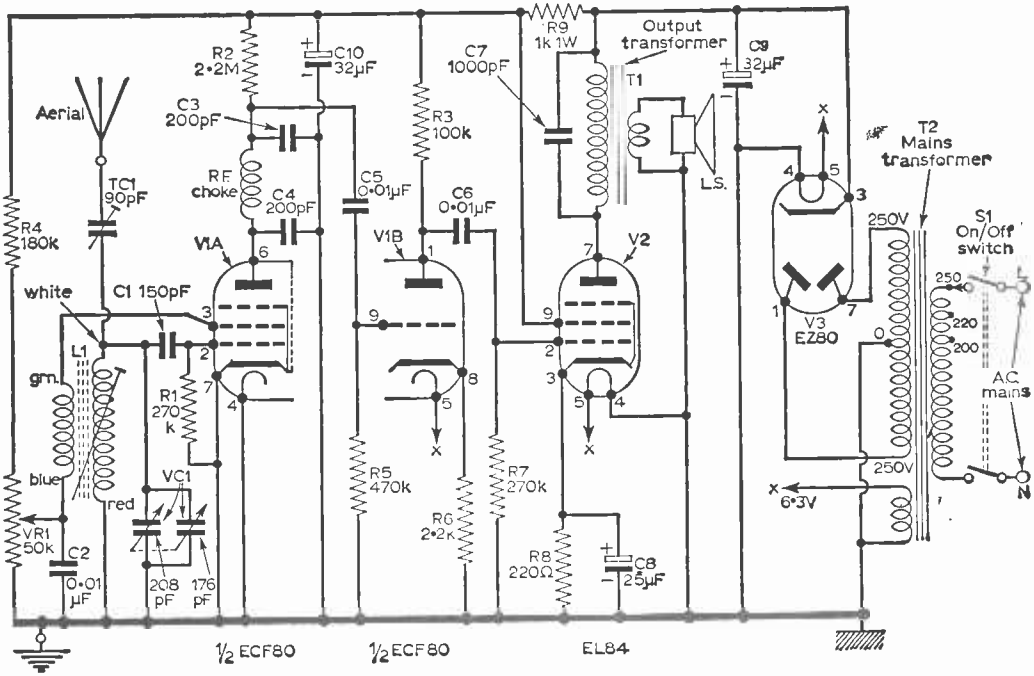


Fig. 1—The circuit.

The anode of V2 is fed with relatively unsmoothed H.T. and permits use of a low wattage resistor for R9. The reservoir capacitor, C9 is large enough (32μF) to ensure that hum from the mains is removed. The value of C10 can actually be increased to 50μF with the particular type of rectifier valve specified.

The Power Supply

The full-wave rectification adopted is considerably more efficient than the half-wave type usually fitted to simple receivers. The cost is approximately equal for both types and space differences are negligible. Half-wave rectification is not recommended for use here.

A fuse may be fitted if desired by connecting the secondary centre tap of T2 to chassis via a 0·15A torch bulb instead of direct as shown in the diagram. This will provide safety should a fault such as a heater/cathode short circuit develop in V3 which would cause a heavy flow of destructive current.

Mechanical Details

As may be seen from Fig. 3, the "chassis" consists of a simple rectangle of aluminium (5in. + 4in.) and this carries the tuning capacitor, the potentiometer VR1, with integral on/off switch, the R.F. choke and the tuning coil together with a narrow aluminium shelf (top surface 5in. × 2in.) which carries the three valves. This valve shelf is bolted to the rectangle where shown by means of 6B.A. nuts and bolts. The weight is negligible and supporting stays are not required.

The tuning capacitor is air-spaced being a miniature type intended primarily for transistor applications (Jackson "00" type—208pF+176pF). It has lower maximum capacitance values than are usually required for valve receiver tuning circuits. Here, the two sections are connected together (in parallel) to provide sufficient capacitance to cover most of the medium waveband. There is some restriction at the low frequency end of the band but this is not important. A conventional air dielectric single gang capacitor (nominal value 500pF) or even a solid dielectric type could be used instead provided it is not too large physically.

An iron cored type of tuning coil is desirable due to the reduced value of tuning capacitance used. The specified coils are remarkably simple to fit, only a single 6B.A. bolt being required. Also the core extension is brought out on a brass threaded rod which fractures less easily than in the type where the adjusting slot is integral with the core material.

Location of Parts

The miniature mains transformer is mounted directly on to the inside of the front panel as are also the output transformer, reservoir and smoothing capacitors and elliptical loudspeaker. Prior to fixing these items, a sheet of metal foil is glued to the inside of the panel, but if this is omitted care should be taken to ensure that all metal component casings are connected to the chassis.

COMPONENTS LIST

Resistors (all ½W except R9 and all 10%):

R1	270k	R6	2·2k
R2	2·2M	R7	270k
R3	100k	R8	220Ω
R4	180k	R9	1k 1W
R5	470k		

VR1 50k pot., preferably wire-wound, with double-pole mains switch

Capacitors:

C1	150pF mica
C2	0·01μF ceramic or paper
C3	200pF ceramic or mica
C4	200pF ceramic or mica
C5	0·01μF mica or paper 250V
C6	0·01μF mica or paper 250V
C7	1000pF ceramic
C8	25μF 25V electrolytic
C9	32μF electrolytic 350V } in same can
C10	32μF electrolytic 350V }
VC1	miniature tuning condenser (see text)
TC1	60-100pF trimmer

Tuning Coils:
Weymouth HA3 (see text)

Transformers:
T1 tapped mains primary; secondaries 250V-0-250V 60mA, 6·3V 2A
T2 40 : 1 ratio for 3Ω speech coil

Loudspeaker:
7in. x 4in. elliptical

Valves:
V1 ECF80 V2 EL84 V3 EZ80

Miscellaneous:
R.F. choke (Osmor QC1); aluminium sheet for chassis (5in. x 4in. and 6in. x 3in.); three B9A valveholders; two control knobs; loudspeaker fabric; metal foil; plywood, etc.

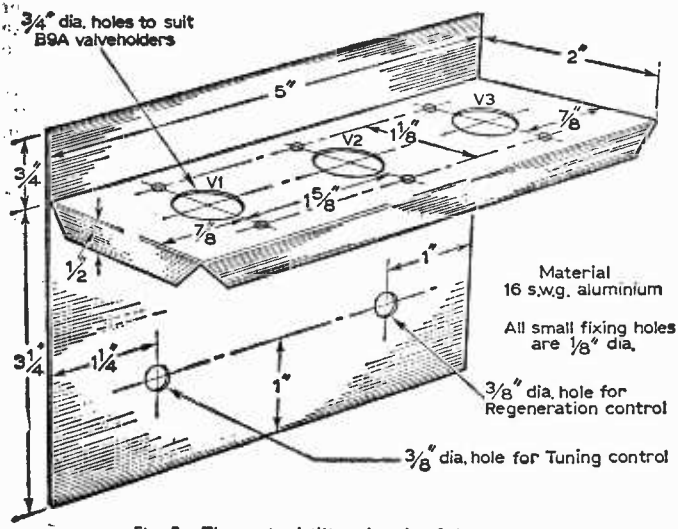


Fig. 3—The main drilling details of the chassis.

The locations of the larger components provides balance of weight (the heaviest items are mounted centrally) so that the receiver is made stable. The balance will be lost if the loudspeaker and transformers are transposed; longer interconnecting leads will also become necessary.

Use of ¼in. thick plywood permits these components and also the chassis to be screwed to the panel without the front being defaced. If desired, or where space is needed, a 3in. square loudspeaker may be used in place of the elliptical model shown. A volume control can be fitted by replacing R5 by a 500k potentiometer and feeding the triode grid from its slider. In the prototype, VR1 was found to perform this function adequately however.

(To be continued)

A Phase-Shift OSCILLATOR

PURE WAVEFORM AND GOOD FREQUENCY STABILITY

By A. Foord

A SMALL inexpensive audio oscillator is always useful in the home constructor's workshop, whether it is used for experimental work, a Morse practice oscillator, or for modulating an R.F. signal generator. The oscillator to be described has been used at one time or another for all the above applications, and also as a signal source for a resistance/capacity bridge. The oscillator uses a single transistor in a phase-shift network, and gives an excellent sine wave output.

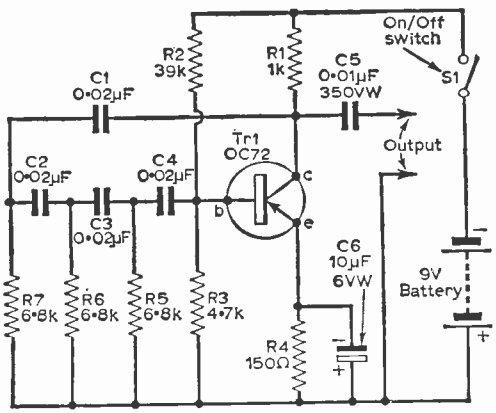


Fig. 1—The phase-shift oscillator circuit.

The Circuit

As can be seen from Fig. 1, a fairly conventional arrangement is used. The collector of Tr1 is coupled into a phase-shift network C1, C2, C3, C4, and their associated resistors. The network feeds back into the transistor base. The circuit will oscillate at a frequency for which the phase-shift network shifts the signal phase by 180°. The values in the phase-shift network were experimentally determined to give a nominal frequency of 1kc/s. The output of the oscillator was taken directly from the collector of the transistor via a capacitor C5. Deriving the output voltage in this manner results in a small change in frequency as the output load resistance is varied. Greater frequency stability could be given by making R1 a potential divider and tapping the output as shown in Fig. 2. This method, although giving greater frequency stability, would give a much

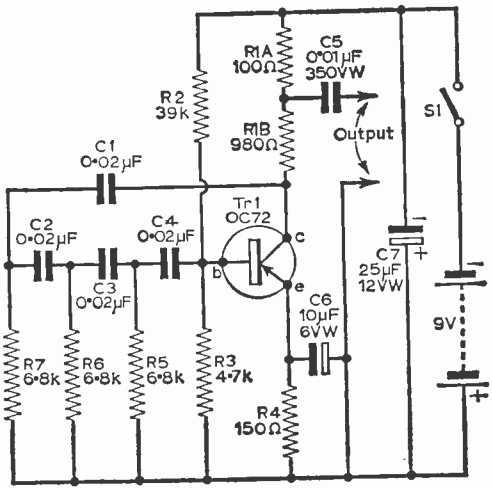


Fig. 2 (above)—A low output circuit with high frequency stability.

reduced output; and it was felt that the high output given by coupling directly to the collector more than outweighs the small loss in frequency stability.

An improvement in long-term stability may also be achieved by connecting a 25μF capacitor between the positive and negative rails, as shown in Fig. 2. This prevents frequency shift due to increasing internal resistance in the battery as it ages. Again, such alterations in frequency are small. Nevertheless, the constructor who requires high frequency stability and only a low output can use Fig. 2. For all normal uses the circuit of Fig. 1 is recommended.

In the circuit of Fig. 1 the transistor takes 5mA at 9V, and it was thought that this current justified the use of the stabilising components R2, R3, R4, C6.

COMPONENTS REQUIRED FOR THE OSCILLATOR OF FIG. 1

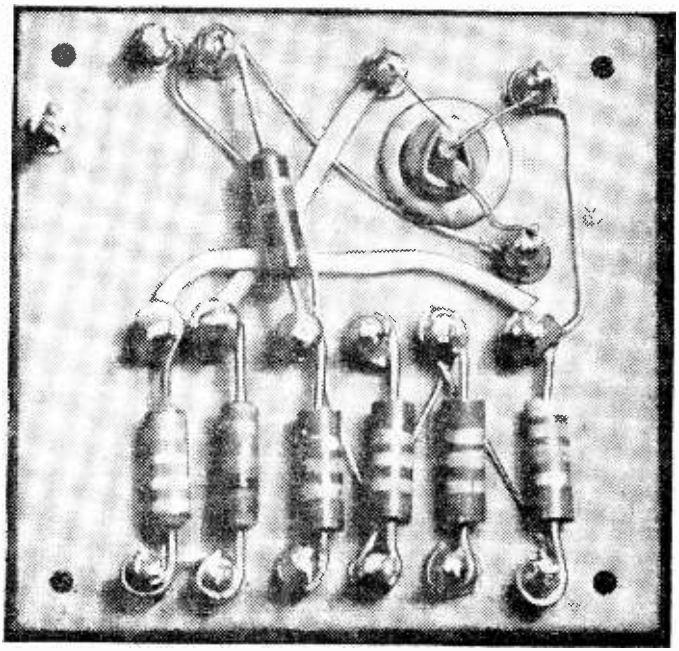
R1	*1k*	*R5*	*6·8k*
R2	*39k (see text)*	*R6*	*6·8k*
R3	*4·7k*	*R7*	*6·8k*
R4	*150Ω*		
C1	*0·02μF*	*C4*	*0·02μF*
C2	*0·02μF*	*C5*	*0·01μF 350V*
C3	*0·02μF*	*C6*	*10μF 6V elec.*
Tr1	*OC72*		
S1	*On/off switch*		
9V battery			

Setting up the Oscillator

When the oscillator has been wired up it is necessary to make sure that R2 has a value which causes the transistor to give maximum output—R2 brings the transistor to the correct operating point. Its value is not critical but varies from transistor to transistor.

To find the "best" value of R2 it should temporarily be replaced by a 50k potentiometer in series with a 12k limiting resistor. Initially set the potentiometer to its maximum value and connect the oscillator to an amplifier or a pair of high resistance headphones. The potentiometer should slowly be reduced in value until oscillation commences. It should then be adjusted until the output is at maximum. The value of the potentiometer and series resistor can be measured and replaced by the nearest standard value. The writer found that this value varied between 27k and 47k for the transistors he tried, while 39k suited the transistor he finally used.

Since all the components used are only accurate to 20% in the case of resistors, and 25% for the capacitors, the circuit may run at frequencies removed from the nominal 1kc/s. If this occurs, the frequency may be adjusted by altering the value of R5, R6 or R7. Increasing these will lower the frequency and vice versa.



The completed oscillator.

Performance

The oscillator gave a reliable output with supply voltages of 6V to 9V. It is not recommended that the supply voltage is increased much above 9V in case the maximum limiting collector voltage for the transistor is exceeded. Oscillation begins immediately the supply is connected. If used for Morse practice, the oscillator could be switched by inserting a key in series with the battery.

For output loads of 10M to 18k there was little change in output. As was to be expected, below 18k the output dropped. Nevertheless, the unit still oscillated right down to a 100Ω load.

The writer used the circuit of Fig. 1 and the layout of Fig. 3. By working on both sides of a $\frac{1}{16}$in. thick piece of paxolin the author made his unit 2in. x 2in. Turret lugs were used to hold the components, while the transistor was mounted in a grommet. Care should be taken when wiring-in the transistor not to overheat it when soldering is carried out or bend its leads nearer to the base than 2mm. ■

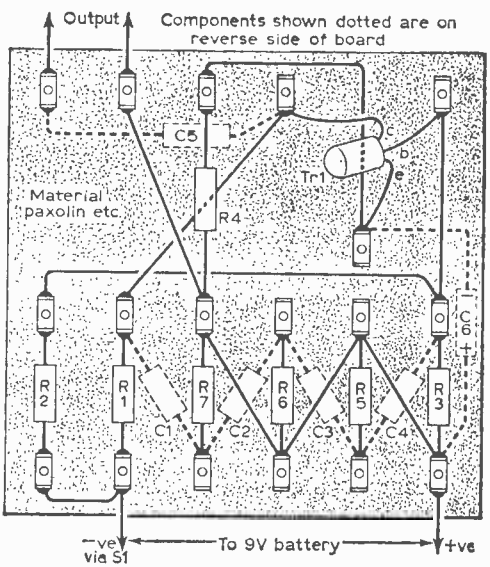


Fig. 3—The wiring diagram of the oscillator shown in Fig. 1.

COMPONENTS REQUIRED FOR THE OSCILLATOR OF FIG. 2

R1A	100Ω (see text)	R4	150Ω
R1B	980Ω (see text)	R5	6·8k
R2	39k (see text)	R6	6·8k
R3	4·7k	R7	8·8k
C1	0·02μF	C5	0·01μF 350V
C2	0·02μF	C6	10μF 6V elec.
C3	0·02μF	C7	25μF 12V elec.
C4	0·02μF		
Tr1	OC72		
S1	On/off switch		
9V battery			

AN AUDIO DISTRIBUTION SYSTEM

PLANNING A MULTIPLEX RADIO/AUDIO INSTALLATION FOR A SMALL FLAT

by M. L. Michaelis

THIS article discusses some practical factors arising during the planning of a multiplex radio/audio installation for several rooms of a flat, using the installation built by the author into his own home as a typical illustration. The reader will be able to design his own installations as far as details are concerned, and thus, as no two constructors are likely to have exactly the same wishes and requirements in this respect, no hard-and-fast building plans will be given here.

Radio and Amplifier Units for the Sub-Stations

Virtually any home-built or purchased units may be used, if necessary with minor modifications which will become apparent in the course of reading further. Sufficient excellent articles have appeared and are appearing in this journal regarding radio units, feeders, amplifiers, etc., and the constructor can take his pick out of these.

It is advisable to make sure that all units feeding the "distribution line" have sufficient audio power output, at least the power of a single EL84 output valve (about 6W). This is because many loudspeakers can be switched in parallel on to the "line", in various rooms.

Output Transformers

A study of the circuit-sketches of the author's installation shows that an arbitrary number of loudspeakers and output transformer secondaries of feeder units can be switched in parallel on to the distribution line, according to the particular combination of sub-stations in the various rooms listening or supplying a programme at any time. This may seem to be taking matters very liberally with impedance-matching, which theoretically is true, but practice shows the matter to be far less critical than might be expected, and the author found absolutely no need for any complicated multiplex-matching system.

It is merely necessary to see that all feeder-units are fitted with output transformers which have secondaries for 15Ω tapped at as many lower impedances as possible. The best combination of tappings for all units is then found by trial and error in the completed installation. If already-existing equipment is to be included into an installation of the type discussed in this article, but such equipment already has only a 15Ω output transformer, then *do not* change it before trying it in the finished installation, for it may prove perfectly satisfactory. Only if purchasing new transformers for new equipment should ones with multi-tap secondaries be obtained. As already mentioned, this question of matching will be found to be surprisingly non-critical, provided the output power of the feeder units is adequate.

Distribution Cable

The central feature of the type of installation under discussion is the elegant solution to the problem of connecting cables. A single 3-core mains power cable, and nothing else whatsoever, is used to connect the units in the various rooms. This cable carries mains, audio and aerial and earth connections. No screened leads whatsoever are used on the long-distance runs.

The cable can be chosen of the flat white plastic insulation type, used sometimes for modern power-wiring. This can be installed very neatly and unobtrusively on walls or skirtings, and thus removes one of the major objections which may otherwise be raised against other forms of versatile music installation—namely, that bunches of unsightly cables so often accumulate. For reasons to be explained below, the current rating of the 3-core cable used should not be less than 15A. In other words, lighting cable is likely to be unsatisfactory, and proper power-cable must be used. A cable of too small a current rating will introduce undue hum in some or all of the speakers installed, and it is thus a question of how far the constructor is willing to compromise in this direction, if he wishes to save on possible cable expenses.

Compromises Involved

The installation discussed in this article is definitely *not* recommended for the hi-fi specialist who always desires to take tone quality to perfection. This is because of the two necessary

compromises made: (a) the introduction of slight background hum on account of the simple type of wiring used and (b) the slight increase of distortion (only noticeable on very-low-distortion amplifiers, as it nevertheless remains less than the inherent distortion of normal output stages) on account of the free-and-easy matching arrangement of the several units on to the one distribution line.

However, the performance of the author's installation illustrating this article is so good that many uninitiated laymen have pronounced it as "real hi-fi", and praised it warmly. This is because such important corrections which can be made with *reasonable expense* have been made, for example, the bass-reflex loudspeaker unit at the living room station is fitted with a variable hum-bucking control (see Fig. 4). It is just here, where really good bass response is present, that even slight residual hum can be most irritating. The circuit in Fig. 4 is very effective in reducing it.

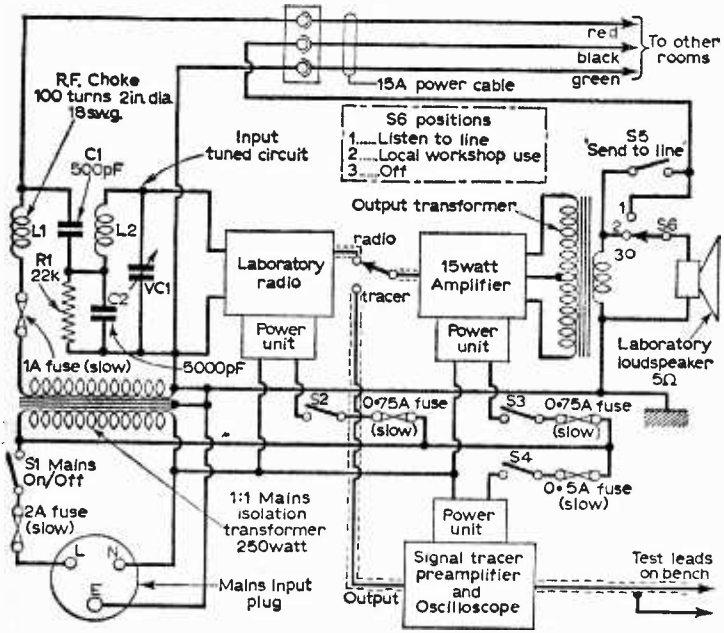


Fig. 1—The main terminal station—in the author's installation, the equipment shown above was in his laboratory or workshop.

The hum-bucking control is variable, as the degree of compensation required will depend slightly upon the exact switch-function positions set at all other stations in the other rooms.

Loudspeakers

The choice of loudspeakers is not critical. Any moving-coil speakers may be used. The author uses various 3Ω to 5Ω units, though there is nothing against using 15Ω units. It is desirable, however, not to mix loudspeaker impedances, i.e. keep either to all 5Ω units, or all 15Ω units. Different sizes may be used, but not too greatly different. Slight differences in loudness may be corrected by means of lengths of resistance wire connected in series with the stronger loudspeakers, but do not take this too far, as it wastes audio power available, and causes loss of bass response. Regarding design for the bass-reflex cabinet for the living-room unit, the author refers readers to the article on this subject by J. B. Dance, which began in the January 1962 issue.

Built-in loudspeakers of units used may certainly be used as loudspeakers for sub-stations concerned, provided modifications are undertaken to install such switching as S5/S6 and S9/S10.

Distribution-Line Outlet Plugs

It is advisable to fit a non-interchangeable 3-pin mains plug and socket at each sub-station, for connection on to the line. The three wires from each sub-station, as shown in the diagrams, are wired on to the corresponding plug. Use a plug and socket of different type or size from other power-points installed in the rooms for normal use, to avoid any accidental wrong connections.

The distribution cable and the outlet plugs must be considered as mains wiring, which must be carried out with the usual care and attention to proper insulation and installation in compliance with local regulations. If necessary, an electrician should be consulted.

The Author's Workshop Terminus

Fig. 1 shows the author's arrangement at the one terminal end of the installation, which is situated in his experimental workshop. It is seen that the mains is fed into the whole installation here, and a master switch and master fuse are also situated here.

A 1:1 ratio mains-isolation transformer feeds mains power on to the distribution line. The expense of the isolation transformer is an unfortunate but a necessary item and it must not be omitted under any circumstances. The expense can be reduced by designing the installation so that the wattage rating of this transformer need be no higher than really necessary. This is the reason why the author feeds his installation at the workshop-end with the mains-input. Here, the equipment having the highest consumption of any of the sub-stations was intended to be installed, and could thus be fed prior to the isolation transformer, as shown in Fig. 1. This reduces the necessary rating of the isolation transformer, and also reduces the mains-supply currents on the line itself to a minimum, which reduces background hum. The constructor should feed his mains input with master switch and fuse into the line at the particular sub-station which is to receive the

equipment of highest total consumption.

It is seen that the mains feed on to the line, subsequent to the isolation transformer, is via an R.F. Choke. This is because the same line wire is used for aerial feed, and otherwise the R.F. would be unnecessarily shunted. The capacity of the distribution line cable is of course high, and thus the R.F. losses are necessarily high. This is a necessary compromise in this installation, and is minimised in its disadvantageous effects by means of feeding on to the line from the aerial proper via a step-down R.F. Transformer (Fig. 4), and using a type of coupling known as "bottom-end capacitive" for the input tuned circuits of the radio units at the sub-stations. This type of coupling is inherently highly capacitive and low-impedance, which largely matches the characteristics of the line as aerial feeder. If already existing radio units are to be used, the input tuned circuits must be modified for this form of aerial connection. L2 and VC1 and L4 and VC2 are the coil and tuning capacitors present. C2 in Fig. 1 and C4 in Fig. 2 are inserted, various values being tried for best results. Take care to use really high-insulation capacitors of 1,000V rating for C1 (Fig. 1) and C3 (Fig. 2), to block the mains voltage safely.

The rest of the installation in Fig. 1 is self-explanatory. Note the arrangement of the loudspeaker switching, to enable independent local use of all units in the workshop, independent of and without affecting the rest of the installation in other rooms, or to enable a programme fed from another sub-station to be listened to in the workshop, or to feed a programme from the workshop radio or signal tracer on to the line and out to the other rooms, with or without the workshop speaker running. An identical arrangement of switching, with the same functions, is used at the study sub-station, in Fig. 2.

The Author's Study Sub-station

This is largely self-explanatory in Fig. 2, details being more a function of the author's particular wishes than of general importance. It is seen that mains is drawn from the line via an R.F. choke, again to avoid shorting R.F. on the line. Remember that these mains R.F. chokes have to carry mains current at mains voltage and proper insulation and wire of adequate diameter must be used. The sub-station here contains a small neon lamp to show whether power is on at the master switch in the workshop. The same form of input coupling is used on the radio unit as on the workshop radio. Note R2 here and R1 in Fig. 1. These are to prevent modulation hum and exact values needed should be found by experiment. Incidentally, the type of installation discussed in this article is prone to severe modulation hum if the normal precautions are not taken as mains and aerial feed go on one and the same wire. Thus all H.T. rectifiers in all units throughout the installation *must* be shunted with capacitors of 0·01μF to 0·1μF and suitable voltage rating. Such modifications need to be incorporated in all existing equipment if not already present. All new equipment should be built with mains transformers having an earthed electrostatic screen between primary and secondary.

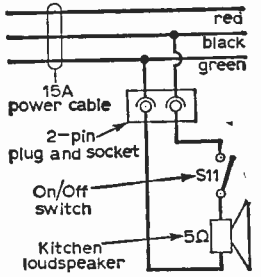


Fig. 3—A simple type of sub-station—this is the scheme used in the kitchen of the author's flat.

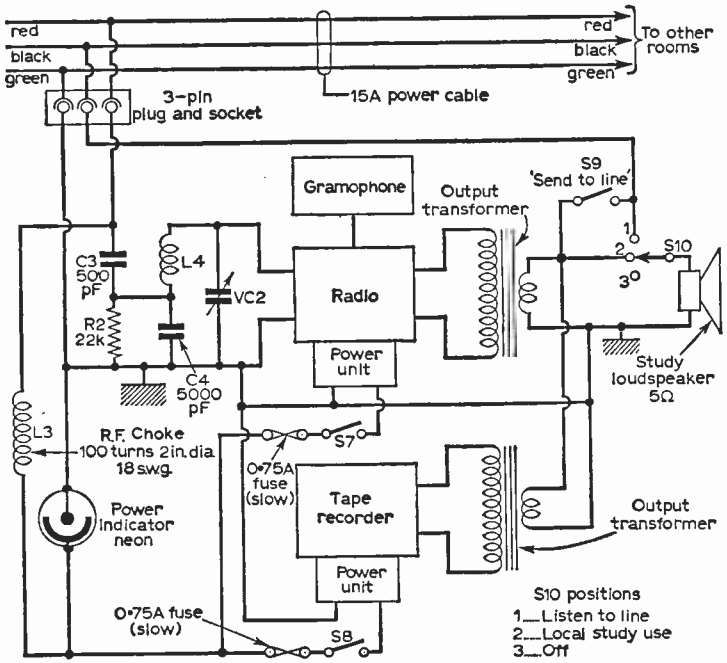


Fig. 2—The arrangement of the sub-station in the author's study.

Kitchen and Bedroom

It is undesirable to instal any ordinary type of loudspeaker in the tropical atmosphere of a kitchen or the cold and damp atmosphere of many bedrooms. Both loudspeakers should be of the "tropicalised" types, especially the kitchen unit.

The master switch in the workshop can be fitted with a time-switch so that any programme can be switched into the bedroom and listened to in bed, the installation being

switched off automatically at the pre-set time. Alternatively, two-way switching can be installed the same as for passage lights.

The Living-room Unit

Nothing but a good amplifier in a bass-reflex cabinet and a few ancillary items shown in Fig. 4 are installed in the living-room. VR1 introduces a compensating voltage at mains frequency to cancel hum due to the voltage drop along the green wire of the line due to mains current and loudspeaker wiring being common on this wire. The hum to be cancelled is kept to a small value from the start by keeping the voltage drop on "green" low —i.e., using substantial 15A cable, as already specified. Hum due to running mains and audio in the same cable unscreened is fully negligible as the impedance is far too low in this installation for this form of capacitive pick-up. Thus, screened cable is not needed.

R3 serves two important purposes. It ensures that the audio line is not completely unloaded when all loudspeakers are off, which could otherwise cause peak voltages

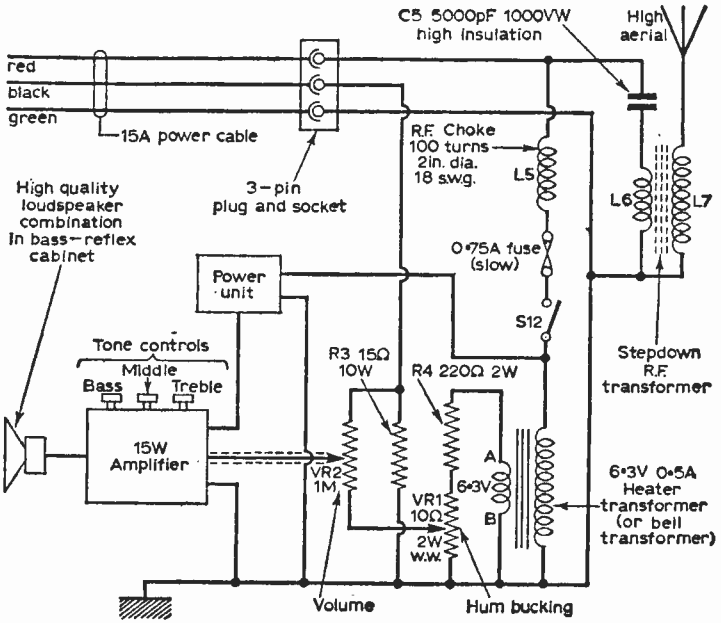


Fig. 4—The second terminal station—in the author's installation, the equipment shown above was in the living room of his flat. The connections to the winding AB of the heater transformer must be reversed if minimum hum is obtained when the slider of VR1 is at the chassis end of the element. Resistor R4 must be reduced in value if minimum hum is obtained with the slider of VR1 at the top or near the top. Conversely, R4 must be increased in value if minimum hum is obtained too near the bottom position of the slider of VR1.

in feeder units which may be switched on. Also it keeps the impedance low even if nothing but the living-room unit is receiving audio. Otherwise capacitive hum starts up as soon as the last of all other loudspeakers is switched off.

The aerial connection is fed on to the line in the living-room simply because the outlet from the communal aerial of the block of flats is situated in this room. The author uses an ordinary long and medium wave coil as the R.F. transformer. The long-wave section forms the primary, with many turns, connected to the aerial. The medium-wave section forms the secondary feeding the line. The two sections are slid about on the former to give the optimum coupling by experiment. This arrangement of aerial coupling is also the most effective in ensuring that mains voltage is kept off the aerial proper, especially if C5 is made of really good insulation quality, as it should be. ■

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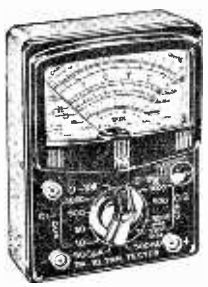

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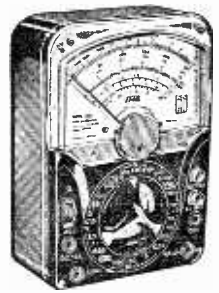

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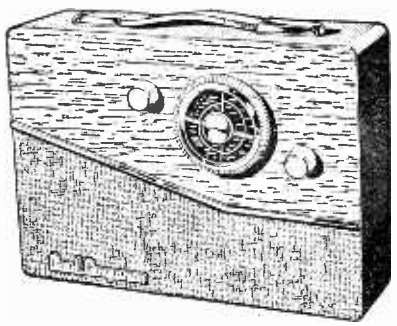

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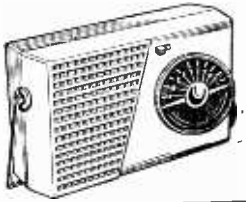

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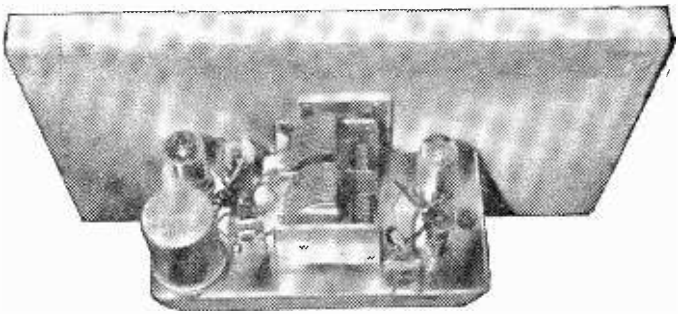
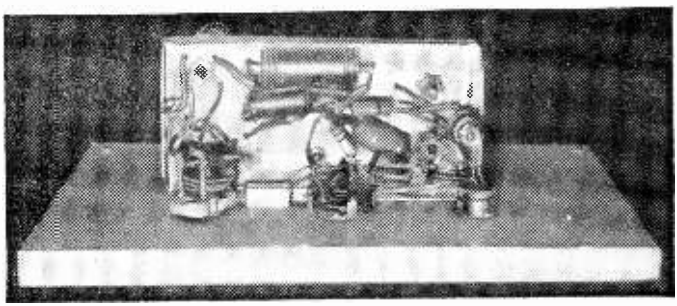




Above and below chassis views of the complete unit; less its case.

Operation

A popular short waveband is that covering 5-15Mc/s (20m-60m). By converting the signal frequencies to say 1·5Mc/s (200m) and feeding them to a standard broadcast receiver not equipped for short wave reception it is possible to increase one's listening horizon as the short wave transmissions will be heard via the receiver's loudspeaker. If the broadcast receiver used is a superhet, two changes of frequency occur and the "double superhet" principle is in use.

Not all enthusiasts have access to the mains supply, however, but fortunately, a useful converter can be constructed and operated successfully from dry batteries. A practical circuit incorporating suitable components is presented here and depicts a recently constructed S.W. unit that is entirely independent of the mains supply. It is small physically and the chassis top plate measures only 6in. x 3in.

Aerial Connection

Switching is incorporated to make the aerial bypass the unit immediately it is switched off; it is reconnected when the unit is switched on the next time. This means that the converter and receiver may be left permanently connected once set up, the latter performing normally when the former is not in use.

The converter may be used to feed a mains receiver provided it is fitted with aerial and earth sockets and is not of the A.C./D.C. variety. It has not been tested in conjunction with transistorised or TRF receivers for, as might be expected, the sensitivity is considerably lower than that obtainable from a mains driven set. Suggested modifications to help improve sensitivity are included

The Circuit

This is illustrated in Fig. 1. When S1/S2/S3 is set to position 1, the aerial is connected to V1 via L1 which is tuned by one section of a twin gang capacitor, VC1. The selected signal appears again at pin 2 of V1 and is fed to the frequency changer, V2. The signal grid circuit of V2 is untuned in the interests of simplicity and to permit the use of a twin gang capacitor. Nevertheless sufficient signal is developed across R2.

Valve V2 is oscillator and mixer and 1·5Mc/s signals appear at the anode of the valve where they are developed across L3 which is tuned precisely to this frequency. To enable a suitable match to be made to the aerial coil of the subsequent receiver with which the converter is used, the low impedance winding associated with L3 is employed and the coil is in fact a standard medium wave coil used in reverse.

R.F. Amplifier

Although the above represents the working of the basic circuit, several finer points of interest exist. It might be argued that V1 could be omitted and the aerial coil connected direct to the signal grid of V2, and although this is true, benefits of slight extra gain would be lost and, furthermore, a sensitivity adjustment would scarcely be practicable. Here, the R.F. amplifier can be used beneficially as a variable gain device by feeding its screen grid from a potentiometer connected across the H.T. supply.

The oscillator circuit is of interest, too, since variable trimming is provided and consists of VC3 arranged as a panel control. This permits manual control of oscillator frequency within limits and also acts as a fine tuner giving a bandspread effect. Any small air-spaced type of variable trimmer

LIST OF COMPONENTS

Resistors (All ½W, 10%):
R1 10k R2 2·2M R3 33k
R4 15k VR1 250k pot.

Capacitors:
C1 0·01μF ceramic or paper
C2 100pF silver mica
C3 50pF silver mica
C4 100pF silver mica
C5 1000pF silver mica
C6 0·01μF ceramic or paper
C7 4μF 200V elec.
VC1/VC2 300pF, twin gang tuning
VC3 trimmer (see text)
TC1, TC2 30pF or 50pF trimmers (may be present on VC1/VC2)

Coils:
L1 Denco Blue (see text)
L2 Denco White (see text)
L3 Denco Yellow, range 2

R.F. Choke (RFC): Denco RFC5
Valveholders: B7G ceramic (two)
Dial and Drive: Muirhead type or Eddystone 843
Valves: V1 DF91 V2 DK92
S1/S2/S3: 4-pole, 2-way rotary switch (see text)
Chassis: 6in. x 3in. x ½in.
Batteries: 67·5V H.T. and 1·5V L.T.
Miscellaneous: Control knobs, coaxial cable, stand-off insulator, tag strip, hardboard, length of ½in. quadrant, etc.

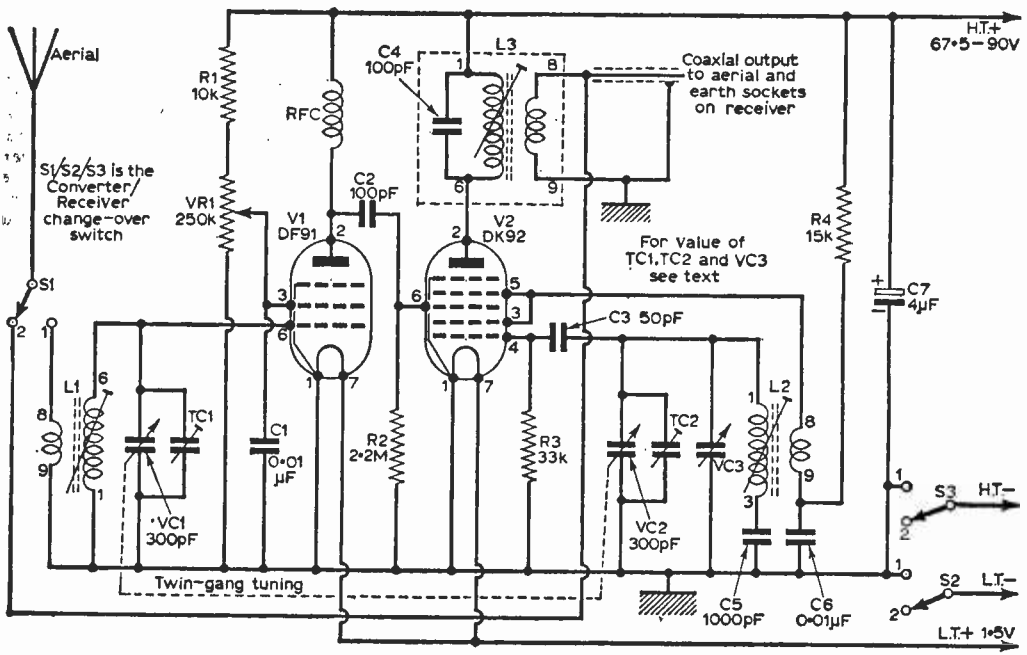


Fig. 1—The circuit of the converter.

may be used, and a plentiful supply is often present in surplus apparatus. The total number of vanes should not exceed four, unwanted ones being removed, since a large capacitance value is undesirable. The control spindle should be fitted with a small scale calibrated 0-10. The general bandspreading is mechanical and consists of an RF27 Muirhead drive, but other suitable types such as the Eddystone 843 may also be used.

Grid Wiring

Connecting g2 and g4 of V2 together was found empirically the most reliable method of operation; sometimes g4 is separately fed via a 33k resistor and decoupled in the usual fashion.

TABLE I

Metres	Mc/s	Padder (C5)	Range No.
57–180	1·67–5·3	340pF	3
20–60	5·00–15·00	1000pF	4
9·5–28	10·50–31·50	2000pF	5

The signal and oscillator coils are not screened but it is desirable that L3 should be screened to prevent unwanted self pick-up at 1·5Mc/s. Note that a fixed capacitor is connected across the main winding of L3 instead of a trimmer, this being quite satisfactory since the coil can be brought to resonance by means of its core, and the capacitor may thus be contained within the coil can. The coils are supplied individually packed in round aluminium screw lid containers which may be used for screening.

The inclusion of C7 is particularly beneficial when the H.T. battery exhibits considerable inherent resistance such as occurs towards the end of its life; it is important that it should be connected as shown in the diagram on the converter side of S3, otherwise the H.T. battery will discharge even when the unit is not in use.

Rotating S1/S2/S3 to position "2" switches off the converter and breaks both H.T. and L.T. feeds, and allows C7 to discharge via R1 and VR1. Simultaneously, the aerial is disconnected from L1 and reconnected to tag 8 on L3 so that the broadcast receiver can function normally. In the prototype, a 4-pole, 2-way miniature rotary switch is utilised for S1, S2 and S3, the spare tags being ignored.

Switching of the earth lead is unnecessary when coaxial cable is used between the converter and receiver, the two chassis being automatically inter-connected via the outer braiding. For this reason *A.C./D.C. apparatus must not be used with the converter.*

The prototype covers the 5-15Mc/s band, but alternatives are possible by changing L1 and L2 for coils from another range. The value of padder capacitor will also require alteration. Suitable coils can be chosen from the Denco range as shown in Table 1.

The coils are wound on colour-coded formers, and for L1, Blue is required, with White for L2.

(Continued on page 319)

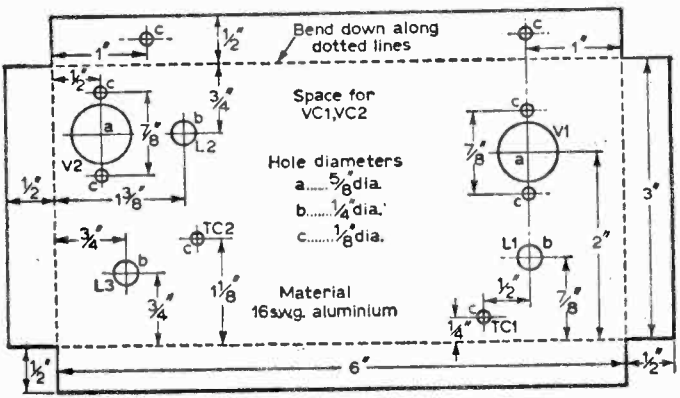
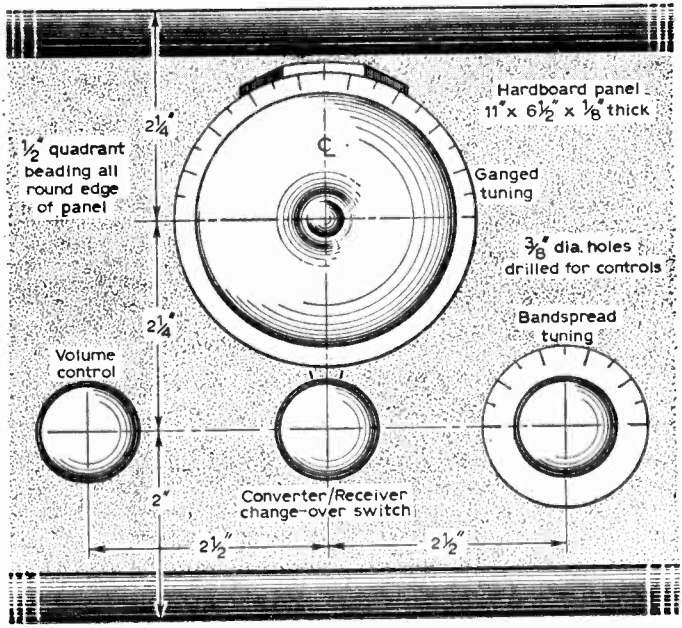


Fig. 2 (above)—The drilling dimensions of the chassis.

Fig. 3 (below)—The layout of controls on the front panel.



POWER Rectifier Circuits

common and uncommon

A SURVEY OF PRINCIPLES OF PRACTICAL IMPORTANCE, AND USES OF THESE CIRCUITS

By L. N. Nash

(Continued from page 258 of the July issue)

THE centre tap of a full-wave voltage-doubler circuit serves merely to feed the mid-point voltage D.C. output. If the centre tap on the transformer is omitted altogether, the circuit degenerates to the familiar *full-wave bridge* circuit. Fig. 16a shows the circuit of Fig. 15 (last month) with the centre tap of the transformer omitted. In Fig. 16b, the circuit of Fig. 16a has been rearranged into the conventional full-wave bridge circuit.

The full-wave bridge circuit has the advantage over the conventional full-wave H.T. rectifier circuit that it does not need a centre-tapped transformer winding.

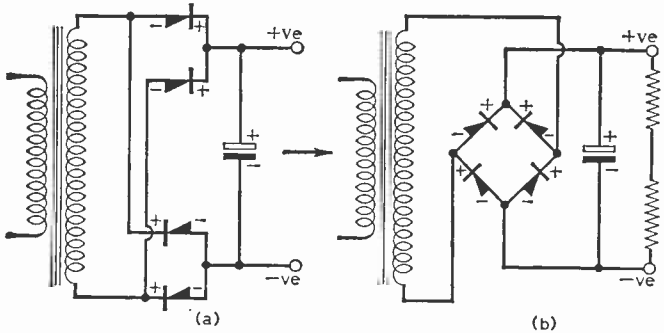


Fig. 16a—The circuit of Fig. 15 (last month) with the centre tap of the transformer omitted.
Fig. 16b—The circuit of Fig. 16a rearranged to show that it is in fact equivalent to the full-wave bridge rectifier circuit.

The important new point to be stressed here concerning the bridge rectifier circuit, of which probably only few constructors are aware, is that any conventional bridge rectifier circuit necessarily embodies the availability of a second D.C. output at half of the main output voltage, directly from a centre-tap of the transformer winding, without any further alteration of the circuit. This second output is already D.C., without the addition of any further rectifiers, as the circuit has returned to the full-wave voltage-doubler arrangement as soon as the centre-tap is present. The two outputs are inherently well decoupled from each other, i.e., loading of the one affects the other far less than if the half-voltage were obtained from the full output by means of an external resistance-bleeder across the output.

However, voltages other than *exactly* half of the main output of the Bridge *cannot* be obtained from the bridge circuit by appropriate choice of a different position for the transformer winding tapping, as such measures would amount to unequal voltages for the two sections of each component fundamental full-wave circuit, which the previous discussion under that heading has shown to lead to unequal current sharing, and consequent possible destruction, of the individual rectifiers. Nevertheless, it is of course perfectly admissible to feed a rectifier circuit of either polarity and any desired voltage whatsoever through a separate rectifier from a suitable tapping in the transformer winding, quite regardless of what rectifier circuitry may or may not be already connected—provided that no conflicting chassis-connections arise, and provided that the total loading of all circuits connected does not overload the transformer. Fig. 18 shows a hypothetical example of a multiplex circuit of this nature, representing just one of numerous possibilities.

Once the constructor is familiar with the basic principles involved, and the important practical points to watch, he will easily be in a position to devise his own peculiar rectifier circuits to meet his particular requirements from occasion to occasion.

Uses of Television Booster Diodes in New Fields

Fig. 19 shows a very interesting and instructive rectifier circuit used by the author for feeding a Geiger-Counter apparatus, supplying positive H.T. for valve amplifiers and positive EHT for the Geiger Tube. The same circuit is usable for feeding H.T. to amplifiers and EHT to the CRT of an oscilloscope, for which purpose constructors could use this circuit directly in most cases, without any modification except in minor details.

It is seen that the basic circuit is the full-wave voltage doubler of Fig. 17, but with the very un-

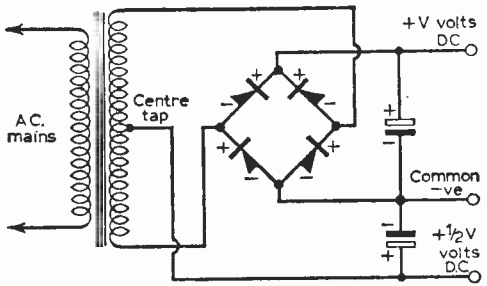


Fig. 17—A circuit to show the relation between the full-wave voltage doubler circuit and the bridge rectifier circuit. In any bridge rectifier circuit, a second D.C. output is available from the centre tap of the transformer winding without any alteration of the circuit. The output voltage from the centre tap is half of the main output voltage.

usual feature that the *negative* fundamental full-wave-circuit is used for the H.T. section, giving nevertheless a positive output voltage w.r.t. (with respect to) chassis. This results in the very unconventional circuit appearance that the main H.T. output is taken via the smoothing-choke direct from the transformer centre-tap, wheas the commoned H.T. rectifier anodes are taken to chassis. This measure is necessary in order to ensure that the positive fundamental full-wave section is of correct polarity to supplement the H.T. output to give the desired positive EHT voltage w.r.t. chassis.

Transformer

A perfectly conventional ordinary mains transformer winding of 400-0-400V is used, and any good mains transformer of reputable make is usable for this circuit. The basic requirement for the transformer is simply that its H.T. winding can tolerate earthing at other than its effective centre-tap without breakdown, and this condition has, in the author's experience, been satisfied by all mains transformers of reputable manufacture. A transformer of doubtful origin should preferably not be used for this circuit, but at least it should first be tested by connection to the mains via a 100W lamp or low fuse in series with the primary, and simultaneous earthing of the core and one end of the H.T. winding. All secondaries should be left open-circuit. If the lamp does not light and the fuse does not blow within 24 to 48 hours of continuous subjection to this test, the transformer may be deemed satisfactory for the circuit of Fig. 19. This time may be considered as sufficient for any corona or glow discharge within the transformer windings to effect a final breakdown, if this is due to take place, and thus at least other components will be saved compared to the same breakdown in a final circuit after up to 50 operating hours.

It must be stressed, that with a good transformer of reputable manufacture no serious danger exists, and the author's circuit is in periods of non-stop operation of a week or more at a time, with perfect reliability.

The constructor should avoid the use of miniaturised transformers for this circuit, as insula-

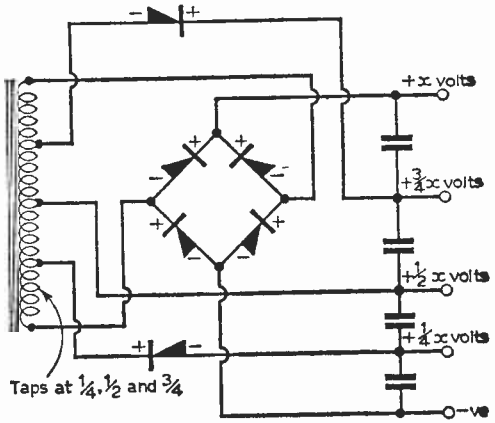
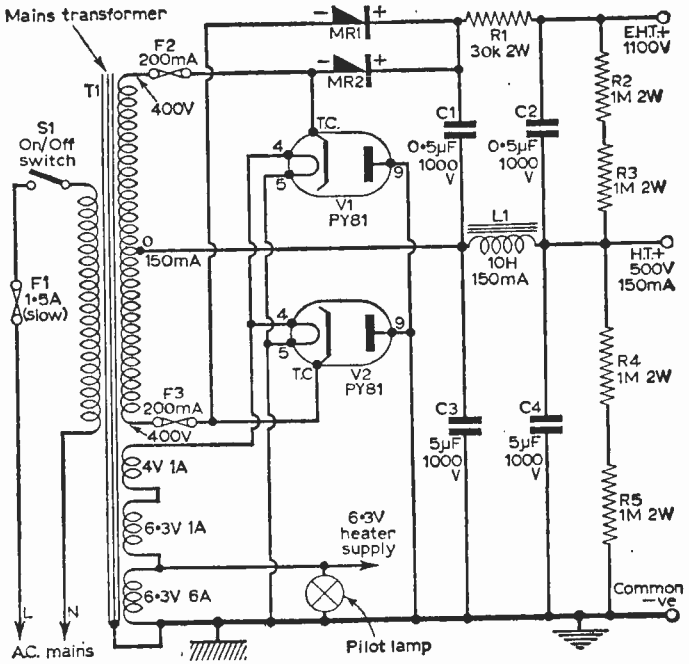


Fig. 18 (above)—A multiple rectifier circuit for obtaining several outputs of varying voltages.

Fig. 19 (below)—A special power supply circuit which was used to feed Geiger counter apparatus. (MR1, MR2—E500C5)



tion is there not as generous as in mains transformers of conventional size, and it is advisable (if it can be identified) to use the end of the H.T. winding which is innermost, i.e. closest to the primary, for earthing in the above described soak-test for a doubtful transformer. In all these experiments it should be remembered that one is dealing with very high peak voltages at low impedance, which could prove immediately lethal if passed through the human body. *It is thus essential to make all connections and disconnections only when*

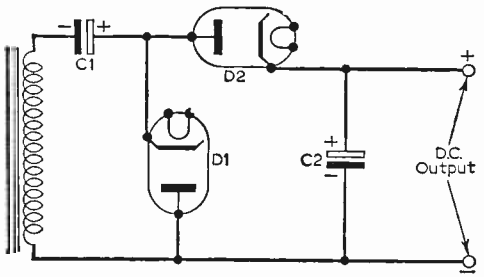


Fig. 20—Cascade voltage doubler circuit.

the mains is switched off and disconnected, and after all condensers have thereafter been shorted with a heavily insulated screwdriver.

It should also be remembered that, under unfavourable circumstances, the voltages involved can flash across up to a tenth of an inch of air or more. This danger is vastly increased if sharp spikes of solder are left on connections. If these spikes cannot be avoided, they must be filed off carefully after the joints have cooled. Loose ends of strands of wire lead to the same dangers.

The constructor of modern times must work with television and oscilloscope equipment, etc., and thus it is pointless to say one should avoid the use of high voltages on account of their dangers. A healthy respect and understanding for high voltage must be developed, and a clean, careful methodical way of working. This experience should first be gained in the use of equipment at normal voltage. A constructor who is still continually receiving small electric shocks from such equipment would be ill-advised to start working with EHT-circuitry, as his experience or methods of working, or both, are then obviously still inadequate. This point cannot be stressed too strongly in a practical magazine of this nature, and the author is convinced that repeated warnings can serve only a good purpose in preventing accidents.

High Internal Impedance

Modern television EHT generators using the line-output stage are much less dangerous, in spite of the vastly greater voltage, because of the very high internal impedance. But such circuits are generally inconvenient and prohibitively expensive in other applications which do not require the whole magnetic line-timebase circuits anyway. Thus it is not possible to avoid using low-impedance EHT circuits sooner or later. Nevertheless, where the expense is justified, the author definitely recommends the use of line-timebase type EHT circuits. Such have high cost, poor regulation and poor voltage stability without special refinements, *and even they could easily give a lethal shock* so that the same precautions mentioned above are still needed.

Returning to the circuit of Fig. 19, the unusual choice of rectifiers merits some discussion. It is seen that a pair of PY81 television booster-diodes are used as H.T. rectifiers. Here we have high current *and* high peak inverse voltage requirements, which previous discussion in this article has shown to be best met by the use of *valves*. The choice of valve for the author's circuit then fell on a booster diode type because of the high heater-cathode voltage rating of these valves compared to conventional H.T. rectifier valve types. The PY81 booster diode is rated at 5kV peak between heater and cathode, a very useful value in unusual rectifier circuits, and the mean anode current is well in excess of 100mA peak rating, enabling at least 200mA D.C. to be drawn from a full-wave pair, a value comparable to the larger full-wave rectifier valves of conventional type. The PY81 is thus already a great favourite in the author's special designs. The heater-cathode voltage rating is so high that all valves in even the most complex circuits may be run from a single heater winding, even for circuits of moderate EHT in the region of 1kV to 2kV D.C. output! Furthermore, one side of this heater supply may be earthed if desired. A disadvantage is the unusual heater voltage of 17V, which the author normally obtains from a couple of 6·3V windings and a 4V winding all in series.

Feeding Other Valves

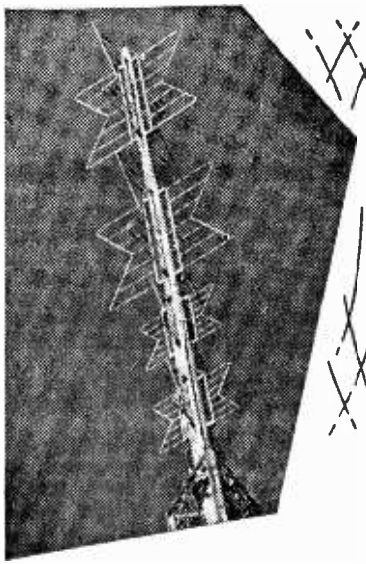
On account of the permissibility of earthing one side of the heater supply, other valves may be fed from the same heater supply or tappings thereon. In such cases one side *must* be earthed, as otherwise the EHT voltage could be impressed across the heater-cathode path of the amplifier valves as well, causing immediate breakdown. Earthing one side of the heater supply also removes the EHT voltage strain from the heater winding on the transformer; thus it is advisable to earth one side of the PY81 heaters as a matter of course in all cases, as shown in Fig. 19.

The EHT supplement, in the form of a conventional fundamental positive full-wave circuit of positive output w.r.t. the centre-tap of the transformer windings, is fitted with a pair of high-voltage metal rectifiers in Fig. 18. These form the simplest solution here, and are of reasonable price on account of the low current-drain required on the EHT output.

The Cascade Voltage Doubler

Fig. 20 shows another form of half-wave voltage doubler, which is used far less frequently. This circuit is included here on account of one advantage, namely the fact that one pole of the A.C. input and the D.C. output are common, which is not the case for the conventional voltage doubler. Thus, the cascade voltage-doubler is the only practicable circuit for doubling the mains voltage direct without a transformer, keeping a common neutral/earth line.

(To be continued)



On Your Wavelength

By THERMION

Those Electronic Games

MY recent comments on the apparent lack of interest in this branch of our hobby had failed to produce any material comment from readers and I was beginning to think that there must be some big snag in the subject when I received a letter from Cpl./Tech. White of the R.A.F. who has summed up the position very clearly, I think. He suggests that the expense of making this type of equipment is probably the biggest snag, but makes the point that the majority of our readers are more interested in making normal radio sets and experimenting with improvements and "gadgets", and that only very advanced students dabble in the electronic games aspect, or conditioned reflex "robots",—and that these enthusiasts are few and far between, and are probably not interested in ordinary radio and as a result are not numbered among our readers. I must agree that I think this is true, but it would be very interesting to know that it is not, and to hear from some ordinary type of reader (as distinct from an advanced student) who has managed to make some progress in this field and I am sure that his activities and results would interest others.

To those who wrote, many thanks.

Artificial Troposphere

I have received a very interesting letter following on my comments in the December issue on the effects of various activities in space carried out in the name of "research". The letter comes from one of our readers in Germany who says:

"Regarding radiations emitted from atomic explosions remaining and accumulating in space, this is in principle not to be disputed. If not complete, then at least partial continuous accumulation is scientifically established. That such an accumulation could disturb ordinary wireless communications, if it reaches sufficient intensity, is also quite true. The question thus boils down to asking whether this sufficient intensity is likely to be reached, and here the answer seems to be a pretty definite "No". The following reasoning should make this point of view clear. The sun itself is simply nothing else but one colossal atomic hydrogen bomb, and has used exactly the same energy-producing processes for countless centuries, as man has only learned to produce on earth in recent years. The nuclear intensity of the sun corresponds to the explosion of many thousands of atomic bombs per second, of the largest size man has yet made. Yet all this radiation from the sun has succeeded in producing through the ages, as regards radio-communication, is our well-known ionosphere, and its well-known effects on shortwave radio, etc. Admittedly, the sun is about ninety million miles distant, but nevertheless, the discrepancy between the rate of release of atomic energy of the sun and from man-made devices is so great that the man-made contribution to a radiation-belt screening the earth is vastly smaller than that present due to the sun anyway. Furthermore, space itself is so vast, that colossal amounts of radiation can accumulate in it without any appreciable rise of local intensity. The dangers of atomic-bomb fallout are of a different nature. Here we have unstable atoms of debris thrown into the atmosphere, which drift with the weather, to be washed down later in rain somewhere. The unstable atoms in this rain will then explode later, giving *new production* of *local* radiation. But this unstable atomic debris in the air will not disturb radio-communication any more than an ordinary fog does to which this debris is analogous."

Any comments?

Remote Controls

The increasing use of remote controls for television receivers brings to mind the complete absence of any devices of this nature for ordinary radio. I think I have mentioned before, there was at one time on the market an extremely simple, but very efficient little device which enabled one to switch a radio (battery or mains operated) on or off from any room in the house, and the only power required to operate it was a small torch battery. It consisted of a small solenoid, the plunger of which operated a star wheel which alternately opened and closed a simple "on/off" switch contact mechanism, and this was inserted between the power supply and the set with extension leads from the actual control to a simple push (bell type) switch. This device was quite cheap, and I had a switch in each room in my house and used it for a considerable period, but I cannot now remember why it was discarded. I am sure it did not go wrong or breakdown, and I am sure many listeners would be glad to see some device of this nature now on the market.

BOOKS REVIEWED

CABINET HANDBOOK—by G. A. Briggs. 112 pages. Published by Wharfedale Wireless Works Limited, Idle, Bradford, Yorkshire.

YET another book by G. A. Briggs makes its appearance. This time Mr. Briggs writes about almost every aspect of cabinet design and construction. The presentation follows the author's usual inimitable style in which a wealth of technical information is presented in an easily readable form which includes numerous detailed explanations. The descriptions are enlivened in many instances by humorous references which add to the appeal of the work and not as might be thought detract from it. For instance, the author recounts how when testing a guitar and amplifier in the open air, scores of people were entertained in the village of Idle "as the guitar could be heard half a mile away".

As well as dealing with the acoustic design and performances of cabinets, the author also discusses the actual construction and the following list of chapter headings will give some idea of the coverage of the book:—Material; Plywood; Adhesives; Veneering; Machines; Assembly; Polishing; Mesh; Resonance; Absorbents; Home Equipment; Cabinet Design; Treble Enclosures; Electric Guitars; and Room Treatment. This is a book which can be recommended to all hi-fi enthusiasts.

RADIO CONTROLLED MODELS—by R. H. Warring. 134 pages. Published by Museum Press Ltd. Price 16s.

ENTHUSIASTS of radio controlled model building must combine knowledge of electronics and mechanics to pursue their hobby, as apart from the problem of transmitting a signal to a suitable receiver on the model, some mechanical method must be used to change the electrical action in the receiver to a physical movement of the controls of the model. Therefore a large part of the interior of the model must be devoted to batteries, receiver and actuator (the device for converting the action of the receiver relay into mechanical movement) and in most cases this means designing both the mechanical and electrical equipment on a very small scale to fit into the limited space available.

It is here that the constructor with no previous knowledge of this kind of work usually comes unstuck and it is at this point also that this book will prove invaluable in making unnecessary the time-wasting, and often heart-breaking experiences of experimenting with various control systems which the enthusiast will have to make when no such guidance is at hand. The disposition of the equipment about the model is of great importance (especially in model aircraft), the correct use of the batteries to run the controls also; these and all the other finer points, which would only occur to the average constructor after a good deal of trial and error, are dealt with in detail in this publication and it will save a great amount of wasted effort if referred to before any building begins.

The fundamental facts of radio control are dealt with but the author quickly moves out of theory after the first chapter, into descriptions of practical equipment. Transmitters, receivers and actuators each have a separate chapter devoted to them and then various refinements of the basic systems (such as multi-channel equipment etc.) are dealt with.

FUN WITH ELECTRONICS—by Gilbert Davey. 64 pages. Published by Edmund Ward Limited. Price 12s. 6d.

THE definition of the word "fun" must, of course, depend largely on the fun-maker, as one person's way of amusing himself would not suit a thousand others. But to the young beginners in amateur radio and electronics in general—for whom this latest work of Gilbert Davey has been published—this book will, at first sight, prove a disappointment. Mr. Davey has secured the admiration of thousands of boys through his series on television and his articles and books dealing with the world of amateur radio, but in this book many will find that the practical side of electronics has been neglected rather and too much space has been devoted to descriptions of commercial equipment, which combined with the frequent reference to manufacturers' data, detracts from the idea that is suggested by the title, which is to have "fun with electronics".

However, the book includes several designs suitable for young radio enthusiasts, with clear and concise descriptions of the construction of receivers, amplifiers, etc. In chapters of a practical nature, the author ensures that the reader does not simply put the components together without knowing why or how they work—all constructional detail is preceded by an explanation of the theory involved. This is what makes Gilbert Davey so popular—his ability to explain "what makes it tick" without baffling his pupils with scientific jargon.

As stated before, there are several chapters which describe commercial equipment, such as tape recorders, car radios, amplifiers etc., and to some—especially to those beginning to take an interest in hi-fi—this information will prove very useful, as much of the field of electronics, by virtue of the complexity of the circuits involved and the expense of components, is outside the knowledge and the pocket of the amateur constructor, who must then, necessarily, turn to manufacturers' equipment. Therefore, the chapter describing tape recorders, for example, will prove valuable to anyone contemplating buying one as these instruments are difficult to make for the amateur without much experience of construction to make. The same applies to the chapters on record players and on loudspeaker enclosures.

The book ends with an interesting chapter describing the uses of electronics in industry, the services, science and education.

SERVICING TAPE RECORDERS

RECORDING AND PLAYBACK EQUALISATION

(Continued from page 227 of the July issue)

By T. S. Smith

LET us recapitulate a little and have another look at the diagrams on pages 52 and 53 of the May, 1962, issue. Fig. 6 showed how a constant current recording is made so that the magnetic induction on the tape is equal over the audio spectrum. Fig. 7(b) showed how the output on replay would rise with frequency to a peak due to the tape signal passing through a replay amplifier with a flat frequency response, as in Fig. 7(a).

The article last month made clear why the output rises at a constant rate of 6dB/octave to a maximum and why the output falls as the frequency is further increased. The whole point in question, therefore, is how to achieve an output which is flat over the greater part of the A.F. spectrum. A typical frequency response characteristic is shown again in Fig. 16.

From a study of this, it becomes obvious that two things must happen. Firstly, the lower frequencies up to the peak (often known as the "turnover point") must be boosted, and the higher frequencies after the turnover point must also be boosted. These things are carried out partly during the recording process and partly during the replay operations. For example, on 'record', a considerable treble boost or lift is applied to the amplifier at a frequency and magnitude depending on the tape speed and the exact characteristics of the heads.

The curve in Fig. 17 shows such treble lift on a recording amplifier, while the curve in Fig. 18 shows what the replay response would be like by using treble boost on record and zero bass lift on playback. At around 3,000c/s. the bass falls as before (Fig. 16) at the rate of 6dB/octave, but there is a definite indication of treble lift and the response is approximately flat from about 3.000c/s to 10kc/s. It is still far from perfect, of course, and would sound thin and lacking in lower frequencies.

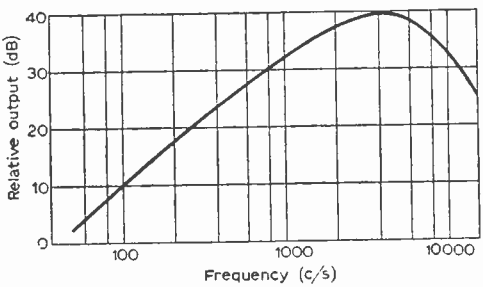


Fig. 16—A typical frequency response characteristic with the bass falling at the rate of 6dB/octave.

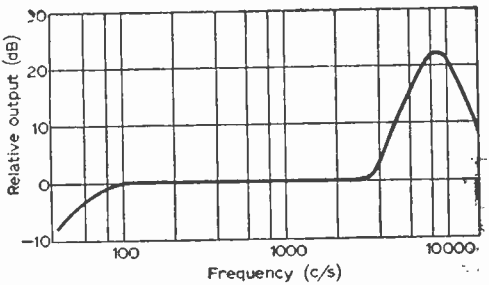


Fig. 17 (above)—How the record amplifier response is given a boost at the high-frequency end to avoid the treble falling too rapidly after the turnover point (see Fig. 16).

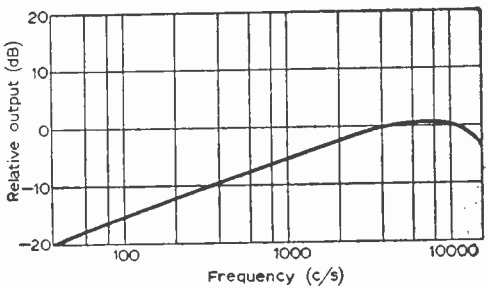


Fig. 18—The replay characteristics on a flat amplifier from a tape which has been recorded with treble boost, as at Fig. 17.

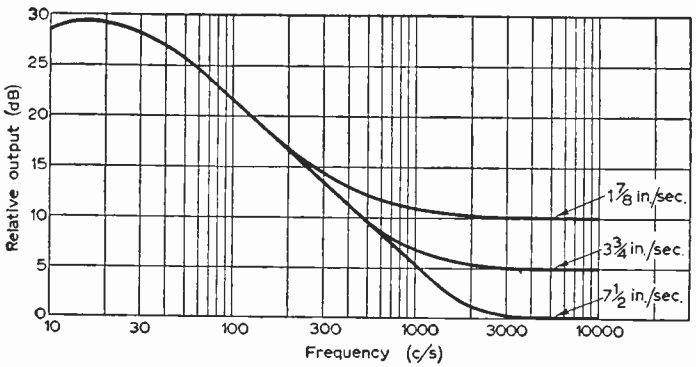


Fig. 19—Three degrees of bass boost corresponding to different tape speeds. Such boost is usually applied to the replay amplifier.

In Fig. 19 are shown three degrees of bass lift on playback corresponding to the three indicated tape speeds. In a similar pattern, three degrees of treble lift when recording are given by the curves in Fig. 20, while the curves in Fig. 21 reveal the overall frequency response characteristics at the three tape speeds of 1⅞, 3¾ and 7½in./sec. These, of course, are created by making the recordings according to the patterns in Fig. 20 and replaying them with the responses of Fig. 19.

This, then, is equalisation, and the curves in Figs. 19, 20 and 21 relate to a tape amplifier circuit designed by Mullard Limited and described in their leaflet TP421 under the title "3W Tape Amplifier Circuit".

Treble Boost Circuit

The treble is usually boosted in the coupling following the microphone amplifier or pre-amplifier of the recording channel. Quite a reasonable amount of boost is needed as may be seen from Fig. 20, and this is invariably accomplished by a resonant circuit consisting of an inductor and parallel-connected capacitor (sometimes the capacitance is contributed by that of the winding of the inductance).

In Fig. 22 is given the circuit of a pre-amplifier which is often the first stage in the recording channel (this could also be the first stage in the playback channel which, on "playback", would have the head switched into circuit instead of a microphone or radio). The pre-amp stage is usually designed to accept either a microphone signal or a signal from the detector circuits of a radio receiver. When the signal is coupled to the "mic" jack, it is applied direct to the control grid of V1, across R1. This is because full gain is necessary on the low-level microphone signal, but when the signal is applied to the "radio" jack, attenuation occurs due to the potential-divider network R2 and R3. This constitutes a form of "level" equalisation, as distinct from frequency equalisation, which is the prime subject of this article.

The amplified A.F. is developed across the anode load resistor R4, and from here it is fed through C2, R5 and R6 to the resonant circuit L1/C1. Now, at frequencies away from resonance, the signal level applied to the voltage amplifier is dependent on the ratio of R5 to R6. The network C1/L1 as far as the signal is concerned is low impedance, meaning that the bottom end of R6 can be considered almost as connected to chassis. Let us suppose that R5 and R6 are of equal value and that C2 is sufficiently high to avoid low frequency attenuation. Then, off resonance, half the signal at the anode of V1 will be fed to the voltage amplifier.

What happens at resonance? Since the circuit is parallel-tuned, the impedance across its terminals (A-B) rises sharply at resonance to a value governed by the "goodness value" (i.e., "Q") of the tuned elements. Let us suppose that L1/C1 is tuned to 8kc/s and that at that frequency the impedance across A-B in series with R6 causes the ratio R5:R6 to rise from half to three-quarters. In this event, then, the voltage applied to the amplifier would also rise from half to three-quarters—but only at resonance. In this way, therefore, the boost is applied in the recording response at the required frequency.

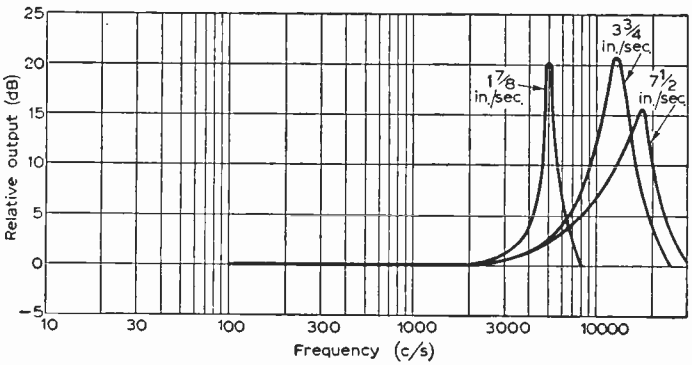


Fig. 20—Three degrees of treble boost, showing how the boost frequency is related to tape speed.

Correction for Different Speeds

As shown by the curves at Fig. 20, top boost has to come in at frequencies to suit the tape speed (and also the characteristics of the head), and

therefore, on multi-speed recorders, some means of switching the recording equalisation is required.

This is simply accomplished on the resonant type of circuit by switching in the appropriate parallel capacitor, as shown in Fig. 23. The values given are taken from the Mullard amplifier referred to in the foregoing text, and L1 is wound on a Mullard Ferroxcube pot core, Type WF816. This gives high efficiency (Q) and excellent equalisation at the lower tape speeds. The frequency of resonance of any tuned circuit is equal to

$$\frac{1}{2\Pi\sqrt{[10^6.L.C]}}$$

where C is in microfarads and L in Henrys.

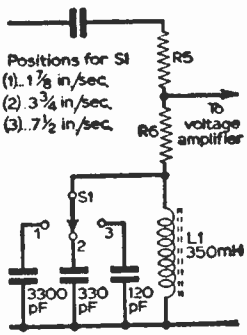


Fig. 23—How the capacitive element of the resonant circuit is switch to give treble boost at the frequency to suit the tape speed.

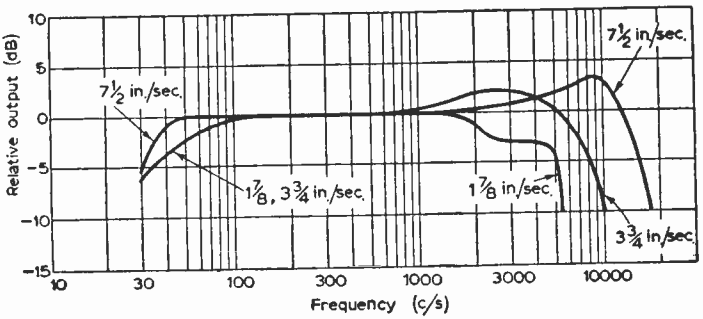


Fig. 21—When the bass boost of Fig. 19 is applied to the replay amplifier, and the treble boost of Fig. 20 is applied to the record amplifier, the resultant overall response is as shown here.

In certain cases, L is made adjustable with a dust-iron core, and misadjustment here should be suspected if there occurs a distinct loss of treble which is definitely not caused by head misalignment or other more obvious defects. In a case such as this, however, it would be as well to check the replay channel on a test tape or tape record and if "top" were then present, then the trouble would almost certainly lie in the record channel.

Bass Boost for Playback

Now is the time to look at the bass boost circuitry used in the playback channel. Such a circuit is given in Fig. 24 and, as with the recording channel, the bass equalisation follows the pre-amplifier — in this case, the replay head amplifier. Instead of an inductor, a capacitor is used in the coupling network, which is C1 in the circuit. What happens is that the capacitor has a low impedance at high frequencies and an increasing impedance as the frequency is decreased. Thus, a potential divider is formed by R1 in one arm and by R2 and Xc in series in the other arm, and the output voltage (that applied to the voltage amplifier) is that which occurs across R2 and Xc in series.

Now, at the high-frequency end of the A.F. spectrum, Xc contributes but little to the bottom arm of the potential divider, and the output voltage is almost proportional to the ratio of R1 to R2. However, at decreasing frequencies Xc adds to R2 progressively, thereby producing an alteration in the overall ratio. *(To be continued)*

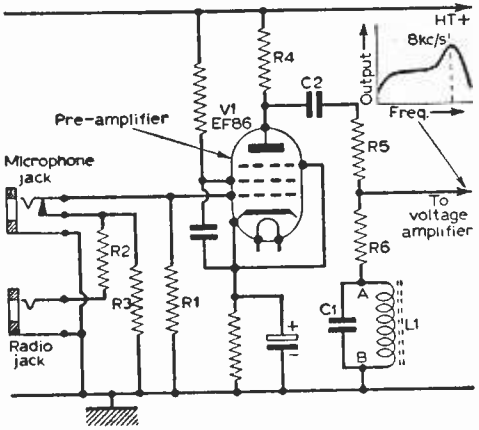


Fig. 22—The pre-amplifier (or microphone amplifier) stage of a record amplifier with treble boost introduced in the coupling circuit by the tuned circuit L1 and C1.

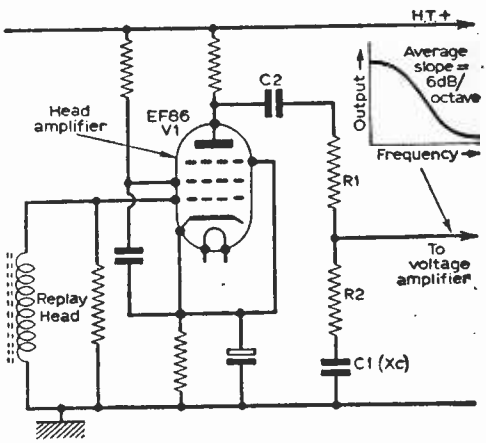
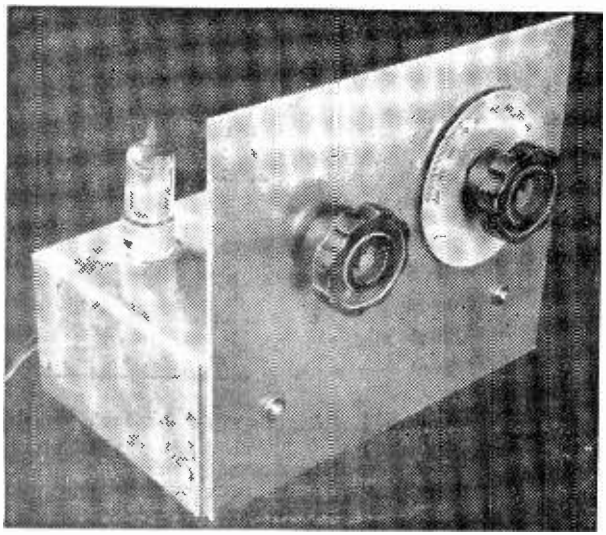


Fig. 24—How the bass boost is applied to the replay pre-amplifier coupling network.



the ATI

S.

THIS is a very simple receiver, and thus suitable for beginners. If used as a single-range receiver, it will cover approximately 15m to 40m, and this includes those bands most generally used for long distance reception. The set also works well on other wavebands, over the range 9m to 200m, and can easily be wired to take plug-in coils.

Circuit

The circuit is shown in Fig. 1, and none of the component values is critical. The tuning capacitor, VC1, is shown as 160pF, but 100pF to 200pF may be fitted, with some change in band coverage. Current is obtained from a mains power pack, and the phones are isolated from H.T. and mains voltages. The receiver will be safe, if the power pack is arranged as described. Consumption is quite low, and it may be possible to take supplies from an amplifier or receiver. If so, the safety precautions mentioned for the power pack should be observed.

Regeneration in the detector is controlled by VR1 and this gives high sensitivity. Reaction is obtained by a cathode tap on the coil, and this is an effective and very satisfactory method. The second valve acts as an audio amplifier, with bias developed across R5, which is 10M. C3 should be a mica condenser, to avoid upsetting working conditions.

Coil Windings

For a single, fixed coil, a waveband of about 15-40m is most generally satisfactory, as mentioned. This coil is thus recommended. But if it is wished to tune other wavebands, it is quite easy to wind further coils for these. Ribbed plug-in coils, with a chassis mounting holder to suit, may be easily obtained, and as many coils can then be wound as wanted.

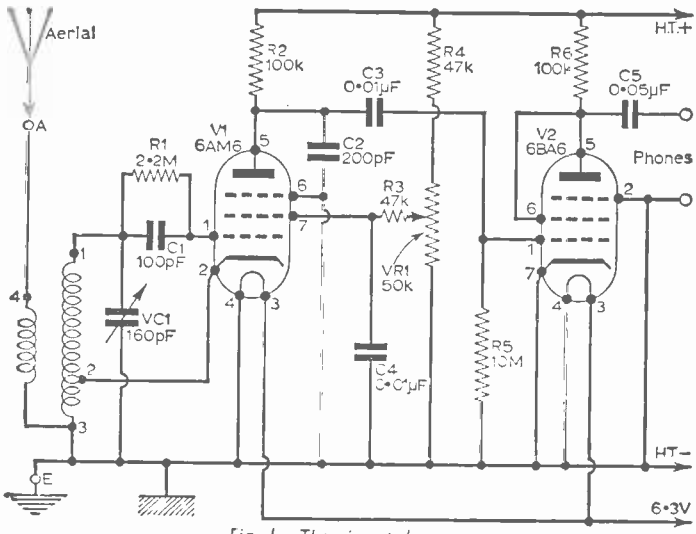


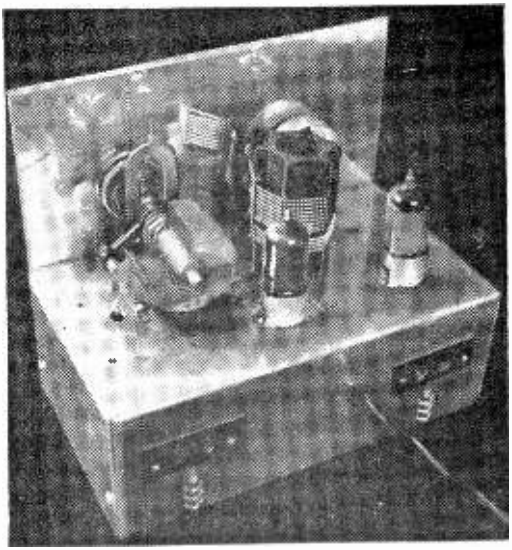
Fig. 1—The circuit diagram.

For the 15-40m coil, a ribbed former about 1¼in. to 1½in. in diameter, and at least 2in. long, will be required. The windings are shown in Fig. 2. There is no need to adhere to the exact wire gauges, turns spacing, or other details. Changes in these, or in the coil diameter, will modify the band coverage, but results should be just as good.

The grid winding of the 15-40m coil consists of 9 turns of 22s.w.g. tinned copper wire, turns being spaced to occupy about 1in. The cathode tap is soldered on one-half turn from the earthed end of the winding. For aerial coupling, 4 turns of 26s.w.g. wire are used, this winding being about ⅛in. from the grid winding, as in Fig. 2. The ends of both windings are

ANTIC
N.TWO

by F. G. Rayer



joined, as indicated, this lead going to the receiver chassis.

Other Ranges

If required, other coils can be wound to give approximate bands as follows:—

9-15m 4 turns 20s.w.g. occupying 1in. space; tap at ¼ turn; aerial coupling, 2 turns.

30-60m 16 turns 24s.w.g. occupying 1½in.; tap at ¼ turn; aerial coupling, 6 turns.

60-110m 32 turns 24s.w.g. occupying 1½in.; tap at 1 turn; aerial coupling, 8 turns.

100-200m 55 turns 24s.w.g. occupying 1½in.; tap at 1¼ turns; aerial coupling, 12 turns.

Aerial coupling windings of coils covering 30 to 200m can be of 28s.w.g. or similar enamelled wire, with turns side by side, to save space.

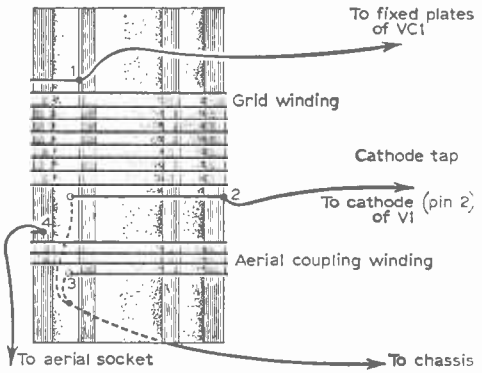


Fig. 2 (above)—The coil winding details.

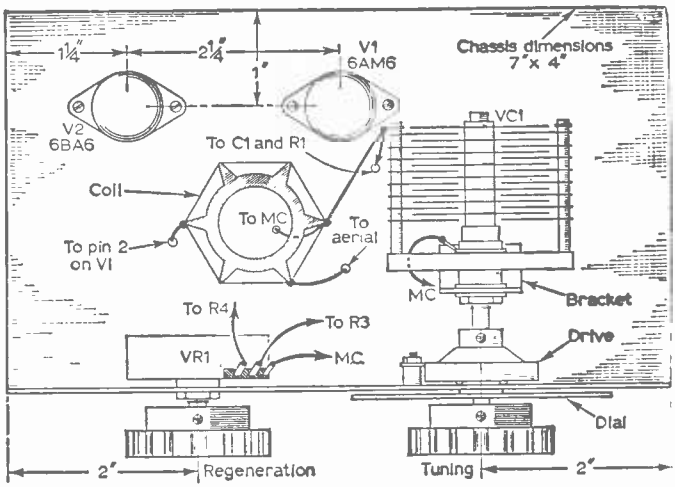
Chassis and Panel

Fig. 3 shows the layout, the chassis being 7in. x 4in. and 2in. or 2½in. deep. The panel is 7in. x 6in. and is secured to the front runner of the chassis by means of two 6B.A. bolts. Fig. 3 will allow the valveholder holes to be suitably placed, and indicates the positions for valves.

Further details of the tuning drive will be seen in Fig. 5. The dial is slightly clear of the panel, some form of reduction drive is essential, and a small ball-drive of this kind is easy to fit. The projecting lug on the drive must be prevented from rotating, and this is arranged by passing a bolt through the panel, as in Fig. 3 or Fig. 5. A slotted bracket will allow the tuning capacitor to be mounted at the correct height, so that the whole turns smoothly.

The moving plates tag of the tuning capacitor is connected to a tag bolted to the chassis. Lead 1 from the coil is left long

Fig. 3 (below)—The above-chassis layout of components.



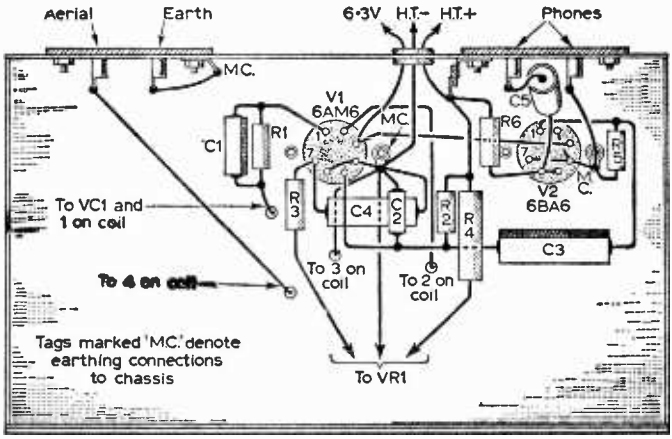


Fig. 4 (right)—The underchassis wiring diagram.

enough to reach the fixed plates, as in Fig. 3. An insulated lead also passes from this point, through the chassis, to R1 and C1.

Lead 4 of the coil is long enough to reach the aerial socket, and is covered with sleeving. The cathode tap goes to pin 2, as indicated. The remaining coil lead passes directly through the chassis to a tag.

Three leads are taken from the 50k potentiometer; all these may be passed through a single hole, provided they are correctly identified, or the lead marked 'M.C.' may be earthed to the panel at the potentiometer bush.

Wiring and parts underneath will be seen from Fig. 4. A tag is placed on each bolt holding the valveholders, and also on the bolt near the earth socket E. These points, marked M.C., are in good contact with the chassis. If the valveholders are if the type with a centre metal spigot, this is joined to the nearest M.C. tag.

A single tag, on a small tag strip, and insulated from the chassis, forms the H.T. positive junction point, for R2, R4 and R6. The three supply leads emerge through a grommet in the rear runner, and should be identified to make sure there is no error in connecting the receiver to its power pack. A lead from the chassis forms the H.T. negative connection, and is also the return for the heater circuit. Pins 3 on both holders

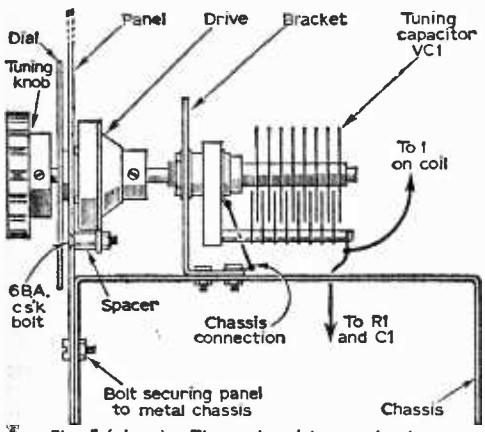


Fig. 5 (above)—The tuning drive mechanism.

COMPONENTS LIST

Resistors:

R1	2·2M	R4	47k 1W
R2	100k 1W	R5	10M
R3	47k	R6	100k 1W
VR1	50k		

Capacitors:

C1	100pF mica	C4	0·01μF 250V paper
C2	200pF mica	C5	0·05μF 500V paper
C3	0·01μF mica		

VC1 160pF S.W. tuning capacitor (see text)

Valves:

V1	6AM6	V2	6BA6

Miscellaneous:

Chassis—approximately 4in. x 7in. x 2½in.; panel—about 7in. x 6in.; two twin sockets for Aerial, Earth and Headphones; insulated tag strip; two B7G valveholders; condenser bracket; 6 : 1 or similar ball-drive; two 1½in. knobs; 2¾in. or similar 0-100 or 0-180 dial; ribbed coil former about 1½in. x 2½in. long (or 1½in. diameter plug-in coil formers, and chassis socket—Eddystone).

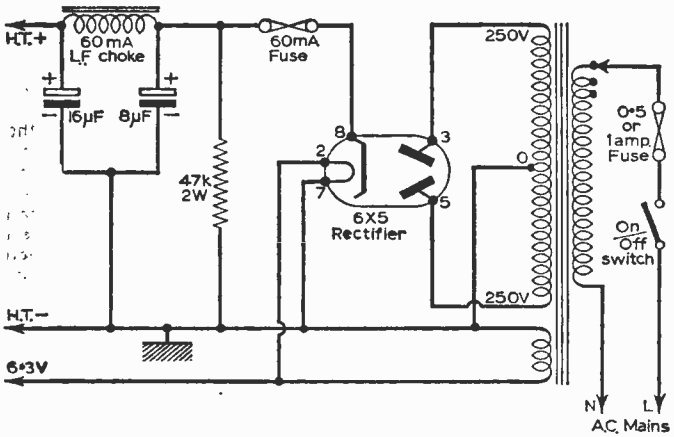
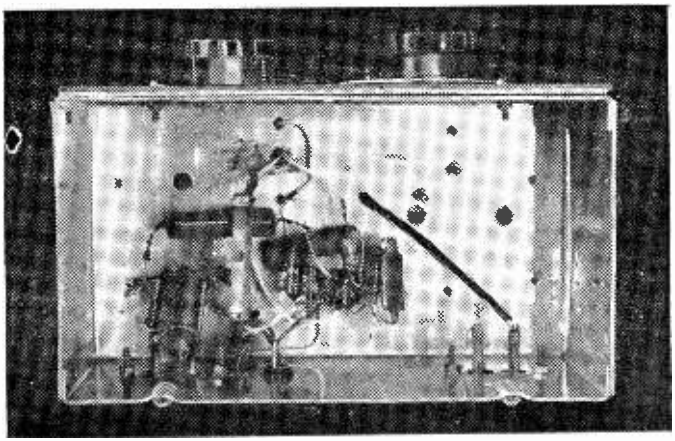


Fig. 6 (left)—The circuit of the power supply.

are joined, and the lead from this point is for the 6·3V supply. The remaining lead is for H.T. positive, as described.

The wires from R1 and C1 to pin 1 should be short, to avoid hum. For the same reason, the wires from C3 to R5, to pin 1 of the second holder, should be short, direct, and clear of the heater lead.



An underchassis view of the receiver

Power Supply

If a mains unit is to be constructed for the receiver, the circuit in Fig. 6 will be satisfactory, and can provide current for larger equipment, at a later date. The 6X5 requires 0·6A for its heater. Added to the 0·6A of the two receiver heaters, the total consumption is 1·2A, so a 1·5A winding will easily provide this current, and also current for a 6·3V, 0·3A indicator lamp, if wanted. A 6·3V heater winding with a higher current rating is also suitable.

The receiver requires a very small H.T. current, at 150V to 250V or so. For the receiver only, the smoothing choke may be replaced by a 5k resistor. However, the power pack is more useful for other purposes when a choke is used. The H.T. voltage will rise somewhat, with little or no current drawn, so a 47k bleeder resistor is fitted. The H.T. voltage can be reduced, if wished, by wiring a resistor between the 60mA fuse, and choke. This fuse is merely to protect the rectifier and transformer, in the event of an H.T. short.

Current is drawn from a 3-pin plug, and the chassis of the receiver is earthed. If this earthing is effective, and a 500mA or other low-rating fuse is included in the mains circuit as in Fig. 6, mains voltages cannot be present at the receiver, even if the mains transformer were faulty.

If preferred, the power pack can be scaled down, to provide a supply of up to 10mA or so, at 150V to 200V. This can be arranged by using a small metal rectifier, and "feeder" type mains transformer. The earthing, and mains fuse should not be omitted, however.

The receiver must not be worked from an A.C./D.C. power circuit, in which the H.T. negative line is connected to one mains lead.

Operating Notes

Any kind of aerial can be used, including short indoor wires. Naturally a fairly efficient aerial will give best results with the weaker, more distant stations. If the aerial is at all long, a small condenser should be added in series with it, at the receiver. A 25pF pre-set trimmer is suitable, or the lead-in can be twisted for a few inches round another insulator wire, to form a small capacity.

Tuning will be very sharp and critical, especially with weak stations, and with loose aerial coupling. Reaction is also very critical, with weak distant stations. Powerful stations will be heard easily, and the exact setting of the reaction control will not then be very important, but, for weak stations, this control must be operated very carefully. It is slowly turned clockwise, from zero, until the set is just on the point of oscillation. Sensitivity is then extremely high, and very long distance reception is possible. The reaction control should be carefully adjusted, as necessary, while tuning. It must not be rotated too far, or the receiver will oscillate and sensitivity will be reduced.

A COMPACT CONVERTER *(Continued from page 305)*

Waveband switching could be fitted but would necessitate a larger chassis with consequently lengthened leads. Separate trimmers, TC1 and TC2, were used in the original, but these might well be an integral part of an existing twin gang capacitor. Use of a 500pF (nominal) type is possible for tuning, but high grade mica 1000pF fixed capacitors must be connected in series with each section to reduce the maximum capacitance value.

Constructional Notes

The dimensions of the small chassis with all necessary cutting and drilling details are shown in Fig. 2. The front panel carries all the variable controls, and the dimensions of this are shown in Fig. 3. Hardboard or plywood may be used provided aluminium foil is glued firmly to the back to eliminate hand capacity effects later. Quadrant—⅛in. or ¼in.—should be cut and mitred to provide rigidity and also improve the appearance. The chassis and front panel may be fixed together by whatever is considered the simplest method. Coils L1 and L2 should be mounted direct and locked thumb tight only by means of the polystrene locking nuts provided, but, for L3, the lid of the metal container supplied should be drilled and the coil mounted through it. The body of the tin can be screwed into position later.

(To be continued)

Faults in Transistor Output Stages

By J. Christy

HOW TO DEAL WITH DEFECTS IN THE AUDIO AMPLIFIER

INCORRECT operation of the audio amplifier, or output stages of a transistor receiver, will most probably cause unsatisfactory results. Reproduction may be distorted, or there may be lack of volume, or current consumption may be too high, so that the battery fitted in a miniature receiver has only a short working life.

Any of these defects can make the receiver disappointing, but fortunately troubles of this kind are among the easiest to cure. In many cases the fault may arise from nothing more serious than the use of resistors of incorrect value.

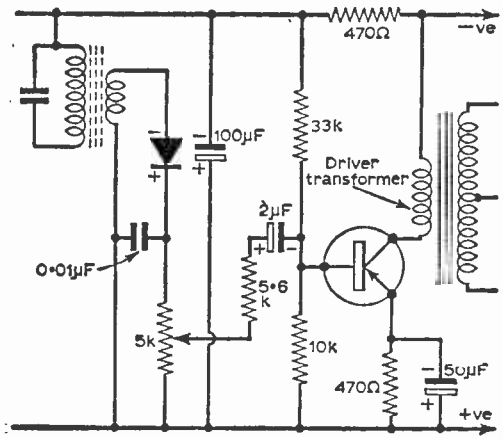


Fig. 1—A diode detector and class A driver stage.

Audio Check

It is fairly easy to check the audio signal which is being obtained from the earlier stages of the receiver. If this signal is strong, clear, and free from any objectionable distortion, then distorted reproduction from the loudspeaker is arising in the audio or output stages.

Previous stages, and the quality to be expected, can be checked by listening to the signal available from the diode detector with medium impedance headphones. To avoid upsetting the AVC action, and the direct-current working conditions, an isolating condenser of about 0·25μF to 0·5μF should be included in one headphone lead. The phones are then wired from the slider of the volume control to the battery positive line. Speech and music should sound free from distortion, and really loud.

It is also possible to listen to the signal with an audio probe or tester, or amplifier. The usual care should be taken to avoid introducing hum, instability, or external voltages into the transistor circuit.

Driver Stage

Most circuits use a driver, followed by push-pull output stage. A typical driver stage, with values for an OC71 transistor, is shown in Fig. 1.

The phones and isolating condenser already mentioned form an easy means of checking this stage. Volume should be reduced, and the headphone lead transferred, with isolating capacitor, from the volume control slider to the driver collector. This should bring about a great increase in volume, and the quality of reproduction should still be satisfactory.

Distortion in this stage can be caused by incorrect base and emitter resistor values. If the stage is very noisy, and consumes more than about 1·5mA to 2mA, the 10k resistor value is probably too high, or the 33k resistor value too low. An error in reading the colour code could be suspected. Current may be checked with a meter between driver transformer primary and battery negative line.

If reproduction is distorted, the base voltage is probably too positive. A low value in the 10k position, or a high value in the 33k

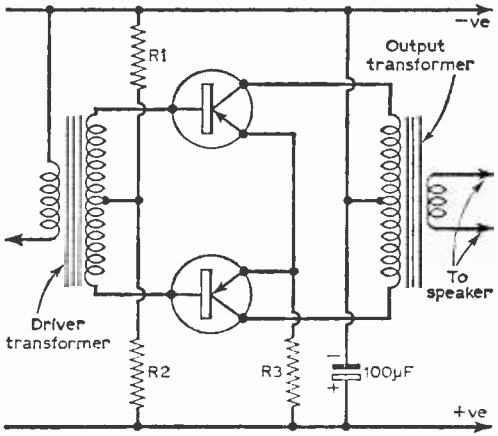


Fig. 2—A typical class B output stage.

position, could be responsible. Here, 47k and 10k values are often employed with a 1k emitter resistor.

It is relatively easy to check the values of the two base resistors, and the emitter resistor in this stage. Lack of volume may also be caused by a defective 50μF condenser. This may be checked, if necessary, by temporarily wiring a further condenser in parallel with the one already fitted. The exact value is not critical.

If these points are in order, the transistor must be suspected. Surplus or alternative transistors may need different resistor values, or have a high noise level, or introduce distortion when volume is attempted.

Class A Output Stage

A few receivers have Class A output stages, employing a single transistor. This transistor is often driven by an audio stage similar to that in Fig. 1, though resistance capacity coupling is probable.

If the driver stage is giving satisfactory results, as already described, the same tests can be applied to the Class A output stage. That is, base and emitter resistor values should be checked, and the emitter bypass condenser can be tested.

Fig. 3(a) illustrates the operation of a Class A stage, either driver or output. The transistor is conducting during the whole of the audio cycle, and there is little difference between the current with no signal, and the average current with a signal. Such stages thus pass a fairly high, steady current, even with no signal. If the base voltage is too negative, the waveform moves upwards, so that the shaded area representing current flow increases. This results in excess current, in the way previously described. If the base voltage is too positive, the waveform moves downwards, so that the current almost or completely ceases in the dips, causing the distortion mentioned.

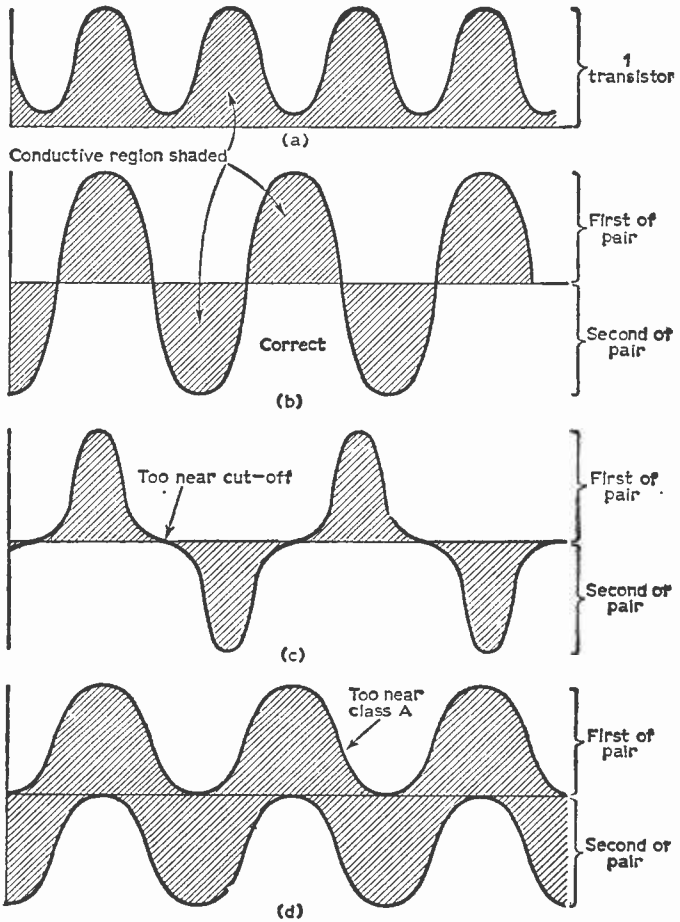


Fig. 3—Correct and incorrect operation of output stages.

Class B Output

Fig. 2 shows a popular type of Class B or push-pull output stage. The resistor values must suit the transistors. For OC72's, R1 might be 6·8k, R2 might be 220Ω, and R3 might be 4·7Ω. If other transistors are used it is almost certain that one or more of these resistor values will have to be changed for proper results.

The low value of R2 makes the transistor base voltage near positive, so that each transistor is passing only a small current, with no signal. The current taken by the pair may be about 2mA to 7mA, with no signal.

When a signal is present, each transistor is driven by its own half of the transformer secondary. Ideally, each of the pair conducts similarly on different half-cycles, as in Fig. 3(b), combining to operate the speaker through the centre-tapped output transformer. (The ideal conditions shown are not wholly attained in practice.) With signal peaks, the pair will be drawing about 15mA to 25mA, the current depending directly on the volume.

If the base voltage is too positive, the pair will pass very little current, with no signal. When a signal is present, the output may be similar to that in Fig. 3(c). This cross-over distortion (lack of linearity) is very unpleasant, and sounds in some ways like a defective loudspeaker. The cure is to increase R2, or reduce R1 (see Fig. 2).

If the base voltage is too negative, each of the pair will work in a similar manner to a Class A amplifier. The way in which the signals combine may be represented by "D." The overall output is much reduced, and the no-signal current of the

pair is high. If R1 is increased in value, or R2 is reduced, this trouble will be removed.

R2 is frequently of very low value, perhaps 68Ω to 220Ω or so. The secondary of the driver transformer contributes to the resistance in series with the base, and this has some effect on results. If a driver transformer of different type to that specified for a circuit has been used, some slight change in the value of R2 may thus be necessary.

The emitter resistor R3 is sometimes omitted. This resistor can help to maintain operating conditions during changes of temperature. A typical fault of this kind arises when the receiver is left in a cold room, so that the drop in transistor temperature brings the transistors nearer the cut-off conditions shown in Fig. 3(c). If this happens, reproduction may sound distorted, but this may cease after a time, when the transistors have slightly increased their temperature.

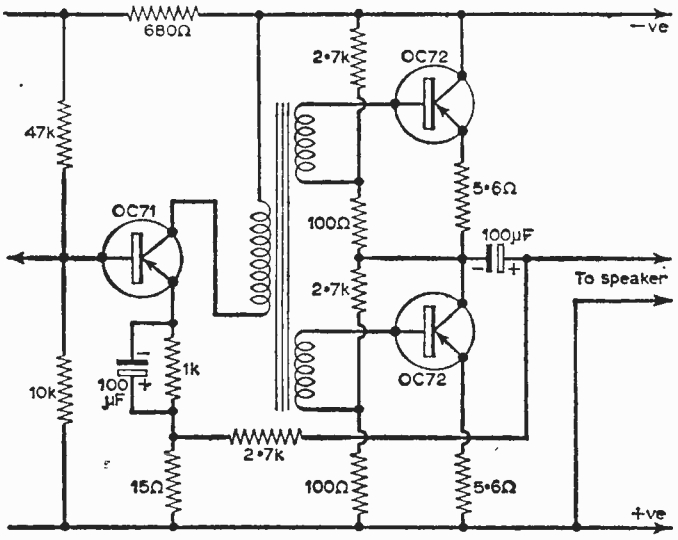


Fig. 4—A push-pull output stage without an output transformer.

Matched Pair

Both transistors are supplied by the same resistors R1, R2 and R3. They should thus have as nearly as possible the same operating characteristics.

For best results, it is thus wise to employ a matched pair, which have been selected by the maker, and boxed together. If two individual transistors of the same type are purchased, they may work together satisfactorily. Alternatively, they may really require slightly different base voltages. If so, the output from the pair will approximately resemble that obtained by adding the top of Fig. 3(b) to the bottom of Fig. 3(c), or the top of Fig. 3(b) to the bottom of Fig. 3(d).

Transformers

For best results, the resistance and ratio of both driver and output transformer should suit the driver and output transistors. This means that transformers intended for a particular driver and output pair will not usually give best results with alternative transistors, unless they are of very similar type indeed.

If transistors such as the OC71 and OC72 are merely replaced by larger power transistors, such as OC81D and OC81, this will only cause a worsening of results, unless operating conditions are changed to suit.

Single-Ended Push-Pull

Circuits of this kind are also used in miniature sets, and one, with values for the OC71 and OC72's, is shown in Fig. 4. If this is examined, it will be seen that each transistor operates on half the supply voltage. Each transistor may be regarded as a separate amplifier, with its own base and emitter resistors. Output is obtained from collector and emitter, and the loudspeaker is coupled by the 100μF condenser.

For correct working, resistor values have to be provided as already explained. It is also necessary that the two separate halves of the driver transformer are connected in the correct phase. (This is automatically assured with the centre-tapped transformer in Fig. 2, unless actual wiring is incorrect.)

Fig. 4 also shows a typical negative feedback circuit. This is from the junction of the loudspeaker and 100μF condenser, through the 2·7k resistor, the feedback being developed across the 15Ω resistor. Note that the 100μF OC71 emitter condenser is in parallel with the 1k resistor, not from emitter to battery positive, which would short out the feedback circuit.

With all feedback circuits, the wrong phase will cause the amplifier to oscillate. Wrong phase may arise from connecting any transformer winding the wrong way round. With circuits like that in Fig. 2, feedback is often taken from the output transformer secondary. Reversed connections here may thus cause oscillation.

Most amplifiers of this type will remain stable with the feedback circuit disconnected. An easy test can thus be made to see if any oscillation is caused by this circuit.

Resistor Tolerances

If correct working is to be assured, without any experiment, the base voltage must be within close limits, for the reasons described. This means that close tolerance resistors should be used. For example, the 100Ω and 2·7k resistors in Fig. 4 should be within 5% of the specified value.

If resistors of wide tolerance are used, the values may be correct, or they may be too far from the specified value, so that results are poor. Resistors of 5% tolerance have a gold marking. A silver marking indicates 10% tolerance, and such resistors may be used elsewhere. Resistors with no

(Continued on page 333)

ELECTRONIC PROCESS TIMER

A USEFUL AND ACCURATE REPETITIVE TIMING UNIT

By E. McLoughlin

(Continued from page 230 of the July issue)

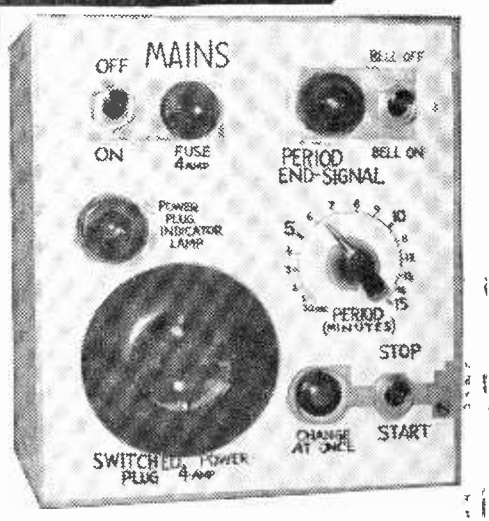
LAST month it was established that the exact value of R2 depended on the relay used and should therefore be found by experiment.

It is suggested that the constructor remove both valves and insert a variable resistor for R2 temporarily. R2 is then reduced until the relay energises, and is then slowly increased again until the relay just falls off again. Its value is then measured, and a fixed resistor 5 to 10% larger selected for R2. If, after the end of a period, the bell rings but does not stop again, then R2 is too small in value. If successive runs are all appreciably shorter than the first, then R2 is too high in value.

Power Supply

It is best not to use a mains transformer larger than necessary, as its low internal resistance would then cause unnecessarily high anode currents if S4 is held pushed-in too long. Constructors who have a larger transformer and wish to use it rather than purchase a new one, must protect the circuit by inserting a resistance between the cathode of V1 and the junction of R4, R5, R6 until a meter in series with Rly1 does not read more than 40mA when S4 is depressed and held depressed. About 100Ω will be roughly the value of this resistance; it will depend on the transformer and components used. It is highly advisable to check this point anyway.

When using the apparatus, do not depress S4 longer than necessary; once the bell rings or the relay has operated, release S4 at once. Do not use larger values for C2 and C3 than specified, as this very poor smoothing is fully deliberate. Firstly, it prevents excessive anode currents if S4 is depressed too long, and secondly it causes considerable hum to be amplified by V2 when the avalanche in V2 starts, thus gently shaking the Relay RL1 and preventing it sticking. The improvement in accuracy thereby is very noticeable.



The H.T. rectification is of normal voltage-doubler type with two metal rectifiers, with the centre connected to earth. This gives 350V H.T. and (−350)V as bias for V2. Check that the rectifiers are connected the proper way round. Remember that the voltage difference between the positive end of MR1 and the negative end of MR2 is 700 or more, and take appropriate precautions against shock or flashover. Use adequately insulated wire and good soldering. This is not only for safety, but also to prevent leakages which could

disturb such a long-period charge circuit. Take great care to connect the power plug correctly. Make absolutely certain that the earth-lead from the mains plug goes without interruption to the earth-pin on the power socket on the front panel, and that the same earth lead goes to the mains-transformer core. It would be very dangerous if the mains live lead were connected to the power-plug earth socket in error, as then the casing of any switched apparatus to be connected would be live at full mains voltage.

Critical Components

Two components in the circuit may cause difficulty in selection or supply. The first is C1. It is not necessary that the capacity value have any close tolerance, but the insulation must be really first class. Even a small leakage in C1 will cause erratic performance of the whole circuit. Thus, an electrolytic condenser is quite unsuitable for C1. A good modern metallised-paper condenser, preferably in a sealed, tropicalised, metal can, is ideal. Smaller ones may be connected in parallel, and, within limits, VR1 and R8 may be increased by the same factor as C1 is decreased, if only a smaller capacity-value is available for C1, or vice versa. Check the condenser to be used for C1 by charging it to its rated voltage. If it fails to give a good healthy spark upon shorting it some hours later, its leakage is very probably too high.

The second component likely to cause some difficulty in supply is the trip-relay Rly2. This is a type often used in automatic corridor and staircase lighting in blocks of flats, and such a relay is used by the author. It has an energising coil for about 6V A.C., and each time the current is switched on in this coil the main contacts switch alternately on and off. This trip-relay is normally designed for its magnet to be operated from the bell-transformer circuit, and its contacts to switch mains lamps up to about 4A.

Regarding the main relay Rly2, any more or less equivalent type is suitable. The resistance is by no means critical, but the energising, current-value of 20mA should be maintained, otherwise the whole circuit requires drastic modification. If no 20mA relay is available, then any more sensitive relay can be used if it is fitted with an appropriate shunt to bring it to 20mA. The procedure for this is exactly the same as shunting a meter.

When adjusting the circuit, connect a voltmeter across R5 and a milliammeter in series with the anode connection of V2. Adjust R3 with series or parallel resistors (or by fitting one as a

(Continued on page 330)

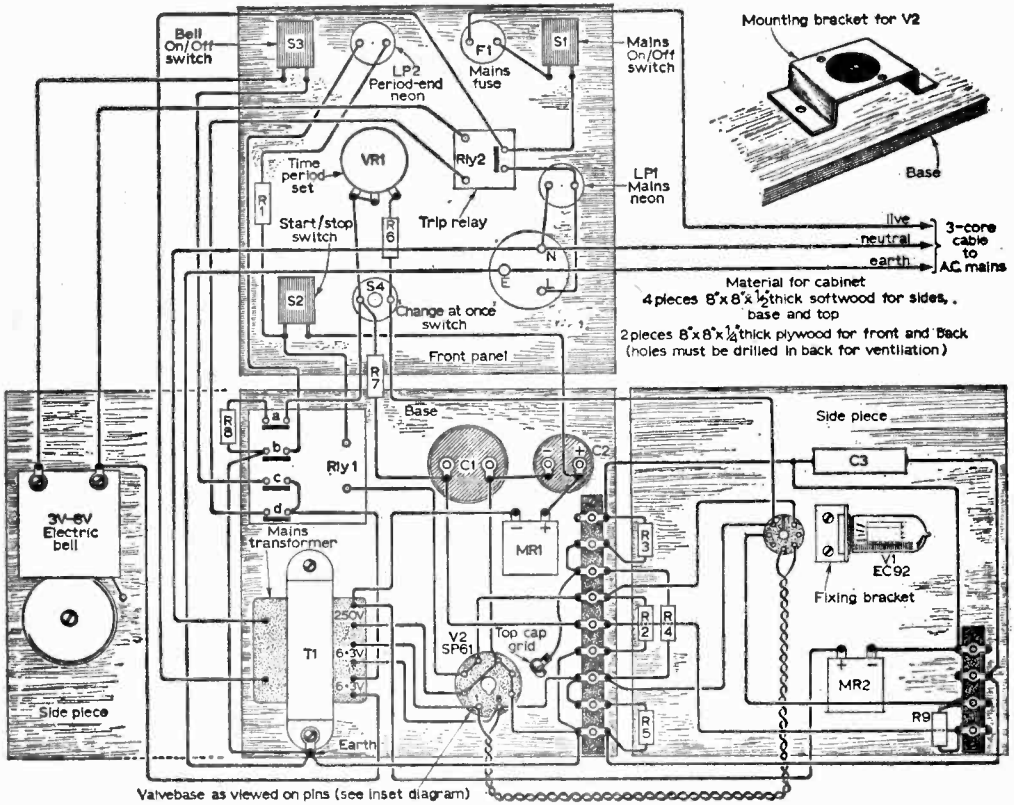


***Fig. 3**—The complete wiring diagram. The side and front panels have been lain flat to make the wiring clear.*

The P.W. Alpha 3 PERSONAL TRANSISTOR SUPERHET

(Continued from page 206 of the July issue)

AFTER the oscillator coil and I.F. transformers have been mounted on to the panel (as described in last month's issue) the transistors are soldered into position.

The mixer and I.F. transistors must be of appropriate type, such as an OC44 for mixer and OC45 for the I.F. stage. A wide range of audio transistors will be satisfactory in the A.F. position. The OC71 is suitable and a red/yellow spot transistor was found satisfactory. Pieces of 1mm sleeving are cut about ¼in. long and one piece is placed on each transistor lead. This will avoid short-circuits and hold the transistors at a convenient height. The emitter, base and collector leads must, of course, be passed through the correct holes, as shown by e, b and c in Figs. 3 and 4.

Wiring Up

Some 26s.w.g. tinned copper wire will be convenient for connections and 1mm sleeving is placed on all leads and the wire ends of components. Fig. 4 shows the underside of the panel (the tuning condenser and potentiometer are left until last).

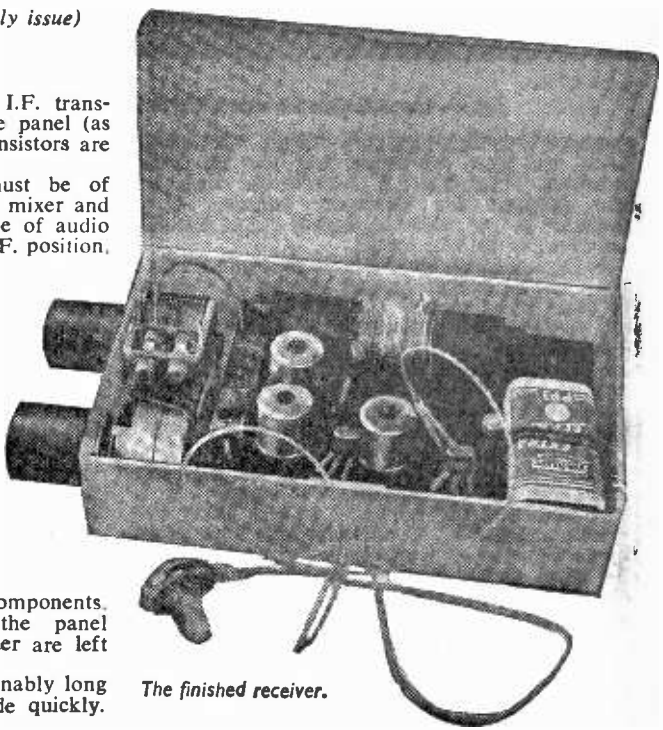
The transistor leads are all left reasonably long and the soldered joints should be made quickly. The same care to avoid overheating is also taken with the diode.

Lead "A" on the aerial is long enough to pass through a small hole to the earth line. Lead "B" passes through a second hole from the 0·05μF condenser to the aerial tapping. Lead "C" passes to the 50pF trimmer TC1, as in Fig. 3, a short lead subsequently passing to the front section of the gang condenser.

The collector lead of the A.F. transistor emerges through a second hole and one headphone lead is soldered to it, as in Fig. 3. The second headphone lead, through hole 'x' in Fig. 3 is soldered to a lead which is wired to the battery negative side of the circuit. A miniature 2-pin plug and socket could be used but is not really necessary when the earpiece can be accommodated in the case.

When all the wiring in Fig. 4 has been finished the tuning condenser and potentiometer can be connected. One switch tag is wired to battery positive; the other tag to the earth line, potentiometer slider and the frame of the tuning condenser. One outer tag of the potentiometer, shown in Fig. 3, is wired to the 0·25μF condenser at pin 5 of the I.F. transformer. One lead is then taken from each trimmer to the sections of the tuning condenser, as in Fig. 3.

After wiring has been checked the controls can be secured to the end of the case. Very small knobs are best avoided. The ¼in. 4B.A. bolt is then inserted in the hole in the case and a nut is tightened to hold it firmly. A further nut is then run on to leave about ¼in. clearance between panel and case. The panel is then dropped into position and held with a third nut.



The finished receiver.

The battery connections can be taken to suitable clips or they may be soldered. A meter may be added in circuit, when first trying the set, to ensure there are no short-circuits or to check the current flowing. This will be in the region of about 3mA to 5mA, depending on the actual battery voltage and transistors.

Alignment

This is similar to that of usual superhet circuits, though there are fewer adjustments. If a signal generator is available set it to 470kc/s, with modulation, and place the output lead near the mixer transistor. The two I.F. transformer cores are then adjusted for maximum volume. If a generator is not available, simply adjust the I.F. transformers for best results.

As the sensitivity control is turned up from zero there will be a considerable increase in volume. At some point around the halfway position the I.F. amplifier will commence to oscillate. This is intended, as sensitivity is then very great. The two I.F. cores are finally peaked up for maximum volume, when the sensitivity control is *just* below the oscillation point. This should be carried out while listening to a weak, distant station.

To align the aerial and oscillator circuits adjust the trimmers at a low wavelength and the oscillator coil core at a high wavelength. It is important that the trimmers have a fairly low minimum capacity. If trimmers with three plates are used it may be necessary to remove the screws and bend up the middle plate slightly to obtain a reasonably low capacity.

With the oscillator trimmer set at nearly minimum capacity a weak station should be tuned in. Adjustment of the aerial trimmer should then bring this station up to maximum volume, and the aerial trimmer should not be either fully screwed down or fully open. If best volume is obtained with the aerial trimmer fully open, screw down the oscillator trimmer slightly, readjust the tuning knob to obtain the station again, then try setting the aerial trimmer.

Alignment at the high wavelength end of the band can be achieved by adjusting the oscillator coil core in conjunction with the tuning condenser for best volume, or by sliding the aerial winding along the slab, leaving the tuning condenser untouched. Hand-wound coils vary somewhat in inductance, but moving the winding on the slab will compensate for this.

If sensitivity improves as the oscillator core is unscrewed and it is too far out, this shows that the aerial inductance is too low. Moving the winding nearer the centre of the slab will compensate for this. On the other hand, if the oscillator coil core is too far in, move the aerial winding nearer the end of the slab.

Alignment is usually fairly easy and has a very great effect on the results obtained. If the aerial and oscillator alignment is much in error it may only be possible to hear the local station. If so, search for a station a little lower in wavelength and then adjust the trimmers to bring this up to best volume. Then find a station a little higher in wavelength and make small adjustments to the aerial winding or oscillator core. Results should then begin to improve until full sensitivity is obtained throughout the whole tuning range. ■

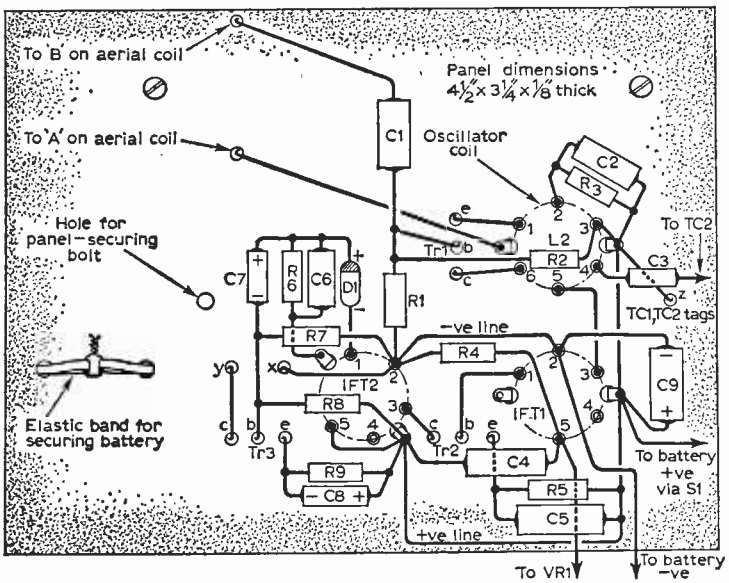


Fig. 4—The wiring on the rear of the receiver panel.

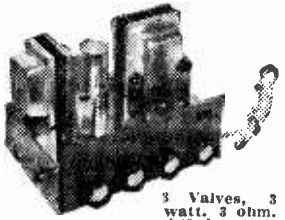
ELECTRONIC PROCESS TIMER

(Continued from page 326)

trimmer) until anode-current of V2 commences when the voltage across R5 has risen to just under 50. In most cases, the specified value of 2.2M for R3 should prove correct, but check this. If anode current in V2 starts too early, then R3 is too large, and vice versa.

No chassis is used. A stout wooden cabinet, the exact carpentry details of which are left to the constructor's taste, is indicated in its rough proportions, as used by the author, in Fig. 3. This wiring diagram represents a suggested layout, as used successfully by the author. The exact layout is relatively unimportant in this circuit. What is important is *meticulously good insulation throughout*. If any trace of instability is observed, try connecting a grid stopper (10k 1W) at the grid-cap of V2, or, as an addition to R9, a similar grid stopper (10k 1W) direct on to pin 6 of V1. Both grid stoppers may be required in some cases. ■

MULLARD 3-3 HI-FI AMPLIFIER



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Short-wave Listeners' Log

SEVERAL types of signals are used by amateur transmitters on the amateur bands, and the receiver needs to be operated accordingly, to obtain best reception. The systems most generally used are A.M. (amplitude modulation), C.W. (continuous wave), SSB (single sideband) and F.M. (frequency modulation). These signals can be heard with a communications receiver, or a receiver to which a beat frequency oscillator has been added.

Amplitude Modulation

This is most used, being the same as employed by medium wave and other broadcast stations. Any ordinary receiver will pick up A.M. signals. For such reception, no BFO is needed, and this is therefore switched off, if fitted in the receiver.

Some short-wave operators may listen exclusively to A.M. signals. This type of signal is, however, susceptible to interference, and may be useless during conditions when C.W. and SSB come through well. A.M. can give world wide results when conditions are reasonably good.

Continuous Wave

This method is used for Morse, the actual radiated wave being interrupted by keying. C.W. cannot be resolved with an ordinary superhet, as a BFO is required. For C.W. reception the BFO is thus switched on. The signal is tuned in as well as possible with the ordinary tuning control, and the BFO tuning knob is adjusted for best readability. Adjustment of the BFO tuning will change the audio pitch of the signal, and the BFO may be tuned above or below the carrier frequency, as required for least interference.

C.W. can be radiated by a very simple transmitter, and can get through interference better than A.M. C.W. may be heard with a TRF type set if reaction is adjusted until the set is oscillating.

Single Sideband

This method provides voice signals which have great ability to be heard through interference. SSB can be used when A.M. would be impossible, due to conditions.

An A.M. signal is a carrier with two sidebands, which carry the "voice" or audio part of the transmission. With SSB, the carrier and one sideband are eliminated at the transmitter, and only the other sideband is radiated. To make SSB intelligible, the carrier has to be re-inserted at the receiver. This can be done with a BFO.

When a SSB station is tuned in, there will be little or no carrier, and the signal will be quite unintelligible. After tuning for best volume, the R.F. gain must be reduced, so that the signal is weak, volume being restored by turning up the audio gain. The BFO is then switched on, and tuned so that its carrier occupies the frequency which would be taken up by the station carrier, if that were present. The sound then becomes intelligible as speech.

If no adjustment of the BFO seems to produce speech, the BFO carrier is probably on the wrong side of the SSB signal. To correct this, tune the BFO through zero, then adjust it as before. If the receiver has an AVC in/out switch, the automatic volume control circuit may be switched off. If the signal is distorted, the SSB may be too strong at the second detector, so the R.F. gain should be reduced even more. The aim is to match the SSB signal to the carrier level produced by the BFO.

Expensive communications receivers have special detector circuits for SSB reception. A BFO is a one-valve oscillator, tunable over the receiver intermediate frequency.

Frequency Modulation

Narrow band F.M. is occasionally used. With A.M. the voice or audio signal changes the amplitude of the carrier. With F.M. the audio signal is made to vary the frequency of the carrier. The usual type of receiver will not have an F.M. detector, but it is possible to resolve F.M. signals by tuning the receiver to one side of the station. This is known as slope detection. No BFO is needed, but high selectivity is helpful. ■

Faults in Transistor Output Stages

(Continued from page 322)

tolerance marking have a 20% tolerance, and are not recommended.

Loudspeakers

Distorted results are more likely to be caused by wrong working conditions, than an actual speaker defect. If gentle pressure on the speaker cone moves it in and out, without any noise caused by the speech coil touching the magnet assembly, the loudspeaker is probably in order. Obvious defects, such as a loose cone, should be seen easily.

A 2Ω to 3Ω loudspeaker will frequently be used in circuits like that in Fig. 2. For the circuit in Fig. 4, a 35Ω or 75Ω unit will generally be employed.

If the speaker is suspected, the output may temporarily be taken to an external 2Ω or similar permanent magnet speaker. If distortion is still present, the receiver speaker is probably in order. But if distortion clears with the external speaker, the receiver unit must be suspected.

In making this test, it should be remembered that 2½in. or similar midget speakers, in a very small cabinet, cannot be expected to give quite such good reproduction as a large, external speaker, possibly with a much bigger cabinet. But the comparison is useful, despite this fact. ■

Letters to the Editor

The Editor does not necessarily agree with the 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 the cover.

THE IDEAL FUTURE TRANS-RECEIVER?

SIR,—I know that it's going to be a very long time before some such apparatus become prevalent on the scene, but this "bug" of microwaves propagation not being suitable for transatlantic communication for example, due to the the earth's curvature, has forced me into thinking that the only perfect way of overcoming this defect in our technical forum is to seriously consider "two-stage transmission". Not utilising wave propagation as we know it, but by producing, instead of oscillators, reservoirs, which can suitably build up and amplify a system of potentials to a pitch, whereby they would escape in the form of a flow of high energy "photons"—I mean similar types of packets of energy which "Quantum" visualised; in fact substitute in practice the quantum theory for the wave theory of electromagnetic propagation. These emitted photons must then, somehow, be controlled and measured after their emission, so as to cause them to "explode" at a preselected distance, and thus create secondary wave-radiation which, it is foreseen, will greatly increase the range of intelligible communication through the "ether". — K. R. CRASKE (Lincoln).

SERVICING TAPE RECORDERS

SIR,—As I am engaged almost wholly in the servicing of tape recorders I should like to comment on a point raised by Mr. T. S. Smith in his article in the June issue about this subject.

Mr. Smith states that "residual magnetism is a very real danger so far as tape recorders are concerned" and goes on to advocate the use of non-magnetic tools. This is quite unnecessary in practice, since any competent service engineer would automatically use a defluxer on all relevant parts (heads, guide posts, etc.) on completion of service.

It is also quite in order to check the D.C. resistance of a head winding so long as the head is du-fluxed afterwards. Magnetism can do no harm to a tape recorder's performance so long as it is removed before a tape is loaded.—J. POCOCK (Wolverhampton).

LOCAL STATION PICK-UP

SIR,—I found R. Ferguson's letter (June issue), most interesting. Experiencing the same problem with my recorder I was relieved to know that I did not in fact own a "freak" instrument. However I would be happy to hear of any information and ideas from fellow sufferers in the hope that this most annoying problem could be solved.

I personally have tried all types of screening, earthing, coaxial leads, aerial trimmers, etc., all to no avail. I'm quite unable to rid my machine of the "three-in-one" programme reception which insists on dubbing itself on to my tapes.—B. J. CLAXTON (Bridlington).

TEST TRANSMISSIONS

SIR,—I often receive signals on my short wave set from New York, Rome, Vienna, Berne, Tel-Aviv, Moscow etc., which are announced as "Test transmissions for receiver adjustment purposes", or something similar. Some of these transmissions are SSB, and I generally hear them between 8 and 16Mc/s. I wonder if anyone could tell me what the purpose of these transmissions is, and who they are intended for.—A. J. RICHARDS (Abermule, Montgomery).

A STRANGE FAULT

SIR,—I recently experienced a strange fault which might be of interest to other experimenters. It was in some experimental equipment I was using, and during the experiments I had reason to connect a resistor across another one in order to arrive at a different value. I then experienced trouble with the equipment under test, and could not find any logical reason for it. I changed the two resistors in parallel for one of equivalent value, and the trouble ceased. I then replaced the paralleled resistors by two others of the same value, and got the same trouble. Eventually it was found that the two resistors in parallel acted as a closed circuit which was being shocked into oscillation. I think it worth while now never to use this arrangement but always to make sure of using a single component to avoid this risk.—L. MENCE (Birmingham).

COPY OF P.W. WANTED

SIR,—I should like to know of any reader who would let me buy or borrow a copy of February 1954 PRACTICAL WIRELESS. I need this issue for the article on an electronic organ.—J. WATSON (227 Cemetery Road, Lidget Green, Bradford 7, Yorkshire).

UNIVERSAL AVOMETERS

Guaranteed perfect working order. Supplied complete with leads, batteries and instructions.
Model "D" 34 range £8.19.6 each
Model "" 50 range £11.5.0 each
Model "S" 20,000 ohm/volt model .....15 Gns.
Registered post 5/- extra.

R.C.A. AR.88 RECEIVERS

Model AR.88 D. Frequency coverage on 6 bands, 550 kc/s to 32 Mc/s. £35 each. Model AR.88 L.F. Frequency coverage on 6 bands, 75 kc/s to 550 kc/s and 1.5 Mc/s to 30 Mc/s. £32.10.0 each. Both models operate on 110/200/250 volt A.C. Supplied fully tested and checked and in excellent condition. Carriage 30/- extra.

AMERICAN C.B.S. TAPES

5in.	std. 600ft.....	13/-
5in.	L.P. 900ft.....	26/6
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5½in.	std. 900ft.....	16/-
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Brand new and guaranteed.

Please add postage. S.A.E. for full list.

24 VOLT D.C. PUMPS

100 gph impeller type. Suitable for water. 15/6 each. P. & P. 2/6.

MINE DETECTORS No. 4A

Will detect all types of metals. Fully portable. Complete equipment supplied tested with instructions. 39/6. Carriage 10/6. Battery 8/6 extra.

PRECISION COMBINATION VOLTMETER/AMMETER FOR A.C. AND D.C.

Two separate instruments housed in polished wood case, 6in. scales with knife edge pointers. Ranges:

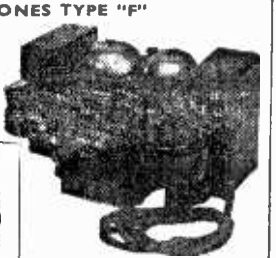
Volts A.C. and D.C. 150–300–600v.

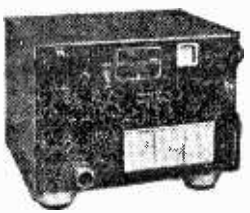
Amps A.C. and D.C. 25–50–150–200A.

Supplied complete with all current shunts, leads and leather carrying case. Manufactured by Elliott Bros. Supplied brand new. £9.19.6 each. Carriage 7/6.

FIELD TELEPHONES TYPE "F"

Ideal for all inter-com systems, house, garage, office, building sites, etc Generator bell ringing, 2-line connection. Supplied complete with batteries and wooden carrying case, fully tested. £4.19.6 per pair. Carr. 5/-.





COLLINS TCS RECEIVERS

BRAND NEW! Superb short wave receiver covering 1.5 to 12 Mc/s on 3 bands. Circuit incorporates r.f. and a.f. gain controls, b.f.o., etc. Power requirements 225v. H.T. and 12v. H.T. Supplied brand new with circuit. £6.19.6 each. Carriage 7/6.

P.C.R. COMMUNICATION RECEIVERS

6 valves. Frequency coverage on 3 bands: 850–2,000 metres, 190–550 metres and 6–18 Mc/s. Super slow motion drive. AE trimmer, tone control, built in speaker. As NEW £6.19.6 each. Carr. 7/6.

P.C.R. 2 RECEIVERS

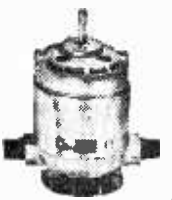
850–2,000 metres, 190–550 metres, 6–22 Mc/s. Output for phones or 3 ohm speaker. AS NEW, £5.19.6. Carr. 7/6. Both above models can be supplied with internal power unit to operate on 200/250 v. A.C. at 39/6 extra or alternatively plug-in external power units are 35/-. Circuit and details are supplied with each receiver.

NATIONAL H.R.O. RECEIVERS

BRAND NEW! Senior model, table mounting. Complete with a full set of 9 coils covering 50 kc/s to 30 Mc/s. Supplied in original transit cases. £25. Carr. 20/-. Power units to operate direct from 200/250 volt A.C. 59/6 extra.

1kV.A. ISOLATION TRANSFORMERS

230v. pri., 230v. sec. Boxed. £5. Carriage 10/-.

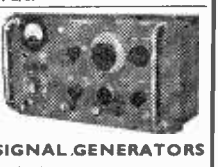


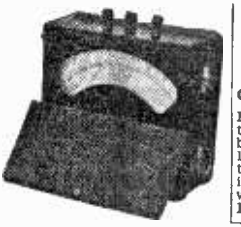
230/250 VOLT A.C. MOTORS

Size 4¼in. x 3in. dia., 90 watt rating, 5,000 r.p.m., ¼in. drive spindle. Brand new, 22/6 each. P. & P. 1/6.

JEMCO 20,000 OHM/VOLT TESTMETER

D.C. and A.C. volts up to 1,000v. Current up to 500 mA. Resistance up to 5 megohm. Decibels from —20 to +36 dB. Supplied brand new, guaranteed with instructions, leads and battery. 5 gns. P. & P. 2/6.





CT-53 SIGNAL GENERATORS

Precision instruments covering 8.9 to 15.5 Mc/s and 20 to 300 Mc/s on 6 bands. Variable attenuator from 1 microvolt to 100 millivolts. Operation 110/200/250 volt A.C. Supplied in perfect working order complete with calibration charts. 19 gns. each. Carriage 10/6.

★ PRECISION A.C. & D.C. VOLTMETERS

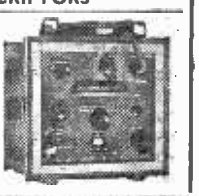
Two ranges, 160 and 320 volts. 3in. mirror scale with knife edge pointer. Housed in polished wooden case. Ideal for schools, labs., etc. Supplied brand new. £5.19.6 each. P. & P. 3/6.

7.5kV.A. AUTO TRANSFORMERS

0–115–230 volts. Brand new, boxed. £15. Carriage 10/-.

COLLARO STUDIO TAPE TRANSCRIPTORS

Brand new 1962 model. 3 speeds, 3 motors, digital counter, etc. Fitted with latest Bradmatic heads and interlock button. Supplied with spare spool, instructions and fixings. 10 gns. each. Carriage paid.



CLASS "D" WAVEMETERS Mk.II

Hetrodyne crystal controlled frequency meter covering 1.9 to 8 Mc/s. 6 volt D.C. operation. Supplied brand new and complete with crystal, valves, spare vibrator, headset and instruction manual. 59/6 each. P. & P. 3/6.

Trade News

7,500V A.C. HIGH-POTENTIAL TESTER

A 7,500V A.C. high-potential tester has been added to Raytheon Company's Sorensen range of products.

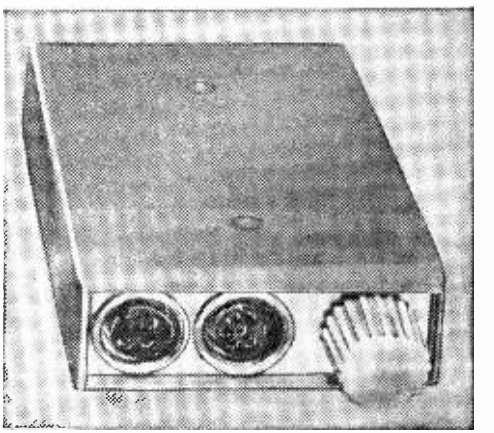
Designed to test and measure cable and equipment breakdown limits, the Sorensen 800 Series high-potential testers feature a direct-reading kilovolt meter and a continuous variable voltage over their entire output range of zero to 3,000 or zero to 7,500V A.C.

A "breakdown" current indicator lamp, precisely calibrated by a potentiometer for a predetermined load current, shows that point when the 10mA current is at or above the selected load, or flashes at breakdown, pinpointing the minimal limit of the tested object.

Incorporating an internal overvoltage protection circuit, the Sorensen air-cooled testers operate from a nominal input of 117V A.C., single phase, and are 6½in. wide, 8¾in. high and 10½in. deep.

Full particulars on the Sorensen 800 Series portable A.C. high-potential testers may be obtained in Europe from *Sorensen-Ard, A. G., Eichstrasse 29, Zurich 3, Switzerland.* Inquiries from all other areas outside the U.S.A. should be addressed to *Raytheon Company International Sales and Services, Spring Street, Lexington 73, Massachusetts, U.S.A.*

A 7,500V high-potential tester from Raytheon.



A new pocket intercom amplifier from Amplivox Limited.

NEW POCKET INTERCOM AMPLIFIER

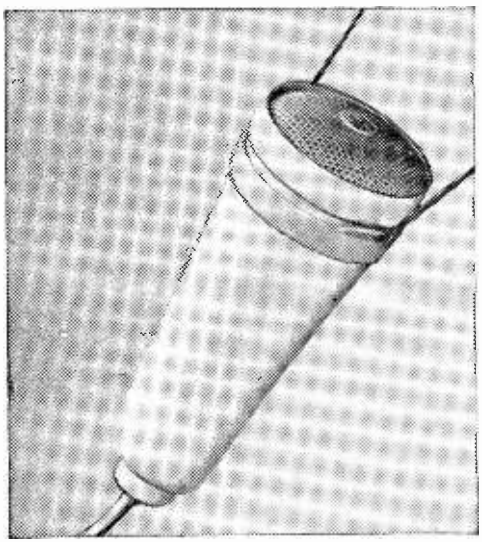
RECENTLY introduced by Amplivox is the Ampliphone Pocket Intercommunications Amplifier for multi-way communications over 2-wire lines, using boom microphone headsets. Special features have been included in this fully transistorised pocket or belt set to achieve superior speech intelligibility in high noise areas. Transmit and receive gain controls are provided and the amplifier is completely self-contained, operating from a 6V internal battery or, if necessary, from a central power supply. It is designed to work with ordinary magnetic, noise-cancelling magnetic or throat microphones.

Amplivox Limited, Beresford Avenue, Wembley, Middlesex.

NEW NECK MICROPHONE

A NEW Lavalier (neck) microphone, Model 4112, is to be introduced by Standard Telephones and Cables Limited. The first model was shown at the London Audio Festival recently.

The model 4112 is a small tubular omni-directional moving coil microphone of high quality, designed for use in broadcasting, commentaries and in public address systems. It weighs only 5oz and is provided with a light neck halter. Attachments are available enabling it to be used from a stand or as a table microphone.



A new microphone made by Standard Telephones and Cables Limited.

The frequency response of the new microphone is substantially uniform between 100c/s and 14kc/s and it has a sensitivity of −82dB referred to 1V/dyne/cm² (0·1mV approximately).

The case is of strong alloy, with a perforated chrome plated steel front. It has a durable plastic diaphragm.

The microphone is made by *Standard Telephones and Cables Limited, Connaught House, 63 Aldwych, London, W.C.2.*

NEW RECORD PLAYER

A NEW inexpensive record player has recently been introduced by Pam Radio and Television Ltd.

The record player—model 5200—features a four speed auto changer and costs only 17 guineas. The two tone cabinet houses a 7in. x 4in. loudspeaker. There is a choice of colour schemes for the cabinet —navy blue and grey or red and grey.

The record player is manufactured by *Pam Radio and Television Ltd., 295 Regent Street, London, W.1.*

NEW AUDIOMETER TO BRITAIN

RECENTLY introduced by the Zenith Radio Corporation of Chicago, U.S.A., is a portable transistorised model of a diagnostic audiometer which can carry out major hearing tests.

This new model is now available in Britain for immediate use by specialists, nurses, industrial and safety personnel, as well as by hospitals, schools, and hearing and speech centres.

Battery-powered, the audiometer measures 10⅝in. wide by 7in. high by 6⅛in. deep. It weighs only 8½lb including batteries, and the price is £150.

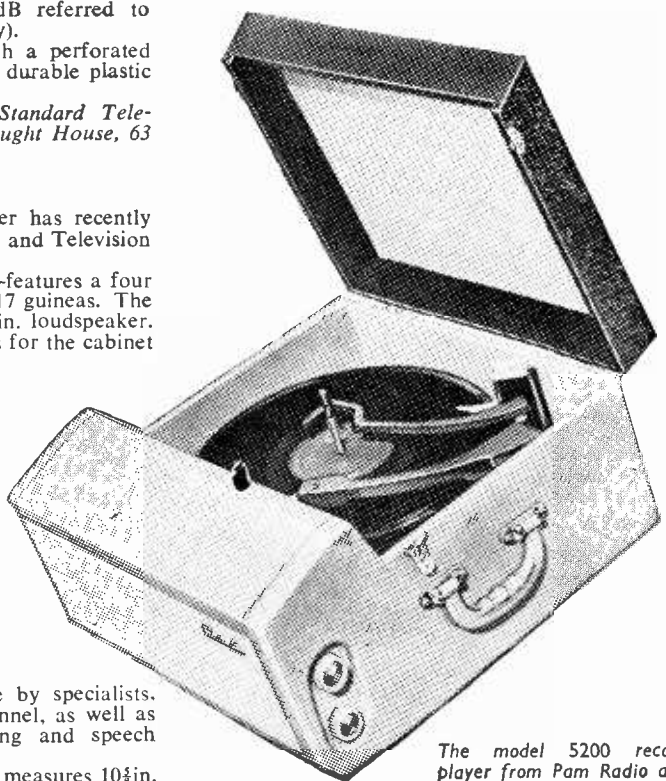
Known as the ZA-100-T, it is housed in a black vinyl and clear anodised aluminium cabinet. Battery-power also provides performance stability in both tone and volume output, a distinct advantage over vacuum tube models that are affected by even the small variations of electric line current that frequently occur.

The audiometer is capable of measuring frequencies from 125 to 8,000c/s for air conduction and from 250 to 4,000c/s for bone conduction.

It has temperature compensated circuitry which includes a transistorised thermistor stabilised Wien bridge oscillator. Also featured is a masking control calibrated in levels of total sound intensity above 0·0002 dyne/cm², a continuously rotating frequency selector dial, and frequency accuracy within ±3%.

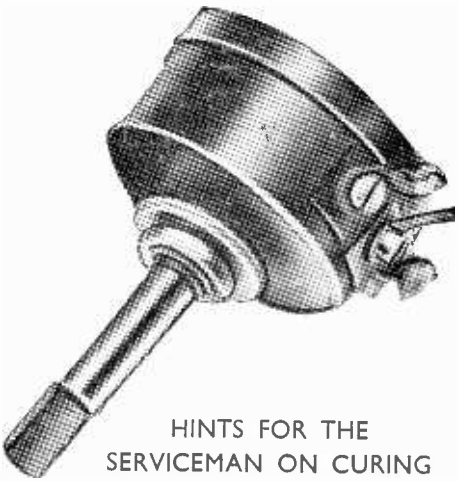
Supplied with the new Zenith portable audiometer are two headphones with cushions, a headband, yokes and cord; a bone conduction receiver and a clear plastic dust cover. Further versatility of the ZA-100-T can be achieved through accessories consisting of a magnetic microphone for communication with the test subject, and a shoulder carrying strap as a replacement for the normal carrying handle, both available at a slight extra cost.

U.K. distributors for Zenith audiometers and hearing aids are the *United Mercantile Company Limited, 13-14 Queen Street, Mayfair, London, W.1.*



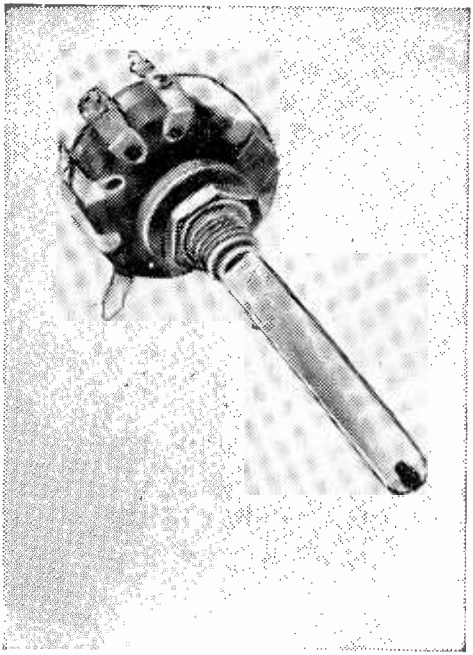
The model 5200 record player from Pam Radio and Television Ltd.

Noisy Volume Controls



HINTS FOR THE SERVICEMAN ON CURING A COMMON FAULT

By E. Dexter



HOW often does a receiver come in for repair with the complaint that every movement of the volume control causes severe scratching and crackling! This is probably one of the most frequent faults in receivers, and thus it is felt that this article will throw some useful light on this subject.

It is probably not generally realised that the symptom of noisy operation is in very many cases not due to the volume control itself, which is often perfectly in order. Cleaning or greasing of the carbon track, or even replacement of the volume control, will thus effect a very temporary cure, and sometimes no cure at all, to the exasperation of the experimenter. It is thus necessary to understand clearly the factors involved, to be able to distinguish between faults originating in the volume control itself and faults from causes outside the volume control.

Faulty Volume Control

If a volume control is faulty in the true sense (i.e., if the slider or the track-ends make insecure connections at some or all positions), various forms of crackling and fizzing are likely. But these will be accompanied by similar simultaneous fluctuations of the programme material actually being amplified, and it is this latter observation which is indicative of the fact that the volume control itself need

cleaning or replacement. When no audio input is applied to a defective volume control of this kind, and all else is in order, crackling should be very weak or absent in most cases—unless, of course, the volume control defect interrupts a negative-feedback chain or other auxiliary circuit-refinement. Thus a study of the circuit of the particular receiver is a necessary preliminary in all cases.

D.C. Leakage

If a volume control is situated at the input to a sensitive audio amplifier, or even one or two stages of audio amplification, as in a simple domestic receiver, then any movement of its knob is likely to produce severe crackling if there is a direct current flowing in the carbon track. This current can be, and usually will be, far too small to damage the volume control, and the volume control will usually be completely faultless.

The reason why D.C. in the track causes "movement-crackling" is very simple indeed; D.C. in the track causes a standing D.C. voltage drop across it. In the circuit of Fig. 1 this would give V2 incorrect bias anyway, which would cause distortion, the degree of distortion being dependent on the volume level set, because the portion of this incorrect bias reaching the valve depends on the position of the slider of the volume control VR1. Thus a receiver with the arrangement of Fig. 1, having D.C. on the track of VR1, due to leakage of C1, would also give severe distortion under some or all conditions of normal operation.

But supposing the actual arrangement is that of Fig. 2, which differs from Fig. 1 only in that the blocking condenser C2 and grid leak R2 are present subsequent to the volume control, then the valve V2 receives no incorrect bias, even if C1 is leaking, and causes D.C. in the track of VR1. Thus distortion will certainly not take place. But every *movement* of the slider of VR1 is *identical to an A.C. signal*, because the momentary value of the D.C. voltage presented to C2 changes thereby and is passed on to V2, etc., for amplification. The effective frequency of this "artificial signal" depends on the speed at which the operator twists the knob of VR1 and, more particularly, on very slight irregularities of the track of VR1.

Track Irregularities

It must be emphasised that the slight track-irregularities just mentioned are entirely normal and virtually unavoidable in anything but the newest and smoothest of volume controls. They may represent random fluctuations of, say, ±¼% of the resistance in rapid succession above and below the supposed value as the slider is moved. These fluctuations are *not* to be considered a fault and will produce no noticeable effects whatsoever under normal conditions and as long as *no* D.C. is flowing in the track.

But now suppose that, in Fig. 2 again, C1 is leaking such that 1V is dropped across the track of VR1. This will happen if the leak on C1 has some 300 times the resistance of VR1—i.e., about 150M, which can easily happen in practice!

Frequency

Suppose we have, for the sake of argument, one "irregularity cycle" of the magnitude (¼%) taken as example above per degree of twist of the knob. Suppose the operator turns the knob at the rate

(Continued on page 345)

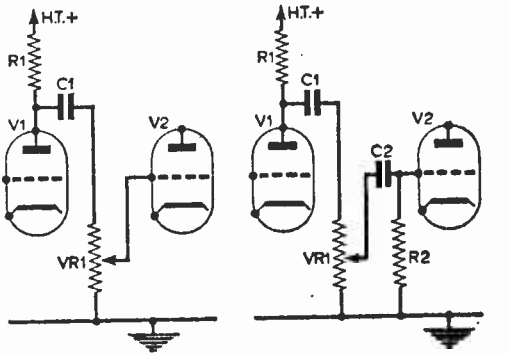


Fig. 1 (left)—Leakage in C1 would cause a direct current to flow in VR1 resulting in noisy operation and also V2 would be incorrectly biased to a degree dependent upon the setting of VR1—causing distortion.

Fig. 2 (right)—This circuit eliminates the incorrect biasing of Fig. 1, if C1 is leaky, but then VR1 will still be noisy in operation.

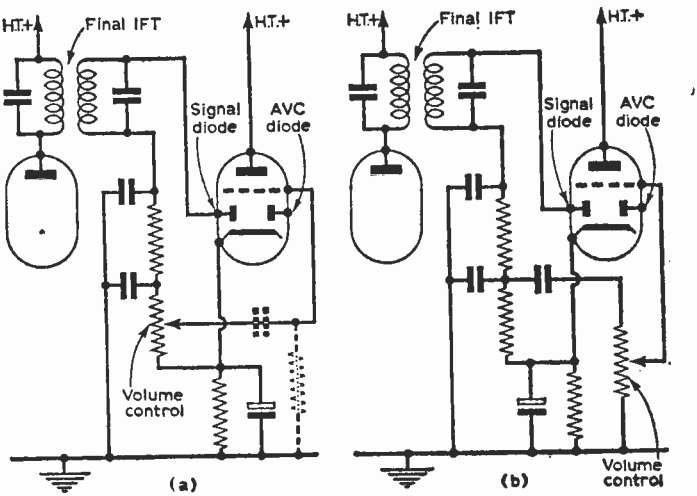


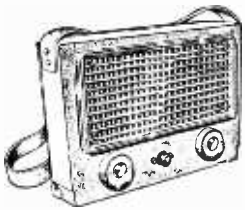
Fig. 3—A conventional double-diode-triode detector/amplifier circuit; (a) gives the incorrect, and (b) the correct wiring to avoid D.C. in the volume control track. Note that (a) is still incorrect even if an extra capacitor and resistor are included (shown dotted). This would remove distortion due to false bias of the triode section, but leave D.C. in the track of the volume control.

SETTING A NEW STANDARD FOR DISCRIMINATING CONSTRUCTORS

HUNDREDS OF TESTIMONIALS PROVE THE EFFICIENCY OF OUR DESIGNS

THE SUPER SEVEN EASILY THE BEST

(7 Transistors plus 2 Diodes)



- ★ 2 R.F. STAGES.
- ★ Mullard and Surface Barrier Transistors.
- ★ Coverage of Medium, Long Waves, Trawler Band
- ★ Use as domestic radio, car radio or fit with strap for carry-about.
- ★ No aerial required except for use as car radio.
- ★ 3-inch speaker but will drive a larger speaker.
- ★ 400 milliwatts output stage.

May be built for **£6.9.6** SIZE: 7½ x 5½ x 1½in. plus 3/6 post, etc.

PARTS PRICE LIST AND EASY BUILD PLANS 2/-

THE EASY-BUILD-7

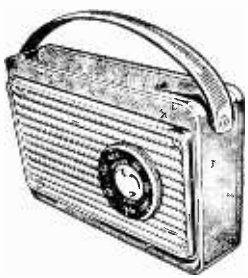
MED/L.W.

Case as Super Seven.

Simple construction for beginners. 7 transistors plus 2 diodes. Performance will amaze you. May be built for ONLY **£5.19.6.** P.P. 3/6. Parts price list and building plans 2/-.

NEW TRANSONA-6

(6 Transistors, plus 2 Diodes)
M/L & T. BAND



400 Mw Mullard push-pull output Transistors. Powerful magnet 3in. high grade speaker. Push-pull transformers. This is a top performing receiver. Many stations listed in one evening including Luxembourg loud and clear. A pleasure to listen to. **FERRITE ROD AERIAL.** All parts sold separately, including pale blue gleaming polystyrene case with duo-diffusion grilles in red. Uses 9 volt battery. Sockets for car aerial.

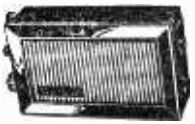
Total building cost **£4.19.6** P.P. 3/-. Size 6½ x 4½ x 1¼in.

"Agreeably surprised with Trawler Band reception. Luxembourg as loud as local. Your easy build diagram helped a lot . . . my first attempt."—H. S., Penzance, Cornwall (poor reception area).

PARTS PRICE LIST AND EASY BUILD PLANS 1/6.

BEGINNERS POCKET 5

(MW/LW and TRAWLER BAND)
(5 Transistors, plus 2 Diodes)



Designed round supersensitive **FERRITE ROD AERIAL** and 3in. moving coil speaker. Attractive case in black with speaker grille in red. On test Home, Light, Radio Luxembourg and many Continental stations were received.

Total cost of all parts **£2.19.6** P.P. 3/-.

EASY BUILD PLANS AND PARTS PRICE LIST 1/6

THE MELODY SIX

- ★ Ferrite rod aerial.
- ★ 6 new type transistors and top quality components. Attractive case in blue and red with gold trim and carrying strap.
- ★ 3in. Speaker.
- ★ M.W/L.W.

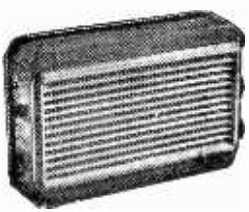
£3.19.6

P.P. 3/-.

Components price list and plans, 2/-.

BEGINNERS PUSH-PULL FIVE

(5 Transistors, plus Diode)



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(Continued from page 342)

of 250° in a second. The result is easily seen to be a spurious signal of about 250c/s fundamental, with harmonics, and some 2·5mV peak amplitude. This will be amplified by V2 and the following stages, giving a scratch or crackle, and may even produce this at great intensity if the gain following C2 is high.

Clearly this scratching noise will be independent of the *position* of the slider and will still be present undiminished even when no audio-signal proper is being applied. Furthermore, as no faulty contacts on the volume control are present, the audio-programme signals will not be in any way affected—i.e., although severe crackling takes place as the volume control is moved, the proper audio signals will nevertheless increase and decrease smoothly and as expected. All these symptoms, in contrast to those given above for a true faulty volume control, indicate D.C. leakage on to the track of the volume control. The source of this leakage must then be traced and removed.

Operating Conditions

An audio-volume control used in the conventional potentiometer arrangement dividing the actual audio signal voltage *must not have D.C. passing through its track under any circumstances.* This is an important fact which is probably not sufficiently realised. Failure to observe this condition produces noisy operation of the volume control at once or very soon after construction of the piece of apparatus in question.

Commercial Circuits or Proved Amateur Designs

If we are dealing with a commercial instrument, or with a properly designed amateur device, where no D.C. flows in the track of the volume control under normal conditions when all components used are faultless, then the cure for complaints of

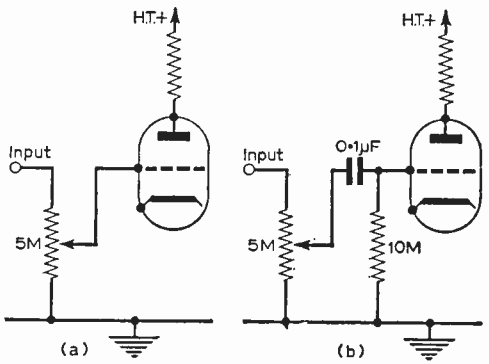

Fig. 4—Using high value volume controls—(a) gives the incorrect and (b) the correct wiring.

the nature here under discussion will amount to looking for a source of D.C. leakage.

The first step is to measure the D.C. voltage across the volume control's track, using a *valve*-voltmeter. If this is not zero, as it should otherwise be under faultless conditions, the fault is confirmed. The magnitude of the measured fault-voltage will give some idea of where it might be

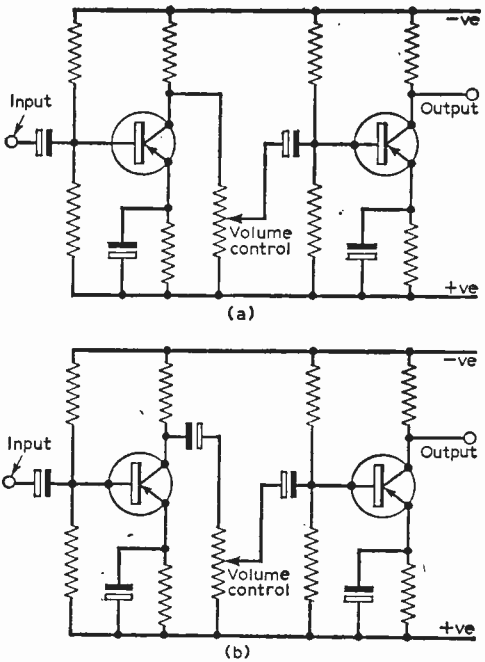

Fig. 5 (a) and (b)—Incorrect and correct circuit for interstage volume controls in transistorised circuits.

coming from. In simple circuits the possibilities are very limited anyway; the fault is most likely a leak in the coupling condenser from the anode of the previous valve. In the case of modern receivers, with all sorts of series-parallel equalisers and tone-equalisers, possibilities are more numerous, but a study of the circuit and a knowledge of the total leakage voltage across the track of the volume control, together with knowledge of any deviations of voltages at nearby points in the circuit (valve-voltmeter), will usually reveal pretty clearly which coupling condenser is leaking. This should then be unsoldered and tested or replaced. Note that, as in the numerical example given above, quite small leakages can produce severe faults of the type under discussion if the following gain is high.

Faulty Design in Amateur Circuits

Figs. 3, 4 and 5 give three typical examples of commonly-made errors in the design of amateur apparatus. Section "a" of each diagram shows the incorrect circuit in each case, leading to D.C. in the track of the volume control, giving noisiness sooner or later, and section "b" of each diagram shows the correct arrangement for the particular circuit in each case.

Fig. 3 shows a conventional double-diode-triode stage of a normal superhet. The diode load necessarily carries the rectified R.F. current, and if it is simultaneously used as the volume control, as in Fig. 3a, there is bound to be D.C. in the track. Thus, the arrangement of Fig. 3b should be used.

(To be continued)

Club News

REPORTS OF CURRENT ACTIVITIES

AMATEUR RADIO SOCIETY OF CHESHAM AND DISTRICT

Hon. Sec.: C. G. Stephenson, G3CLJ, 21 Lynton Road, Chesham, Buckinghamshire.

A front-page write-up and photograph in the local newspaper was the result of a visit from the press to the society's meeting on May 12th.

While work still goes on for a two-metre local link, the society held a Jumble sale on June 30th to raise funds for a second transmitter site.

CLIFTON AMATEUR RADIO SOCIETY

Hon. Sec.: C. Godsmark, G3IWL, 211 Manwood Road, London, S.E.4.

The club has planned five direction finding contests—two of them at night—for the summer months. Also two portable transmitting contests have been arranged for members.

CRAY VALLEY RADIO CLUB

Hon. Sec.: S. Coursey, G3JJC, 49 Dulverton Road, Eltham, London, S.E.9.

The club meets on every fourth Tuesday in the month at the Station Hotel, Sidcup, Kent and the meetings begin at 8 p.m.

The general meeting on May 22nd was followed by a film show. On June 26th Geoff Stone (G3FZL) talked about 'VHF'.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

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

The first two-metre field day was held on May 6th. The direction finding event, held on May 16th, was a fixture in the D.F. League Table formed by the society this year to encourage members to take part regularly in these contests.

At the meeting on May 23rd, G3FUR gave a talk on "Receivers". A new trophy has recently been added to the society's collection, and will be awarded for the best piece of home constructed equipment exhibited at the Constructors' Night.

Future Event:

August 19th—Mobile rally.

DUDLEY AMATEUR RADIO CLUB

Hon. Sec.: D. Pratt, G3MHS, 23 Kent Street, Upper Gornal, Dudley, Worcestershire.

The membership of the club after being in existence for only 9 months has risen to 41.

On June 8th members attended a lecture by G8RF, and on 22nd June a Treasure Hunt was held.

EXETER AMATEUR RADIO SOCIETY

Hon. Sec.: S. Line, 46 Roseland Crescent, Heavitree, Exeter, Devon.

At the May meeting the result of the Short Wave Listeners' contest was announced, the winner being Clive Vicary with 616 points, followed by Barry Marshall with 377 points.

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: G. Sunter, 24 Booth Fold, Luddendenfoot, Halifax, Yorkshire.

After the single sideband debate on July 3rd, members had a chance to examine a 160m. SSB rig brought along by G3NBI.

As usual, the second meeting of the month—July 17th—will be a ragchew night.

Future Event:

August 7th—Amateur television by G3EKE.

MORECAMBE AMATEUR RADIO SOCIETY

Hon. Sec.: K. J. Singleton, G3NLM, 8 Westmoor Grove, Heysham, Morecambe, Lancashire.

Meetings are held on the first Wednesday of each month at the Liberal Club, Balmoral Road, Morecambe. Visitors to the meetings are always welcome.

At the June meeting, a number of items of home-built equipment were shown, including an R/C Bridge built to the design in P.W. (January 1962 issue) and giving very accurate results, a multimeter a transistor power pack for mobile transmitters and receivers, a 12V top-band converter using ECH83's and an indication wavemeter and modulation monitor.

Future Events:

On one Sunday in July, the Society will be operating on top band under the calls G2FCL/A and G3GPH/M.

August 1st—Ragchew.

September 5th—Junk sale.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY

Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

At the AGM all the retiring officials were re-elected. More recently members had a chance to show-off their equipment at the display of gear held on July 4th.

PLYMOUTH RADIO CLUB *

Hon. Sec.: R. Hooper, 2 Chestnut Road, Peverell, Plymouth, Devon.

At the Annual General Meeting H. Jones was elected president; E. Diggle and L. J. N. Kirkby were elected vice-presidents; A. Baker chairman; R. Hooper secretary and N. Stoneman treasurer.

PRESTON AMATEUR RADIO SOCIETY

Hon. Sec.: W. K. Beazley, 9 Thorngate, Penwortham, Preston, Lancashire.

The club station is now active under the callsign G3KUE.

On May 22nd, Norman Lowe gave a talk on "Dx working with indoor antennas." An illustrated tape lecture on semi-conductors was given on June 26th and on July 4th members visited the television transmitter at Winter Hill.

PURLEY AND DISTRICT RADIO CLUB

Hon. Sec.: E. R. Honeywood, G3GKF, 105 Whytcliffe Road, Purley, Surrey.

The Annual General Meeting was held on May 18th when M. Nisbet was elected chairman; M. Hubbard treasurer and E. R. Honeywood secretary.

The club operated two stations on June 2nd and 3rd as their part in N.F.D.

On July 6th Ian Wade, G3NRW talks about his trip to Moscow.

Future Event:

July 20th—R.S.G.B. tape recorded lecture.

READING AMATEUR RADIO

Hon. Sec.: R. G. Nash, G3EJA, 9 Holybrook Road, Reading, Berkshire.

The subject of the lecture given at the May meeting was "How to become a radio amateur". The following month's subject was "Transistors" and the talk was given by G8SC.

SLADE RADIO SOCIETY

Hon. Sec.: C. N. Smart, 110 Woolmore Road, Erdington, Birmingham 23.

Future Events:

July 13th—R.S.G.B. Tape Recordings: "Experiments in Sound", "VHF Propagation".

July 27th—Lecture by K. W. Morris of the G.P.O. on the "Technical Aspects of STD".

WESSEX AMATEUR RADIO GROUP

Hon. Sec.: G. J. Fowle, 138 Surrey Road, Branksome, Poole Dorset.

The "Bournemouth Amateur Radio Society" has recently been dissolved and reformed as the "Wessex Amateur Radio Group". Meetings continue to be held at the old society's headquarters, i.e. Cricketers Arms, Windham Road, Bournemouth, Hampshire, on the first Monday of each month, commencing at 7.45 p.m.

On June 4th, "Railway signalling and communications" was the subject of the lecture. On June 9th, members visited Hurn aerodrome. Members visited the BBC transmitting station at Rampisham Down on June 24th and on 2nd July heard a talk given by G8VB on "Transmitters".

Future Event:

July 22nd—Visit to the Science Museum, London.

YORK AMATEUR RADIO SOCIETY

Hon. Sec.: N. Spivey, G3GWI, 80 Melton Avenue, Clifton, York.

Two club meetings per week are to be held in future. On Tuesday evenings, instruction will be given in Morse and other matters related to obtaining an Amateur Transmitting Licence. On Thursday evenings the club's top band station, G3HWW, will be on the air, and once per month a special function will be arranged.

* (We were pleased to note in the report from the Plymouth Radio Club, that when asked how they came to learn of the society, new members invariably replied that they had seen it mentioned on the Club News page of Practical Wireless. The result of this publicity has been to double the membership of the club during the past year.—Ed.).

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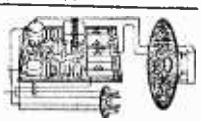

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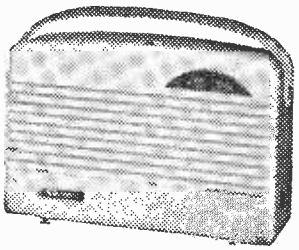

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FOR OFFICE, HOME OR TRAVEL

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Ideal for portable tape recording, etc.
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Output to 3 ohm speaker

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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, constructional details are available free with each blueprint except for the PW Monophonic Electronic Organ and the PW Roadfarer.

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, London, 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		
A.C. Band-pass Three	PW99	4/-
A.C. Coronet-4	PW100	4/-
A.C./D.C. Coronet	PW101	4/-
The PW Pocket Superhet	—	5/-
MISCELLANEOUS		
The PW 3-speed Autogram	—	8/-
The PW Monophonic Electronic Organ	—	8/-
(No constructional details are available with this blueprint)		
The PW Roadfarer	—	5/-
(No constructional details are available with this blueprint)		
TELEVISION		
The PT Band III converter	—	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
A One-Valver for America	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

QUERY COUPON

This coupon is available until 7th August, 1962, and must accompany all queries in accordance with the notice on our "Letters to the Editor" page.

PRACTICAL WIRELESS, AUGUST, 1962

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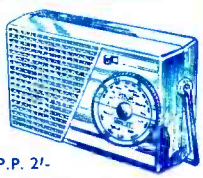
PUSH-PULL SPEAKER OUTPUT

Size 5¼ x 3 x 1¾in.

Red or Blue with Gold trim



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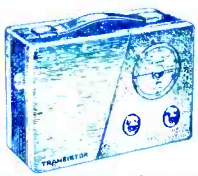

Medium and Long Wave Portable

8½ x 6½ x 3¼in.

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A simple to build 5-Transistor and Diode, Printed Circuit, Medium and Long Wave Portable. Features 5in. speaker, Car aerial socket, Mullard transistors and carded components. Building plans free on request. THE IDEAL PORTABLE. **Full after sales service and guarantee.**

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69/6 P.P. 1/6.

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